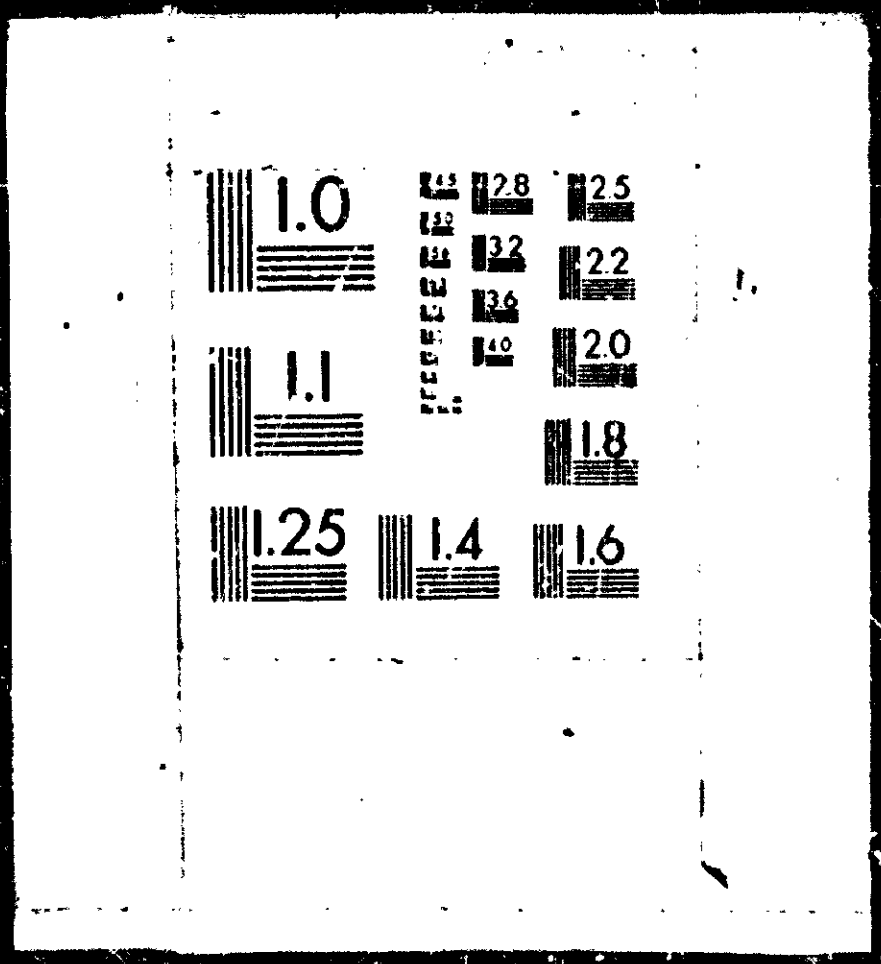

PB86-917004

Special Investigation Report - Failure of Cargo Tank Transporting Hazardous Waste on the Washington, DC. Beltway, I-95 Fairfax County, Virginia, August 12, 1985

(U.S.) National Transportation Safety Board
Washington, DC

13 May 86

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NATIONAL TRANSPORTATION SAFETY BOARD

UNITED STATES GOVERNMENT

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16.Abstract On August 12, 1985, in Fairfax County, Virginia, a cargo tank loaded with 5,000 gallons of corrosive hazardous waste from the Norfolk Naval Shipyard in Portsmouth, Virginia, leaked its cargo while en route to a disposal facility in Deepwater, New Jersey. The 17-year-old cargo tank had recently received corrosion damage repairs; however, no technical examinations were performed on the cargo tank at that time to determine the severity of corrosion damage to the shell or the welds. The cargo tank subsequently failed while transporting its fifth load of hazardous waste after the repairs were made. Examination of the cargo tank after the incident disclosed a 12-inch crack immediately adjacent to a corroded vertical weld in the cargo tank's rear head; the vertical weld in the rear head had not been repaired.

A 4-mile stretch of Interstate 95 was closed to traffic for about 9 hours, and about 600 persons were evacuated from an area within a half-mile radius of the cargo tank. Local emergency response personnel initially experienced difficulties when attempting to call the waste generator to determine the concentration of the hazardous materials contained in the waste solution and to determine the threats presented to public safety; a telephone number listed on the shipping paper for the waste generator was called about 5:20 p.m., but no one answered the phone.

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This report addresses inadequacies of Department of Transportation requirements for inspecting, retesting, and repairing cargo tanks; for measuring and evaluating the severity of corrosion damage to cargo tanks; and for providing information on shipping papers to inform emergency response personnel about the concentration and hazards of the material transported.

CONTENTS

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

SPECIAL INVESTIGATION REPORT

Adopted: May 13, 1986

FAILURE OF CARGO TANK TRANSPORTING HAZARDOUS WASTE ON THE WASHINGTON, D.C. BELTWAY, INTERSTATE 95, FAIRFAX COUNTY, VIRGINIA AUGUST 12, 1985

SYNOPSIS

On August 12, 1985, in Fairfax County, Virginia, a cargo tank loaded with 5,000 gallons of corrosive hazardous waste from the Norfolk Naval Shipyard in Portsmouth, Virginia, leaked its cargo while en route to a disposal facility in Deepwater, New Jersey. The 17-year-old cargo tank had recently received corrosion damage repairs; however, no technical examinations were performed on the cargo tank at that time to determine the severity of corrosion damage to the shell or the welds. The cargo tank subsequently failed while transporting its fifth load of hazardous waste after the repairs were made. Examination of the cargo tank after the incident disclosed a 12-inch crack immediately adjacent to a corroded vertical weld in the cargo tank's rear head; the vertical weld in the rear head had not been repaired.

A 4-mile stretch of Interstate 95 was closed to traffic for about 9 hours, and about 600 persons were evacuated from an area within a half-mile radius of the cargo tank. Local emergency response personnel initially experienced difficulties when attempting to call the waste generator to determine the concentration of the hazardous materials contained in the waste solution and to determine the threats presented to public safety; a telephone number listed on the shipping paper for the waste generator was called about 5:20 p.m., but no one answered the phone.

This investigation report focuses on the inadequacies in the following Department of Transportation requirements: for inspecting, retesting, and repairing cargo tanks used to transport hazardous materials; for measuring and evaluating the severity of corrosion damage to cargo tanks; for establishing measurable qualification standards for persons inspecting and testing cargo tanks; for establishing measurable standards for repairing cargo tanks which involve corrosion damage or weld defects; for establishing measurable qualification standards for persons performing repairs on cargo tanks involving corrosion damage and weld defects; and for providing information on shipping papers to inform emergency response personnel about the concentration and hazards of the material transported.

INVESTIGATION

The Incident

On August 12, 1985, the Norfolk Naval Shipyard at Portsmouth, Virginia, loaded 5,000 gallons of corrosive hazardous waste into a single compartment, stainless steel cargo tank operated by Applied Technology Transportation, Inc. The hazardous waste, a pipe cleaning solution used on ships, was loaded into the cargo tank from a 20,000 gallon storage tank to be shipped to a waste disposal facility in Deepwater, New Jersey.

U.S. Department of Defense (DOD) personnel began loading the hazardous waste into the 17-year-old cargo tank about 11 a.m. and finished about noon. The driver drove the tractor-semitrailer to a truckstop, weighed it, and began his trip about 1 p.m. He followed Interstate 95 (I-95) north and stopped at a weigh station and service area about 3 p.m. He walked around the vehicle and checked the tires; he saw no leak at that time. After the truck entered the Washington, D.C. beltway about 4:30 p.m., a motorist signaled to the truckdriver that something was wrong with the semitrailer. The driver pulled the vehicle onto the right shoulder of the highway and inspected it (see figure 1). At that time, he found a liquid leak near the rear of the cargo tank, but he could not determine the precise location of the leak because the outside of the cargo tank was covered with insulation and a stainless steel jacket. (Examination of the cargo tank at a later date disclosed a crack 12 inches long immediately adjacent to a vertical weld in the rear head.)

The DOD had contracted Applied Technology, Inc., to dispose of the hazardous waste and by that contract assigned to it the responsibilities of a shipper to properly describe the material and to use a transportation container meeting U.S. Department of Transportation (DOT) regulations. Applied Technology, Inc., hired Applied Technology Transportion, Inc., to transport the load in a cargo tank leased from D. M. Equipment Leasing, Ltd. All three companies are commonly owned.

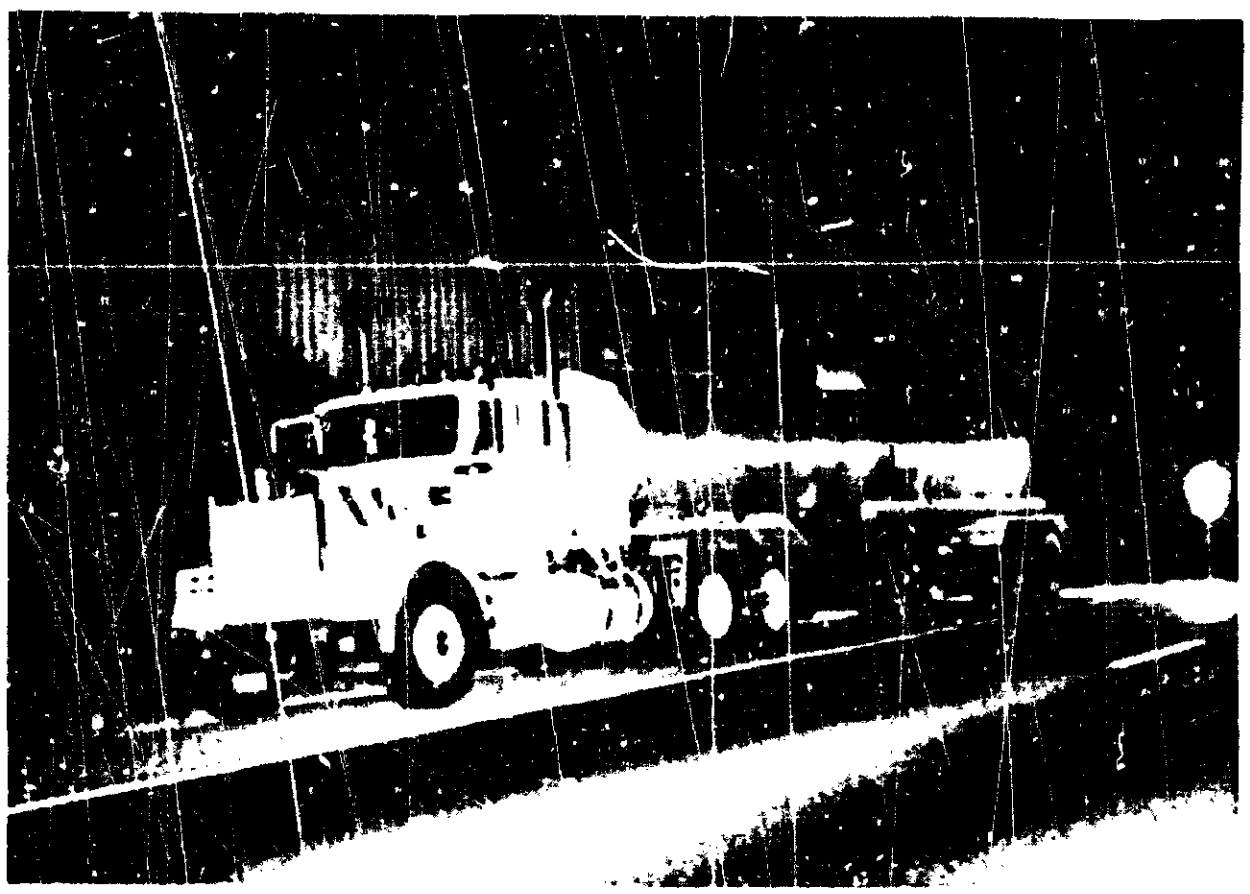

Figure 1.--Cargo tank on right shoulder of Washington, D.C., beltway in Fairfax County, Virginia.

D. M. Equipment Leasing, Ltd., had purchased the used cargo tank from a private salesman on March 27, 1985, specifically for transporting the hazardous waste solution for the Norfolk Naval Shipyard. The salesman had purchased the cargo tank from a motor carrier about 2 weeks earlier and had taken it to a cargo tank repair facility to be hydrostatically tested; however, when filled with water for the test, it leaked. 1/ While a small hole at a corrosion pit inside the cargo tank and some corrosion-damaged welds, also inside the cargo tank, were identified and repaired, repair work was not performed on other welds including the vertical weld in the rear head of the tank. The cargo tank was given another hydrostatic test which it passed, and then the cargo tank was made available to the new owner, D. M. Equipment Leasing, Ltd. The cargo tank was subsequently used to transport four loads of the hazardous waste solution prior to the incident on August 12, 1985.

Emergency Response

After detecting the leak, the driver called for help on a citizens band radio and as a result contacted a person he believed to be in a traffic watch helicopter. That person caused the Fairfax County Fire and Rescue Department to be called about 4:49 p.m. and advised about the driver's request for help with the cargo tank that was leaking waste material containing ammonia.

The truckdriver furnished the fire department a shipping paper (see appendix B) when they arrived on scene at 4:59 p.m. While the shipping paper identified the ingredients contained in the waste solution, it did not provide the percentages or concentrations of those materials or the actions to take to mitigate any hazards should there be leakage or should the material become involved in an accident.

To reduce the risk of public exposure to those materials, the fire department closed the Washington, D.C., beltway to all northbound and southbound traffic from the junction of I-95 and Interstate 495 (I-495) near Springfield, Virginia, to the Van Dorn Street exit about 4 miles away. Several thousand vehicles were stranded on the closed section of highway during rush hour, and an estimated 34,000 vehicles were rerouted during the 9-hour period it was closed. The fire department also evacuated about 600 people from a mixed residential and business area located within a half-mile radius of the vehicle and ordered a Richmond, Fredricksburg and Potomac Railroad track closed to traffic. The fire department reported that one commuter was given oxygen after reporting minor breathing difficulties; this person was not transported to a hospital for treatment. A second commuter was given oxygen and placed on a heart monitor after reporting chest pains; this person declined transportation to a hospital. None of the 70 local emergency response personnel on the scene nor any of the 22 Virginia State Police officers used to control traffic were injured.

The fire department used sand and absorbent material to contain the leaking waste and prevent it from running into a nearby creek. The Virginia State Police estimated that 500 to ,000 gallons of waste leaked from the cargo tank; the Norfolk Naval Shipyard estimated that 700 gallons of waste leaked.

1/ Details of inspections, tests, and repairs performed on the cargo tank are contained in subsequent sections to this report.

About 5:20 p.m., the fire department called Applied Technology, Inc., and the Norfolk Naval Shipyard at telephone numbers listed on the shipping paper; no one answered the phones. Next, they called CHEMTREC 2/ about 5:33 p.m. and asked for assistance in contacting the Norfolk Naval Shipyard and E.I. du Pont de Nemours & Co., the disposal facility at Deepwater. About 6:56 p.m., 1 hour 57 minutes after emergency response personnel arrived on scene, personnel at du Pont told CHEMTREC that the waste solution in the cargo tank was probably 95 percent water and offered to help clean up the spill site. About 7 p.m., the Norfolk Naval Shipyard advised on-scene emergency response personnel that the waste solution was mostly water; however, it was not until about 10 p.m. that the Norfolk Naval Shipyard completed its analysis of a sample of the hazardous waste solution, which it collected from the storage tank at its facility, and informed the on-scene emergency response personnel of the precise concentrations of the hazardous materials contained in that shipment. In the meantime, the fire department had called a hazardous materials spill cleanup company to transfer the hazardous waste to another cargo tank and to clean up the spill site. Transfer equipment arrived on scene about 10 p.m., and the transfer of the waste solution began about 10:15 p.m. By midnight, the transfer of the waste solution from the leaking cargo tank to another cargo tank was completed and residents were allowed to return to their homes. The highway was reopened to southbound traffic about 1:30 a.m. and to northbound traffic about 2:30 a.m. the next day.

Cargo Tank

Description.--The single compartment cargo tank was constructed by The Heil Company of Milwaukee, Wisconsin, in 1968. A certificate of compliance was issued by The Heil Company in April 1968 certifying that the new Heil tank was designed, constructed, and tested in accordance with cargo tank specification number MC-307. (See appendix C.) Company records show that the cargo tank was manufactured to the following specifications:

Design pressure	30 psig
Test pressure	45 psig
Head material	304 stainless steel 10 gauge
Shell material	304 stainless steel 12 gauge
Weld material	304 stainless steel
Lining	none
Nominal tank capacity	5,500 U.S. gallons
Maximum product load	55,000 pounds
Density of product	10 pounds per gallon
Maximum temperature	250° F

The cargo tank was insulated and covered with a jacket manufactured of 18-gauge stainless steel at the heads and 20-gauge stainless steel around the shell. A thermometer kit was installed near the right-center of the cargo tank for measuring the temperature of cargo transported inside the tank.

2/ Chemical Transportation Emergency Center, a public service of the Chemical Manufacturers Association, provides general advice to emergency responders and helps contact the shipper of the hazardous materials for more detailed assistance.

DOT regulations (49 CFR 178.340-10) require a metal certification plate to be affixed to a cargo tank to indicate that it has been designed, constructed, and tested in accordance with specification requirements. A shipper may then inspect the specification plate to determine if the cargo tank has been manufactured to meet the specification requirements. An adjustable multipurpose plate is also required if a cargo tank may be physically modified to change compliance with specification requirements, and it must be mounted adjacent to the metal specification plate. Those parts of the tank which must be changed or added to meet the applicable specification requirements identified on the multipurpose plate must be color-coded, and the required color-coded parts must also be identified on the multipurpose plate. The adjustable multipurpose plate then must be positioned to show the specification requirements that the cargo tank meets at the time of its use.

No metal certification plate was found on the cargo tank after the incident on August 12, 1985; however, a metal multipurpose plate was attached to the right side of the cargo tank vehicle. (See figure 2.) The metal multipurpose plate identified the cargo tank as an MC-307 GREEN when equipped with a 1 1/2-inch 30 PSI pressure vent, a 1-inch 3/4 PSI vacuum vent, and two 3-inch or 333,500 CFH fusible vents. When the sliding metal multipurpose plate is adjusted to another position, it identifies the cargo tank as a nonspecification BLUE cargo tank with a 1-inch binocular pressure vent and a 1-inch binocular vacuum vent.

After the incident, a Bureau of Motor Carrier Safety (BMCS) investigator for the DOT found that the cargo tank did not meet the requirements for an MC-307 specification container for the following reasons:

- o A pipe extension was added to the product discharge pipe located at the rear of the cargo tank, and adequate distance between that pipe and the bumper was not provided (49 CFR 178.340-8(b)).

- o A metal certification plate was not attached to the cargo tank (49 CFR 178.340-10(b)).

- o A vent was not color-coded (MC-307 GREEN or Nonspecification BLUE), as required when it must be changed or added to meet the applicable specification requirement (49 CFR 178.340-10(b)(1)).

- o The pressure-actuated vent on the cargo tank was a Girard MC-307 set to open at 25 psig; however, an MC-307 cargo tank is required to be equipped with a pressure-actuated vent set to open at not less than the tank design pressure, which was 30 psig (49 CFR 178.342-4(c)).

- o The vessel's structural integrity failed.

Ownership and Prior Use.--The cargo tank was originally purchased by Chemical Leaman Tank Lines, Inc., (Chemical Leaman) of Lionville, Pennsylvania, in April 1968. Chemical Leaman is a transporter that owns about 2,800 cargo tanks. The cargo tank involved in this incident was used as a system vehicle to transport many different products throughout the country. Although used to transport some corrosive materials, the maintenance manager for Chemical Leaman stated that the primary hazardous materials transported in the cargo tank were flammables and poisons. It was last used by Chemical Leaman to transport motor oil and latex a few months before it was sold.

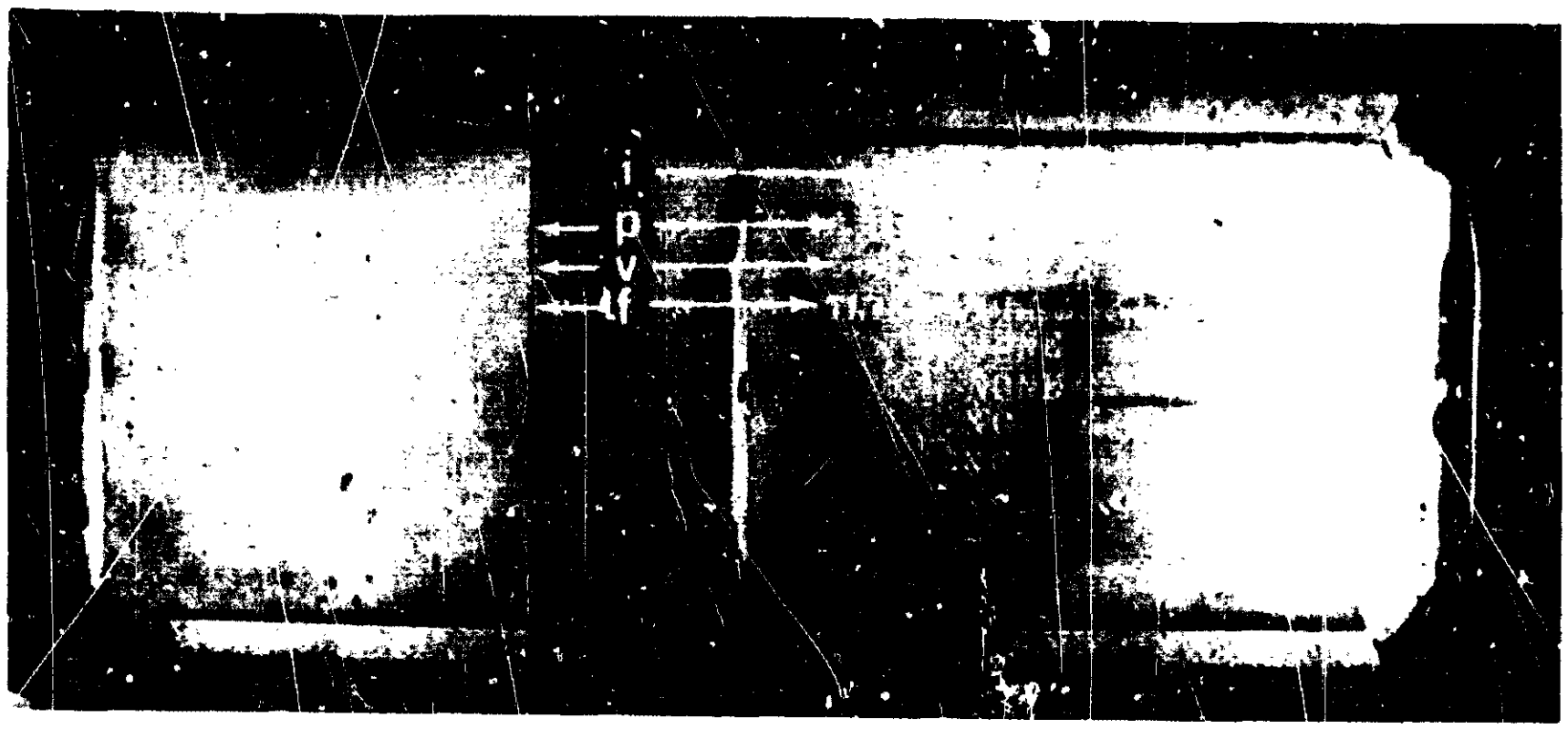

Figure 2.--Metal multipurpose plate mounted on right side of cargo tank semitrailer. Plate identifies the cargo tank as an MC-307 GREEN (arrow "i") when pressure, vacuum, and fusible vents are installed on the cargo tank as marked on the plate (arrows "p", "v," and "f," respectively).

A spokesman for Chemical Leaman testified that it sold the 17-year-old cargo tank because the wheel base made it an unpopular model because of current bridge load restriction formulas, and because it was not economical to refurbish the cargo tank cosmetically or structurally. According to the corporate maintenance manager, the cargo tank was not sold because of problems with its structural integrity, although it did need some frame repairs.

On March 12, 1985, the cargo tank was purchased in an "as is" condition by a salesman who was leaving his sales position with a major cargo tank dealer and was beginning his own cargo tank sales business. The salesman had inspected the outside of the cargo tank at Chemical Leaman's facility about a month earlier, and he had asked Chemical Leaman to hold it for his purchase. The salesman and Chemical Leaman contractually agreed that before the manufacturer's MC-307 certificate of compliance would be transferred, the cargo tank must pass a hydrostatic test.

Before purchasing this used cargo tank from the salesman on March 27, 1985, D. M. Equipment Leasing, Ltd., had purchased several new cargo tanks from the same salesman. The owner of D. M. Equipment Leasing, Ltd., testified that he bought this used cargo tank to transport the shipyard's hazardous waste because the facility required a clean cargo tank to be furnished on 24 hours' notice, and the cost of dedicating a new cargo tank to that service was not economical. At the time of the incident, D. M. Equipment Leasing, Ltd., owned eight tractors, six 45-foot van trailers, two MC-307/312 insulated stainless steel cargo tanks, and one 20-foot straight truck in addition to the cargo tank involved in the incident.

Inspections/Tests Prior to Incident.--The Heil Company certified in 1968 that the cargo tank had been tested in accordance with cargo tank specification requirements of the Interstate Commerce Commission, the Federal agency responsible for establishing highway cargo tank standards before the DOT was given the responsibility.

According to Chemical Leaman's records, the following inspections and tests were performed on the cargo tank and no problems were identified:

September 30, 1969	visual inspection
October 11, 1972	visual inspection
February 7, 1975	hydrostatic test
February 8, 1975	visual inspection
February 28, 1977	visual inspection
January 24, 1979	visual inspection
February 24, 1981	visual inspection
March 25, 1983	visual inspection

Chemical Leaman's corporate maintenance manager told the Safety Board that it had not performed any major repairs on the cargo tank shell or welds. He also said that Chemical Leaman's mechanics usually performed the visual inspections. They do not conduct hydrostatic tests on MC-307 cargo tanks on a regular basis, but only if a leak is suspected. Chemical Leaman also does not conduct thickness measurement tests unless there is a reason to question the integrity of the tank.

After Chemical Leaman sold the cargo tank to the salesman, the salesman had the cargo tank transported to Keystone Tank Trailer Services Corporation (Keystone) in Exton, Pennsylvania, for a hydrostatic test. The salesman said that he selected Keystone because it was an American Society of Mechanical Engineers (ASME) approved facility, it had ASME welders, and major motor carriers used the facility.

The cargo tank was filled with water for the hydrostatic test, but before any pressure was applied, water leaked from the tank. After the water was drained from the cargo tank, the salesman and the owner of Keystone entered it. They found a small corrosion hole in the left side of the cargo tank at about the eight o'clock position and near the center of the shell. The size of the hole was described by the owner of Keystone as being between that of a dime and a quarter. The salesman and the owner of Keystone further inspected the inside of the cargo tank and jointly identified corrosion pits in the bottom weld seams. The owner of Keystone described the corrosion pits as round and about the size of the end of a pen, some a little larger and some a little smaller. The salesman said that when he buys a used cargo tank, he looks primarily at the floor and heat-affected areas for corrosion pits, areas which he considers critical. The inspection he performs does not take the place of the "visual inspection" as required in 49 CFR 177.824. 3/

The owner of Keystone described the cargo tank's interior welds before the incident as "dirty, a brownish like color," and the cargo tank's interior shell as stained a yellowish color. The salesman said that there was some staining and dulling to the cargo tank's shell and welds, but that most cargo tanks are stained from the products transported and he saw nothing unusual.

Keystone performed a hydrostatic test on the cargo tank on April 17, 1985, after the tank was repaired. (See the next section for a description of the repairs.) The cargo tank was filled with water and pressurized for 8 hours at 45 psig (1 1/2 times the design

3/ Details of visual inspection requirements are contained in a subsequent section of this report.

pressure of the cargo tank). It did not leak and therefore passed the test. A hydrostatic test information record was prepared, and the following information was entered onto that record: "No guarantee on shell. No warranty. Used trailer hydro, this trailer did not leak now; but no guarantee can be issued against future leaks." The owner of Keystone told the Safety Board that the cargo tank performance disclaimer is not entered on all hydrostatic test records but "only on real old tanks." He said that the disclaimer is especially entered on hydrostatic test records when used tanks are sold. He said that this disclaimer is not added for other customers with new or upgraded tanks, or for those customers who request that all repairs be made that are necessary for a good trailer.

No one from D. M. Equipment Leasing, Ltd., inspected the cargo tank before purchasing it, and no visual inspection (as described in 49 CFR 177.824) was performed after receiving the tank.

Repairs Prior to Incident.--Keystone repaired the cargo tank by welding a patch over the hole in the shell. A pneumatic grinding wheel was used to remove brown stains and corrosion pits from bottom weld seams, and new welds were overlayed using 316 type stainless steel. The welders were not ASME qualified, and according to the president of Keystone, ASME approval of the repair work on MC-307 cargo tanks is not required. 4/ Neither the salesman nor the president of Keystone inspected the repair work after it was completed.

The salesman decided which welds to repair, and he did not seek recommendations from Keystone because he said it was "textbook pitting" and that "normally [for] all these tanks you have to do some pit filling." No technical examination tests were performed to determine the extent of corrosive damage to the cargo tank shell or the welds. He said that the cargo tank would have passed the hydrostatic test after repairing only the small hole in the shell--"a ninety dollar patch"; however, he had the corrosion pits in the floor welds repaired as a precaution against additional damage from products. The DOT regulations (49 CFR 178.342-7 and 177.824(d)(4)) provide that the "suitability" of repairs made to cargo tanks failing to pass a hydrostatic test shall be determined only "by the same methods of test."

The owner of Keystone confirmed that they did not advise the salesman on which repairs should be made. He told the Safety Board that other repairs needed to be made and "money" needed to be put into the cargo tank, but that without a more thorough inspection and written record, he could not be specific.

Examination After Incident.--A Safety Board metallurgist examined the cargo tank on August 19, 1985, at the Keystone facility in Exton. The leak was found at the rear head of the cargo tank. A small portal was cut in the cargo tank jacket for external examination of the area, and a vertical crack in the head was visible. The crack was approximately 12 inches long and ran immediately adjacent to a vertical weld in the head. The cargo tank's rear head bulged inward near the area of the crack; however, no external damage was found in the corresponding region of the tank jacket.

The interior of the cargo tank was examined next. The rear head was constructed from two halves joined by a vertical weld. (See arrow "W" in figure 3.) The crack identified during the external examination was also identified during the internal

4/ Title 49 CFR 178.342-1 requires only that MC-307 cargo tanks manufactured to a design pressure in excess of 50 psig be designed in accordance with the requirements of the ASME Code. The cargo tank involved in this incident was manufactured to a design pressure of 30 psig.

Figure 3.--An internal view of the tank looking at the rear dome with the leak location at bracket "L". Other welds visible in this view are denoted by unmarked white arrow.

examination. The crack, indicated by bracket "L" in figure 3, was located in the fusion zone of this weld near the bottom of the rear head. Figure 4 shows a closer view of the crack area.

The original metal of the weld was discolored and appeared to have corroded to a depth of approximately 0.05 to 0.10 inch over the apparent length of the crack. Above this region, the weld metal was discolored but still in place; however, the weld metal was easily flaked away by the point of a knife blade, as illustrated by figure 5, which shows another location in the cargo tank. The material removed by the knife had the consistency and appearance of damp compacted soil. The surrounding base metal was only slightly stained and did not appear to have been damaged.

The inward bulge of the rear head was also visible during the interior examination of the cargo tank. (See figure 3.) A similar bulge pattern was found at the corresponding location in the forward tank dome.

Many of the remaining welds in the tank had been repaired by additional weld metal overlay. The repaired welds were generally concentrated in the lower third of the cargo tank and were longitudinal and circumferential. These welds were readily distinguished from the original welds by their geometry and appearance. (See figure 6.)

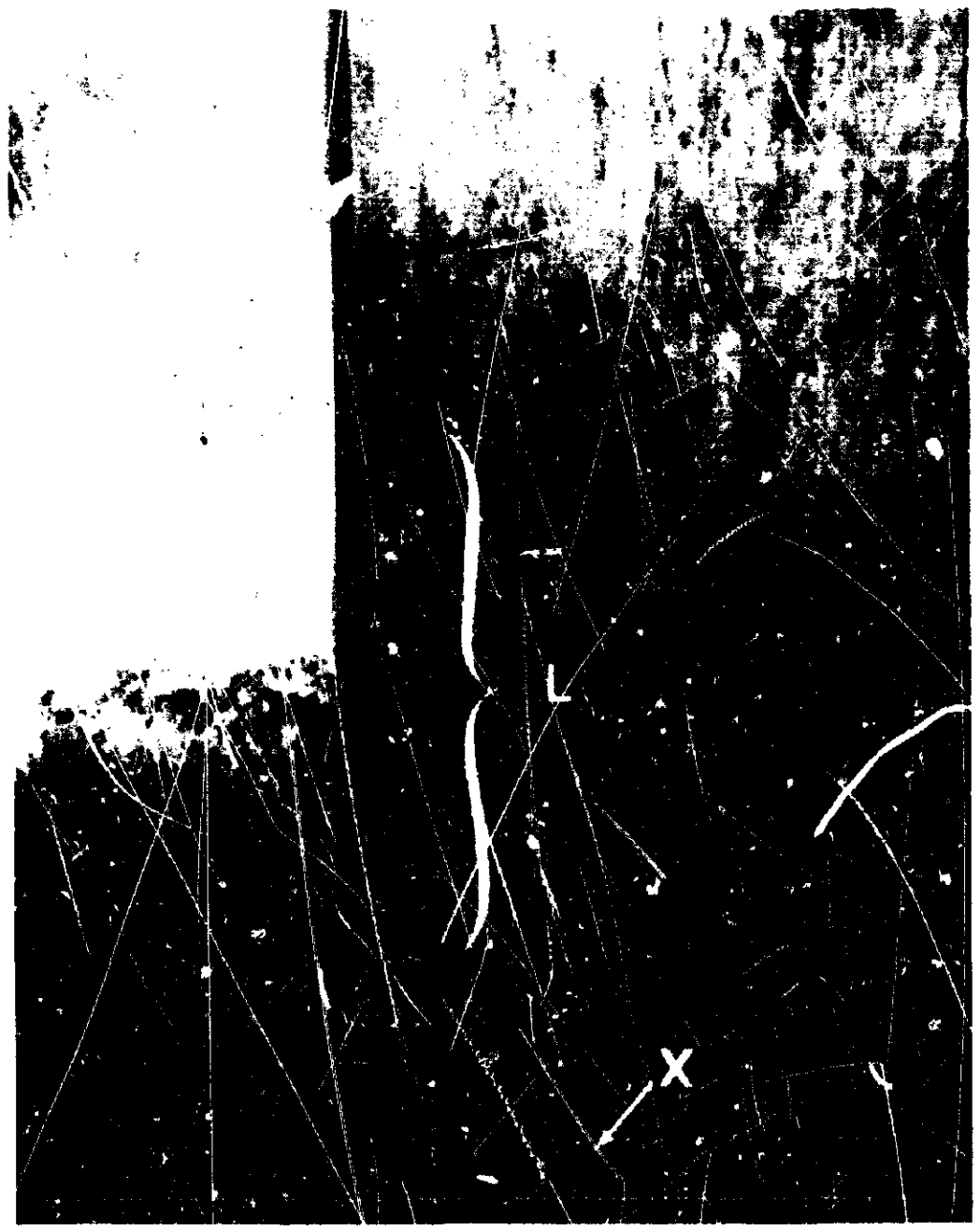

Figure 4.--A closer view of the leak area (bracket "L" in the rear dome).

Note the appearance of the repaired circumferential dome to tank weld at arrow "X".

The unrepaired welds were generally discolored, a rusty brown. When lightly tapped with the point of a knife, the discolored welds were easily penetrated and dents were left. The extent to which the metal was penetrated varied considerably with the vertical location of the weld and somewhat with its longitudinal location. In general, the welds nearest the bottom of the cargo tank were the softest and most easily penetrated.

Meteorological Information

On the day of the incident, Washington National Airport recorded a temperature of 87° F and 39 percent humidity at 4:51 p.m., changing to 74° F and 66 percent humidity by 11:30 p.m. The winds were from the north northeast at 3 to 7 mph. Conditions were clear, and visibility was 10 to 12 miles.

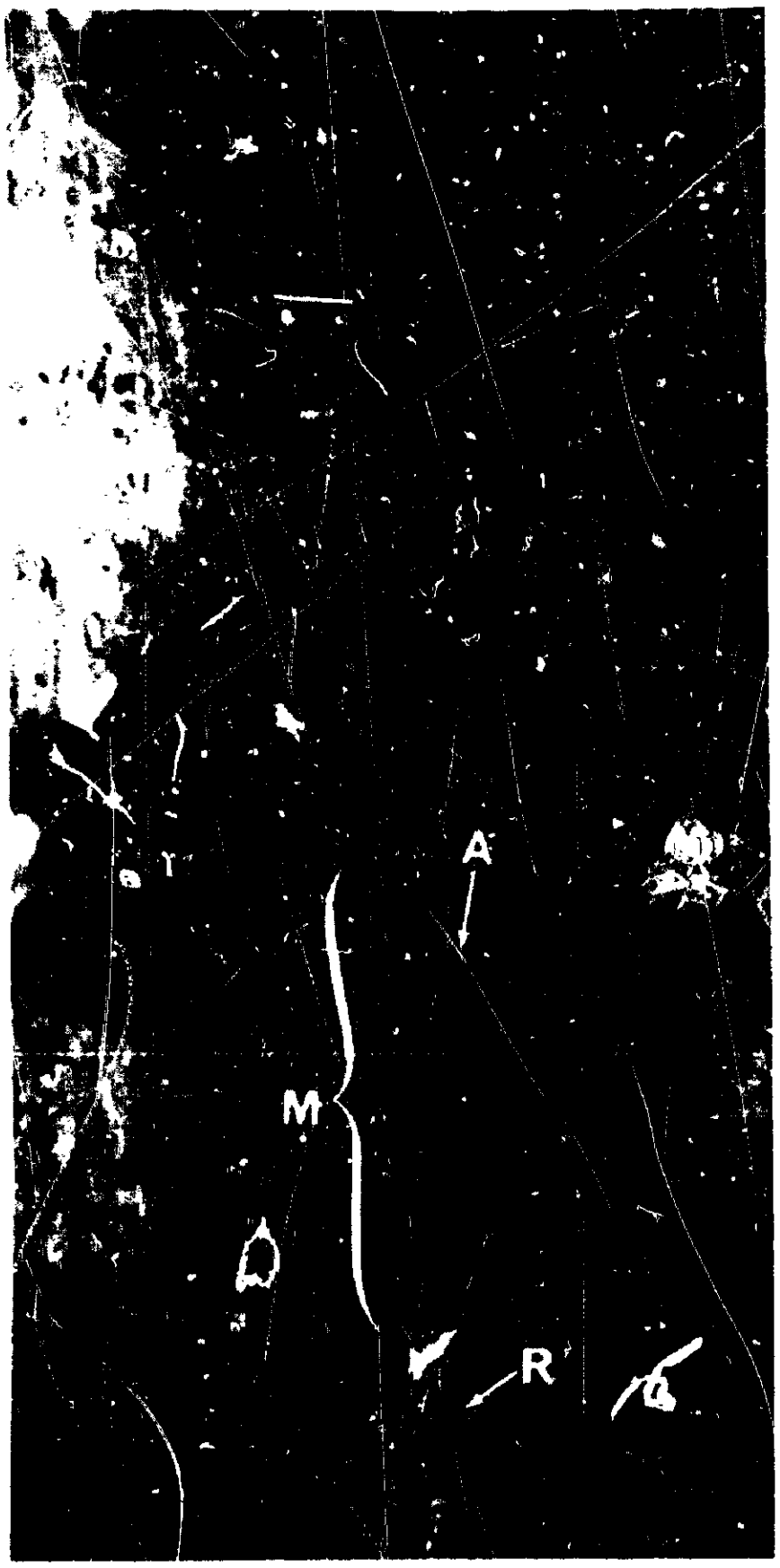

Figure 5.--Circumferential weld located at the front left of the tank showing the ease in which material was removed from the corroded weld by the knife point. The end of a repair weld is visible at arrow "R". Also, note an additional line of corrosion at arrow "A". Forward tank dome is located at the right of the weld.

Figure 6.--Typical lengths of repaired weld (arrow "R") and discolored original weld (arrow "W").

Hazardous Materials Information

The pipe cleaning solution was described on the shipping paper as "WASTE COMPOUND, CLEANING LIQUID (hydrazine, thiourea, ethylene diamine tetraacetic acid, ammonium hydroxide, sulfates, ethylenediamine) CORROSIVE MAT'L NA1760, HAZ CODE-C, PHSY STATE-L, SPGR 1.00, PERCENTAGE 100%." Fire department personnel used National Fire Protection Association health hazard guidelines and other reference materials to determine that short-term exposure to some of the ingredients contained in the waste solution could cause serious temporary or residual injury even if prompt medical treatment was given. (Additional information on the hazards posed by those materials, even in very low concentrations, is available in appendix D.) The fire department initially did not know the concentrations of those ingredients; however, they obtained a sample of the hazardous waste solution from the cargo tank during the incident and analyzed it at a later date. Another sample of the solution had been taken from the storage tank before the transfer to the cargo tank, and it was analyzed by the Norfolk Naval Shipyard's Chemical Laboratory after the incident. While the Norfolk Naval Shipyard's sample was taken from the storage tank rather than from the leaking cargo tank, table 1 shows that both analyses found a pH of about 10 and a low percentage of hazardous ingredients.

Inspection, Retest, and Repair Requirements

Before this accident the DOT sponsored a research program to determine the integrity of MC-307 and MC-312 cargo tanks, which resulted in a report issued in October 1984. The research program included, among other topics, a review of inspection, maintenance, test, and repair practices and procedures. It identified corrosion and weld failures as maintenance problems of "some magnitude," and as the most serious problems faced by MC-307/312 carriers. 5/

Table 1.--Comparison of hazardous waste solution analyses.

	Norfolk Shipyard Analysis*		Fairfax County Analysis	
pH	10.15		10	
	parts per million (ppm)	percent of solution	parts per million (ppm)	percent of solution
Hydrazine	26	<0.01	6.5	<0.01
Thiourea	1	<0.01	not determined	
Ethylenediamine-tetraacetic acid	65,000	6.5	not determined	
Sulfates	6,600	0.66	22,000	2.2
Ammonia	16,000	1.6	29,000	2.9
Water		90.0	not determined	
Total		98.76	not determined	

*Small amounts of cadmium, chromium, silver, barium, lead, arsenic, mercury, selenium, nickel, zinc, copper, and iron were also identified in the solution. Solution corrosivity toward steel was found to be <1.0 mm/year.

The report concluded that all carriers studied during the research program experienced corrosion problems and that visual inspections do not detect many of the problems identified by the carriers. Carriers involved in the research program recommended changing the reporting, inspection, and testing requirements. Some of their comments are listed below:

> Conduct visual inspections annually and make the inspections an enforceable requirement rather than a paper exercise.
>
> Reduce the 2-year frequency for the visual inspection and require a hydrostatic pressure test.
>
> The present requirement [for inspections and tests] is inadequate; the inspection should be done by an independent agency and include an ultrasonic test.
>
> Two-year visual [inspection] is "paper" exercise. Require monthly inspections and report.

5/ The DOT is currently sponsoring a research program to evaluate cargo tank corrosion problems.

Require all tank repair agencies and technicians to be licensed.

Specify tolerances for inspecting and requiring repairs as result of visual inspections.

The DOT's retesting and inspection requirements for cargo tanks used to transport hazardous materials are contained in Title 49 CFR 177.824. The regulations require DOT specification MC-306, MC-307, and MC-312 cargo tanks 6/ to be given an external visual inspection at least once every 2 years. When insulation prohibits an external visual inspection, the DOT requires that an internal visual inspection be made. The visual inspection requires that the cargo tank be inspected for corroded areas, bad dents, and defects in welds; for defects in piping, valves, and gaskets; and for other conditions, including leakage, which indicates weakness in the tank that might render it unsafe for transportation service. An internal visual inspection is not required when an external visual inspection can be performed.

When the visual inspection of a cargo tank is precluded by both an internal coating and external insulation, or when it is not equipped with a manhole, the regulation requires the cargo tank to be hydrostatically tested at 5-year intervals. MC-306, MC-307, and MC-312 cargo tanks are not otherwise required to be given periodic hydrostatic or pneumatic retests; however, if a cargo tank is taken out of hazardous materials transportation service for a year, is involved in an accident, or is altered, it must pass a hydrostatic or pneumatic test before being used to transport hazardous meterials.

Although DOT regulations prohibit a cargo tank from being used to transport hazardous materials "if evidence of any unsafe condition is discovered and until such condition has been corrected," 7/ they do not define when a condition should be considered unsafe. At the Safety Board's deposition proceedings during the investigation of this incident, a BMCS mechanical engineer testified that there are no BMCS criteria to tell an inspector when to pass or fail a cargo tank if corrosion is found in either the shell or welds during a visual inspection; he described the decision as a "judgment call" by the inspector.

The DOT regulations also do not require shell or weld integrity examinations, i.e., radiography, wet fluorescent magnetic particle, liquid dye penetrant, ultrasonic tests, or equivalent techniques to ascertain the extent of corrosion damage to MC-306, MC-307, or MC-312 cargo tanks. The DOT also does not define the qualifications required of a person performing visual inspections, other than that the person must be "responsible and experienced." Furthermore, should an inspector, based on his visual observations, judge that repairs should be made to one of these cargo tanks, the regulations require only that the repairs be performed in a workmanlike manner, also undefined by the DOT.

Generally, the inspection requirements contained in 49 CFR 173.33 for MC-330, MC-331, and MC-338 cargo tanks 8/ are similar to the requirements for other cargo tanks, except that the inspections need only be performed every 5 years instead of every 2 years and that pressure tests also must be performed every 5 years. However, after an inspector determines that repairs should be made to an MC-330, MC-331, or MC-338

6/ MC-306, MC-307, and MC-312 cargo tanks are used for the transportation of most hazardous materials other than compressed gases or cryogenics. Many older cargo tanks which are not currently authorized by DOT to be manufactured are also subject to these visual inspection requirements.

7/ 49 CFR 177.824(b).

8/ MC-330, MC-331, and MC-338 cargo tanks must be designed and constructed to meet the requirements of the ASME Code, and are generally used to transport compressed gases and cryogenic liquids.

cargo tank, the regulations prescribe specific repair procedures that must be followed. Repairs on these cargo tanks must be performed in accordance with Compressed Gas Association (CGA) Technical Bulletin TB-2 titled "Guidelines for Inspection and Repair of MC-330 and MC-331 Cargo Tanks." Both the DOT regulation and the CGA technical bulletin require the cargo tank to be repaired in accordance with the ASME Code under which the cargo tank was manufactured. The regulation further provides that after repairs are made by grinding or welding, the cargo tank must be examined by the wet fluorescent magnetic particle method and hydrostatically tested to ensure that all defects have been removed. The ASME Code provides specific requirements for the removal of unacceptable defects, rewelding of areas to be repaired, and examination of repaired welds, including nondestructive examinations such as radiographic, ultrasonic, liquid penetrant, wet fluorescent, and magnetic particle test methods. The ASME Code also requires that personnel performing inspections, repairs, and examinations meet specific qualification standards.

The DOT issued a notice of proposed rulemaking (NPRM) (Docket numbers HM-183 and HM-183A) on September 17, 1985, to revise and clarify the regulations pertaining to the manufacture and operation of cargo tanks. In its preliminary regulatory evaluation, the DOT stated that severe internal and external tank corrosion in MC-307 and MC-312 cargo tanks contributed to a high incidence of cargo tank motor vehicle failures and that the number of cargo tanks with evidence of external and internal corrosion appeared to be increasing. Furthermore, the DOT found that there are no well-defined requirements for an ongoing cargo tank maintenance program, that cargo tank corrosion is not adequately addressed in the present regulations, and that inspection and testing of cargo tanks is inadequate. The NPRM proposes to change the inspection and test requirements for cargo tanks (49 CFR 180.407), to change the qualifications of those persons permitted to perform inspections and tests (49 CFR 180.409), and to establish requirements for repairing cargo tanks (49 CFR 180.413).

ANALYSIS

Release of Hazardous Material

The hazardous waste solution leaked through a crack in the vertical weld of the cargo tank's rear head. The weld had been previously weakened by extensive and severe corrosive attack. Severe corrosive attack had also occurred on other welds in the tank prior to the transport of the waste pipe cleaning solution. Although some of the corrosion-damaged welds were repaired by grinding the damaged welds and overlaying new welds, many lengths of corrosion-damaged welds were not repaired, including the rear head vertical weld that failed.

For the following reasons, the cargo tank did not meet the DOT's MC-307 specification requirements: it had a missing identification plate, a product discharge pipe extension had been added, required equipment had not been color coded, and the pressure relief device was set to open at 5 psig lower than required. These factors did not, however, contribute to the incident that occurred on August 12, 1985. Furthermore, the cargo tank was originally manufactured to meet MC-307 specification requirements when equipped with appropriate color-coded vents, and no major repairs or alterations had been performed on the cargo tank shell or welds by the original owner.

Cargo Tank Inspections, Tests, and Repairs

Although the DOT's regulations did not require the 17-year-old cargo tank to be visually inspected or hydrostatically tested before being sold, the original owner and the salesman buying it exceeded DOT regulatory requirements by agreeing that the cargo tank

pass a hydrostatic test before a manufacturer's certificate designating it as an MC-307 specification cargo tank would be transferred. After the cargo tank initially failed the hydrostatic test because of a liquid leak, the salesman and the owner of the testing and repair facility entered the cargo tank and found a small corrosion hole in the shell. The salesman asked the repair facility to repair the cargo tank shell by welding a patch over the hole. Since DOT regulations provide that the "suitability" of repairs made to cargo tanks failing to pass a hydrostatic test be determined "by the same method of test," this repair by itself probably would have been sufficient to meet DOT repair requirements when a cargo tank fails a hydrostatic test. However, the salesman and the owner of the repair facility also noticed that several weld seams inside the cargo tank had corrosion damage, and the salesman asked the repair facility to repair some of the welds that he judged to be more severely damaged, those generally concentrated in the lower third of the cargo tank. The cargo tank was given another hydrostatic test after the repairs were made and since it did not leak, the repairs met DOT requirements.

The owner of D. M. Equipment Leasing, Ltd., did not take prudent safety precautions to ensure that the cargo tank he was purchasing would be safe for the transportation of corrosive hazardous materials. He did not inspect the cargo tank before purchasing it and did not conduct a visual inspection after obtaining it. 9/ Furthermore, he apparently never questioned who had previously owned the 17-year-old cargo tank, what it had been used to transport, or what previous repairs and tests had been performed on it. However, even if the new owner had conducted a "visual inspection" of the cargo tank, there is no reason to believe that as a result of the visual inspection he too would not have "judged" it to be safe for transportation under the current DOT regulations. A BMCS mechanical engineer testified at the Safety Board's deposition proceedings that there are no BMCS criteria that tell an inspector when to pass or fail a cargo tank if corrosion is found in either the shell or the welds. The determination of an unsafe condition is a judgment call with no specific tests being required to determine the effects of corrosive damage to welds and the structural integrity of the tank.

The Safety Board investigated an accident near Beaumont, Texas, on March 9, 1983, involving a rubber-lined MC-312 cargo tank transporting 5,000 gallons of hydrochloric acid. After the cargo tank shell sheet material separated catastrophically behind a ring stiffener and between two continuous circumferential welds which attached the ring stiffener to the tank, the cargo tank released its entire load onto the highway. Samples of the shell were removed from the cargo tank and analyzed; rusting on the outside surface of the cargo tank at locations inaccessible to normal visual inspection techniques had reduced the material thickness by approximately one half. As a result of the investigation, the Safety Board issued Safety Recommendation H-83-30 on May 10, 1983, to the DOT's Research and Special Programs Administration (RSPA):

> Revise 49 CFR 177.824, "Retesting and Inspection of Cargo Tanks," to:
>
> (1) Require that all hazardous materials cargo tanks of mild and high strength, low alloy steel be subjected to several periodic external visual inspections annually.
> (2) Require that the thickness of cargo tank sheet material be inspected once each year using ultrasonic or equivalent techniques.

9/ The last visual inspection was conducted by Chemical Leaman on March 25, 1983. Since the DOT requires a visual inspection every 2 years, a visual inspection was due before the new owner used the cargo tank to transport hazardous materials.

(3) Require measurement of the thickness of appurtenances once each year that form air cavities adjacent to the cargo tank sheet material. If the thickness of the appurtenance material has corroded to a predetermined percentage of its manufactured thickness, require that access to the tank sheet material within the air cavity be made and that the thickness of the tank sheet material be measured.

(4) Require that cargo tanks be placed out of service when the thickness of the tank sheet material has corroded to a predetermined percentage (consistent with stress levels that will insure operational safety) of its manufactured thickness.

Concurrently, as a result of the Beaumont, Texas, accident, the Safety Board issued Safety Recommendation H-83-27 to the Federal Highway Administration (FHWA):

> Develop and prescribe continuing motor carrier operational inspection requirements for hazardous materials cargo tank sheet material thickness consistent with the results of the ultrasonic, or equivalent, inspection sampling program recommended by the Safety Board.

Following the Board's recommendations, the RSPA and the FHWA jointly funded research of the integrity of MC-307 and MC-312 cargo tanks including manufacturing, inspection, and retest and repair requirements. Subsequently, they issued an NPRM on September 17, 1985, effecting those requirements, and they requested public comments to be submitted by May 22, 1986. As a result of the August 12, 1985, incident, the Safety Board urges the RSPA and the FHWA to respond as expeditiously as possible to Safety Recommendations H-83-30 and H-83-27.

In its preliminary regulatory evaluation of the proposed rulemaking, the RSPA and FHWA concluded that severe internal and external tank corrosion in MC-307 and MC-312 cargo tanks contributed to a high incidence of cargo tank motor vehicle failures and that the number of cargo tanks demonstrating evidence of external and internal corrosion appeared to be increasing. The RSPA and FHWA also found that the regulations inadequately addressed cargo tank corrosion problems and cargo tank inspection and testing requirements. Furthermore, the motor carriers involved in the RSPA and FHWA research program suggested more frequent and more adequate inspection, testing, and repair requirements.

Among other changes, the proposed DOT regulations increase the frequency of external visual inspections and require internal visual inspections for more cargo tanks. Despite these provisions, the proposed regulations fail to provide adequate guidelines to evaluate the integrity of welds when corrosion is present. Appropriate technical examinations, i.e., radiography, wet fluorescent magnetic particle, liquid dye penetrant, ultrasonic, or other equivalent techniques, should be specifically required to evaluate the severity of corrosive damage to welds or other defects identified during visual inspections to preclude the necessity of inspectors making nonscientific, subjective judgments. The proposed regulations also would require thickness tests only every 2 years, rather than annually as recommended by the Safety Board in Safety Recommendation H-83-30, or in conjunction with annual visual inspections when the severity of corrosion or other defects need to be evaluated.

Furthermore, while requiring persons performing visual inspections to "judge" the condition and structural integrity of cargo tanks, neither the current nor the proposed regulations establish measurable qualification standards for persons performing visual inspections. The current regulation requires only that the inspector be "responsible and experienced" while the proposed regulation requires the inspector or witness to "be familar with the cargo tank and skilful in the use of the inspection and testing equipment needed." The DOT should develop objective standards for the qualification of persons inspecting and testing cargo tanks.

On February 26, 1986, the Safety Board filed comments on the NPRM with the DOT. The Safety Board stated that while the proposal clarifies and strengthens the conditions under which cargo tanks must be tested or inspected, it does not adequately establish measurable qualification standards for persons performing or witnessing important visual inspections and testing, and that the inspection requirements are inadequate for welds when indications of corrosion are present.

The proposed rulemaking also would require all cargo tanks to be repaired by a facility that 1) holds a current certificate of authorization from the ASME for Boiler and Pressure Vessel Code, Section VIII, Division 1, 2) holds a valid National Board of Boiler and Pressure Vessel Inspectors certificate, or 3) is under the direct supervision of an Authorized Inspector 10/ provided the Authorized Inspector witnesses the repair and subsequent testing of the repair and then certifies the repair as being acceptable. The Boiler and Pressure Vessel Code provides standards for the repair of weld defects, the removal of unacceptable defects, the rewelding of areas to be repaired, the examination of repaired welds by nondestructive examination methods to ensure that satisfactory repairs are made, and the qualification of persons doing the repair work.

Although the facility that repaired the cargo tank that failed during this incident held a current certificate of authorization from the ASME, the cargo tank was neither repaired in accordance with ASME standards nor was it required to be by the DOT. No technical examinations were performed or required to be performed on the cargo tank either before or after repairs were performed, and no one inspected the repair work after it had been completed. Furthermore, the repair work was not performed by an ASME-qualified welder. Had the cargo tank repairs been subject to the ASME or equivalent standards, including appropriate technical examinations, and had it been inspected by an independent inspector to ensure compliance with those standards, the testing and repair of other corrosion-damaged welds most likely would have been performed, and the failure that occurred on August 12, 1985, probably would have been prevented. However, while the DOT's proposed regulatory changes would improve cargo tank repair requirements, those changes may not go into effect because some of the proposed requirements may be difficult or impossible to meet, e.g., that welding repairs on the shell or head of cargo tanks with a design pressure of 15 psig or greater must be made in accordance with the National Board Inspection Code, even when the cargo tanks may not have been originally manufactured to meet that code. 11/ In addition, comments from the industry during public meetings addressed concerns about the difficulties of constructing all new cargo tanks to meet the ASME Code--especially technical problems associated with manufacturing oval-shaped MC-306 cargo tanks.

10/ The DOT defines "Authorized Inspector" as an inspector who is currently commissioned by the National Board of Boiler Pressure Vessel Inspectors and employed as an inspector by an Authorized Inspection Agency, Title 49 CFR 171.8.

11/ NPRM, Docket HM-183, 183-A 49 CFR 180.413(b)(4)(i).

The DOT should require corrosive damage and weld defect repairs to cargo tanks to be performed in accordance with measurable qualification standards and should require technical examinations, i.e., radiography, wet fluorescent magnetic particle, liquid dye penetrant, ultrasonic, or other equivalent techniques, after the repairs have been performed. Furthermore, all cargo tank corrosion damage and weld defect repairs should be performed either by a person who meets measurable qualification standards or by a person working under the direct supervision of an independent inspector who is so qualified and who will witness the repairs and subsequent examination(s) of the repairs and then certify the repairs as being acceptable.

Emergency Response

The truckdriver immediately furnished a shipping paper to the fire department when they arrived at the site of the leaking cargo tank, and the fire department promptly closed the highway to traffic, evacuated nearby areas, and effectively reduced public exposure to vapors from the hazardous waste. However, while the description of the hazardous waste on the shipping paper exceeded DOT requirements by identifying the hazardous ingredients in the waste solution, relative quantities of those materials were not provided. Even a very low concentration of some of the hazardous materials contained in that shipment can be harmful. The lack of that information to help evaluate the severity of the threat posed to public safety and the lack of information about the condition of the cargo tank, which could not be inspected because of an insulated covering, caused the well-trained fire department to properly take a conservative approach and to evacuate the area for the worst case scenario. It was not until 10 p.m., 5 hours after arriving on scene, that the fire department finally was provided the results of an analysis confirming that the concentrations of hazardous materials contained in that shipment were low. By then, however, on-scene personnel were preparing to transfer the load to another cargo tank, and the condition of the leaking cargo tank was still unknown. Therefore, the fire department continued its evacuation of the area until about midnight when the transfer was completed; the highway was reopened to traffic about 2 hours later, after the spilled solution was cleaned up. While the fire department probably would have closed the beltway until after the hazardous waste was transferred to another cargo tank even if they had initially known the concentrations of the hazardous ingredients, they may not have evacuated 600 persons from nearby areas.

Norfolk Naval Shipyard personnel told Safety Board investigators that since the incident on August 12, 1985, relative amounts of ingredients contained in hazardous waste shipments are entered on shipping papers when that information is available; however, that information is not presently available for all shipments. The DOD should esteblish procedures to identify the relative amount of hazardous ingredients contained in waste shipments and enter that information on shipping papers to better inform emergency response personnel about the composition and hazards of the waste material being transported in case of an incident. They should also include action that can be taken to mitigate its hazards.

In 1984, the Safety Board investigated another incident involving difficulties experienced by emergency response personnel in determining the composition and hazards of waste material contained in a cargo tank. On March 6, 1984, in Orange County, Florida, vapors escaping from the cargo tank containing waste acids caused the evacuation of a 3-square-mile area and the injury of 12 persons. The shipper, in compliance with DOT regulations, used the shipping name "waste, acid liquid,

NOS" 12/ for the waste material. The Board found that, as was the experience with the Fairfax County Fire and Rescue Department, the fire department could not quickly get accurate information about the composition of the hazardous waste acids from the shipping papers, the shipper, or the carrier during the incident. As a result of its investigation, the Board issued Safety Recommendation I-85-10 to the RSPA on May 16, 1985:

> Determine the adequacy of general shipping names on shipping papers for hazardous wastes and the need for additional information, such as technical and chemical group names, to better inform emergency response personnel about the composition and hazards of the material being shipped.

DOT has taken no substantial action on this recommendation, which remains open.

Shortly after arriving on scene, the Fairfax County Fire Department tried to get additional information about the leaking waste solution by calling telephone numbers for the Norfolk Naval Shipyard, as listed on the shipping paper, but because it was after 5 p.m., no one answered the telephone. The fire department later reached the Norfolk Naval Shipyard only after going through CHEMTREC. After the incident on August 12, 1985, the Norfolk Naval Shipyard began entering a 24-hour telephone number for its facility on shipping papers.

On August 1, 1984, the Safety Board investigated another accident in which local emergency response personnel had difficulty contacting the DOD for help when one of its hazardous materials shipments was involved in an accident. A tractor-semitrailer transporting explosive Navy torpedoes overturned while traveling through Denver, Colorado. Shortly after arriving on scene, the Denver Fire Department identified two DOD emergency telephone numbers on the shipping papers and called those numbers for help; however, neither telephone was answered. The Board found that the lack of a readily identifiable means for local emergency response personnel to obtain technical information from the DOD about the hazards of the shipment contributed to difficulties in conducting the emergency response. As a result of its investigation, on November 15, 1985, the Board issued Safety Recommendation I-85-21 to the DOD:

> Establish an effective 24-hour communication system to provide local emergency response personnel immediate access to authoritative information and expertise on the threats presented by explosive and other high-hazard Department of Defense shipments involved in transportation accidents.

On January 22, 1986, the DOD advised the Safety Board that it is evaluating communication systems to provide 24-hour assistance to emergency response personnel, and the recommendation remains "Open--Acceptable Action." In the interim, toll-free telephone numbers have been established for Military Traffic Management Command class A and B explosive shipments, and other DOD shipping activities have been instructed to enter on shipping papers 24-hour duty telephone numbers for shippers and receivers on shipments of high explosive and other hazardous material.

12/ NOS (n.o.s.) is a transportation industry abbreviation for "not otherwise specified." If a proper technical shipping name is not shown in DOT's hazardous materials table, a proper shipping name must be selected from general descriptions or n.o.s entries.

As a result of the August 12, 1985 accident, the Safety Board urges the DOD to respond, as expeditiously as possible, to Safety Recommendation I-85-21.

CONCLUSIONS

1. The hazardous waste solution leaked from the cargo tank through a crack in the rear head vertical weld, which had been weakened by extensive and severe corrosion.

2. Severe weld seam corrosion and a corrosion hole in the cargo tank shell were identified following a hydrostatic test that was performed on the cargo tank prior to the use of the cargo tank to transport any hazardous waste solution from the Norfolk Naval Shipyard.

3. A salesman determined which cargo tank weld seams would be repaired without the benefit of technical examinations to evaluate the extent of corrosive damage to the welds or the effect on the integrity of the cargo tank; repair work was not performed on the cargo tank's rear head vertical weld.

4. The current DOT regulations fail to provide objective standards to evaluate the severity of damage to welds when corrosion is identified.

5. The cargo tank repairs performed after the hydrostatic test did meet DOT requirements; however, the regulations are inadequate because they do not require technical examinations to evaluate the adequacy of repairs performed, and they do not provide objective standards for the qualification of persons performing the repair work.

6. A visual inspection, required by DOT regulations before the cargo tank was used to transport hazardous materials, was not performed by the new owner.

7. A visual inspection of the cargo tank by the new owner would not have ensured the repair of other weld seams with corrosion damage, including the rear head vertical weld, because DOT inspection requirements do not establish objective standards for persons performing or witnessing the inspection.

8. DOT requirements do not establish adequate, objective standards for persons performing visual inspections.

9. Although exceeding regulatory requirements, the shipping paper did not provide adequate information about the concentrations of waste material to assist on-scene emergency response personnel in evaluating the risks posed to public safety and the extent of evacuations necessary to prevent injuries.

10. The lack of a 24-hour DOD telephone number contributed to local emergency response difficulties in obtaining technical information about the hazardous waste shipment, in accurately evaluating the risks posed to the public by the spill, and in determining the extent of evacuations necessary to prevent injuries.

RECOMMENDATIONS

As a result of its investigation, the Safety Board reiterated the following safety recommendations:

--to the U.S. Department of Defense:

> Establish an effective 24-hour communication system to provide local emergency response personnel immediate access to authoritative information and expertise on the threats presented by explosive and other high-hazard Department of Defense shipments involved in transportation accidents. (I-85-21)

--to the Research and Special Programs Administration:

> Determine the adequacy of general shipping names on shipping papers for hazardous wastes and the need for additional information, such as technical and chemical group names, to better inform emergency response personnel about the composition and hazards of the material being shipped. (I-85-10)

In addition to the reiteration of these safety recommendations, the Safety Board also made the following recommendations:

--to the Department of Defense:

> Identify the relative amounts of hazardous ingredients contained in Department of Defense waste shipments and provide that information with the shipping papers to better inform emergency response personnel about the composition and hazards of the waste material being transported; include action that can be taken to mitigate the shipments' hazards. (Class II, Priority Action) (I-86-4)

--to the Research and Special Programs Administration:

> Establish objective standards for the qualification of persons performing inspections, tests, and technical examinations of cargo tanks. (Class II, Priority Action) (I-86-5)
>
> Establish objective standards for the qualification of persons performing repairs on cargo tanks involving corrosion damage and weld defects, or require that the repairs be performed under the direct supervision of an independent inspector who is qualified to established standards and who will certify acceptable repairs. (Class II, Priority Action) (I-86-6)
>
> Require appropriate technical examinations to be performed on cargo tanks when corrosion damage or weld defects are identified to scientifically measure and evaluate the severity of the corrosion damage or weld defects, and prohibit use of the cargo tanks to transport hazardous materials when the results of technical examinations signify structurally unsafe conditions. (Class II, Priority Action) (I-86-7)

Establish objective standards for repairs to cargo tanks with corrosion damage and weld defects, including the requirement of postrepair technical examinations. (Class II, Priority Action) (I-86-8)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ JOHN K. LAUBER
Member

/s/ JOSEPH T. NALL
Member

May 13, 1986

APPENDIXES

APPENDIX A

Investigation

The National Transportation Safety Board learned of the incident about 8:30 p.m., on August 12, 1985, and an investigation team from the Safety Board's Washington, D.C., headquarters arrived at the scene that evening. Investigation groups were established for emergency response and cargo tank factors.

Deposition Proceeding

The Safety Board convened a public deposition proceeding as part of its investigation of this incident on December 10, 1985, in Washington, D.C. Parties to the proceeding included Applied Technology, Inc., Applied Technology Transportation, Inc., Chemical Leaman Tank Lines, Inc., Keystone Tank Trailer Services Corporation, the cargo tank salesman, and the Bureau of Motor Carrier Safety of the Federal Highway Administration. Testimony was taken from five witnesses.

APPENDIX B

SHIPPING PAPER

State of New Jersey
Department of Enviromental Protection
Division of Waste Management
CN 028, Trenton, NJ 08625

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0404 Expires 7-31-85

UNIFORM HAZARDOUS WASTE MANIFEST

1 Generator's US EPA ID No. VA1170024813 — Manifest Document No. 12424A

2 Page 1 of 1 — Information in the shaded areas is not required by Federal law.

3 Generator's Name and Mailing Address
NORFOLK NAVAL SHIPYARD, RMCO BLDG 59, CODE 457
PORTSMOUTH, VA 23709

A State Manifest Document Number NJA0059373

B State Gen. ID

4 Generator's Phone (804) 396-7287

5 Transporter 1 Company Name — 6 US EPA ID Number
APPLIED TECHNOLOGY, INC DWD Rule 1.1.01.51.21.71.81.4

C State Transporter's ID NJSHAS 6818 TRCP

7 Transporter 2 Company Name — 8 US EPA ID Number
N/A

D Transporter's Phone (201) 255-5163

E State Transporter's ID

9 Designated Facility Name and Site Address — 10 US EPA ID Number
E.I. DUPONT
DEEPWATER, NJ
5 1 9 9 9 2 3 8 5 7 3 0

F Transporter's Phone

G State Facility's ID

H Facility's Phone (609) 299-6122

11 US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12 Containers No.	Type	13 Total Quantity	14 Unit Wt./Vol.	I Waste No.
a. WASTE COMPOUND, CLEANING LIQUID (hydrazine, thiourea, ethylene diamine tetraacetic acid, ammonium hydroxide, sulfates, ethylenediamine) CORROSIVE MAT'L NA1760	0 0 1	TIT	0 1 5 0	G	D002
b.					
c.					
d.					

J Additional Descriptions for Materials Listed Above
a. HAZ CODE-C, PHYS STATE-L
SPGR-1.00, PERCENTAGE-100%
b. c. d.

K Handling Codes for Wastes Listed Above
a. b. c. d.

15 Special Handling Instructions and Additional Information
WORK ORDER ON S[illegible]
REL. 005
SEALS [illegible]
OWD 112479, and 112480, OWD 112460, OWD 015109

16 GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national governmental regulations, and all applicable State laws and regulations.

Printed/Typed Name: JAMES J. MORE — Signature: James J. More — Month 08 Day 18 Year 84

TRANSPORTER

17 Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: AARON SWAIN — Signature: Aaron Swain — Month 08 Day 18 Year 84

18 Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name — Signature — Month Day Year

FACILITY

19 Discrepancy Indication Space

20 Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19
Printed/Typed Name — Signature — Month Day Year

In Case of an emergency or spill immediately call the State there at (609) 292-7172 (Night) (609) 292-5560 (Day)

EPA Form 8700-22 (3-84)

3 – TSD MAIL TO – GENERATOR

APPENDIX C

CARGO TANK SPECIFICATION CERTIFICATE

THE HEIL CO.
MILWAUKEE, WISCONSIN 53201

ICC Certificate of Compliance

This certifies that the new Heil tank identified below was designed, constructed and tested in accordance with Interstate Commerce Commission Cargo Tank Specification No. MC-307

Vehicle Type Trailerized
Nominal Capacity 5500 Gallons
Date Shipped April, 1968

Year Manufactured 1968
Heil Serial Number 919944
Manufactured by
THE HEIL CO. at Milwaukee, Wis.

Richard L Baker
Richard J Fuhl

APPENDIX D

HAZARDOUS MATERIALS INFORMATION 13/

Hydrazine

Hazards: highly toxic by ingestion, inhalation, and skin absorption. Strong irritant to skin and eyes. Severe explosion hazard when exposed to heat or by reaction with oxidizing materials. Shortterm inhalation limits 1 ppm for 30 minutes. A known carcinogen (OSHA).

Shipping information: (anhydrous) Flammable Liquid and Poison labels. (aqueous solution) Corrosive label.

Properties: colorless, fuming hygroscopic liquid; physical state as shipped - liquid; ammonia like odor; flash point open cup 126° F; shipping information for grades of purity - anhydrous to 99 percent, water solutions 35-64 percent.

Ammonium hydroxide

Hazards: toxic by ingestion and inhalation. Both liquid and vapor extremely irritating, especially to eyes. Short term inhalation limits 100 ppm for 30 minutes.

Shipping information: 12 - 44 percent ammonia, corrosive material; less then 12 percent ammonia, not regulated by highway.

Properties: colorless liquid; strong odor.

Ethylenediamine

Hazards: strong irritant to skin and eyes; toxic by inhalation and skin absorption. Short term inhalation limits 20 ppm for 5 minutes. Flammable, moderate fire risk.

Shipping information: corrosive material.

Properties: colorless, alkaline liquid; ammonia odor. Strong base. Soluble in water, alcohol. Readily absorbs carbon dioxide from air. Flash point 93° F closed cup.

Thiourea

Hazards: a known carcinogen (OSHA). Skin irritant.

Shipping information: not regulated.

Properties: white, lustrous crystals; bitter taste; soluble in cold water, ammonium thiocyanate solution, and alcohol.

13/ The Condensed Chemical Dictionary, Tenth Edition, revised by Gessner G. Hawley, Van Nostrand Reinhold Company, Inc., New York, New York, and Chemical Hazard Response Information System (CHRIS) Manual II, U.S. Coast Guard, Washington, D.C.

Ethylenediaminetetraacetic acid

Hazard: low toxicity.

Shipping information: not regulated.

Properties: colorless crystals; slightly soluble in water; insoluble in common organic solvents.

*U.S. GOVERNMENT PRINTING OFFICE: 1986-491-098:40016

END

DATE

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NTIS