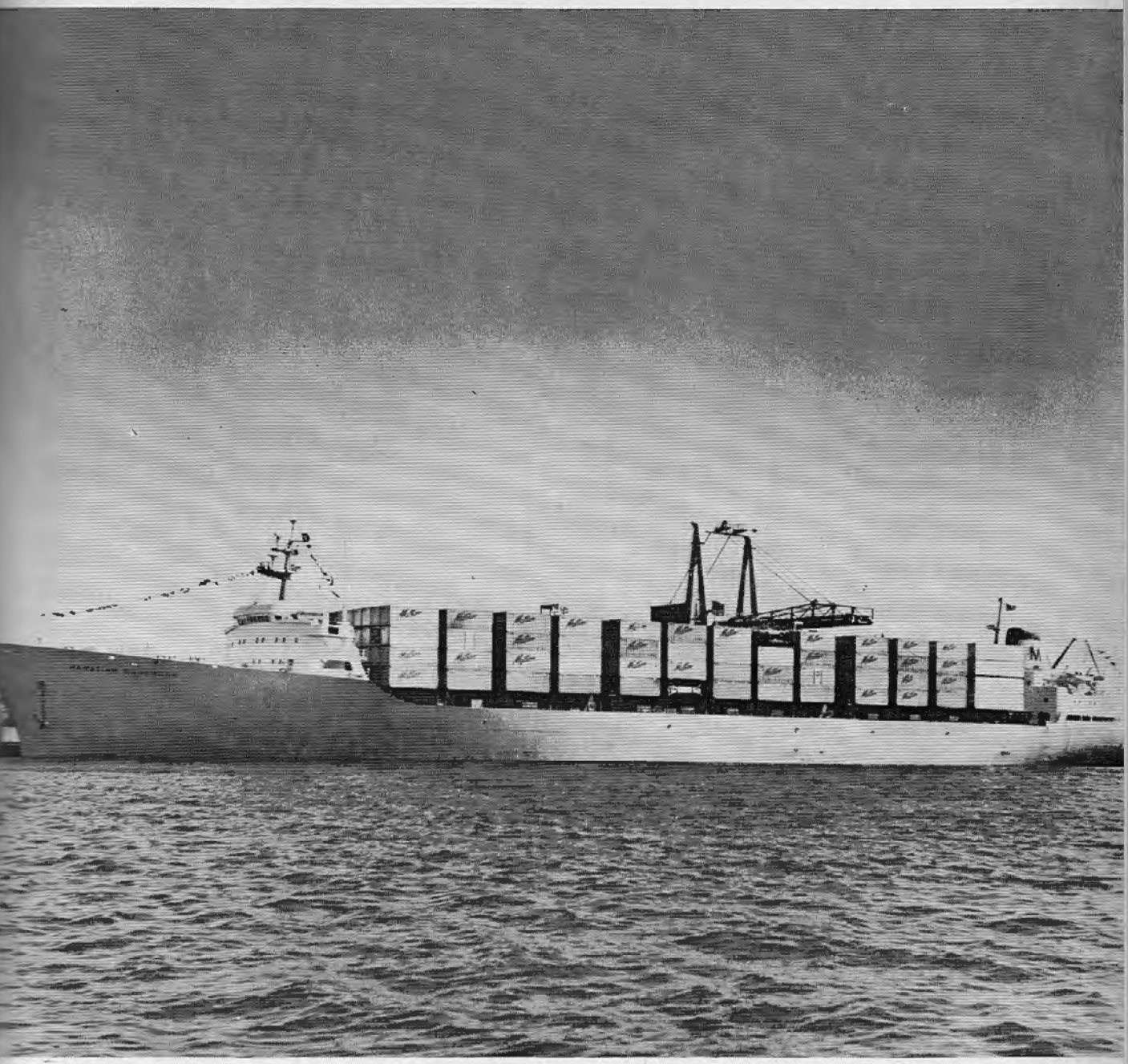
PROCEEDINGS
OF THE MARINE SAFETY COUNCIL



DEPARTMENT OF TRANSPORTATION UNITED STATES COAST GUARD

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PROCEEDINGS
OF THE
MARINE SAFETY COUNCIL

Vessel Transportation and Hazards of Liquefied Natural Gas . . .

The Tragedy of the M/V *Marjorie McAllister* . . .

THIS COPY FOR NOT LESS THAN 20 READERS—PLEASE PASS IT ALONG

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CONTENTS

COVERS

FRONT COVER: Matson containership, SS *Hawaiian Progress*, can carry 1,168 of Matson's 24-foot containers with a service speed of 23 knots. Its 32,000-horsepower engine is among the most powerful installed in a single propeller vessel.

BACK COVER: These ships collided in heavy fog off Galveston, Tex. Though the injury toll could have been much higher, only one man died and one was seriously injured. The M/V *Norbu*, only 5 miles away from the collision, was notified of the distress by the AMVER System and diverted from her course to render assistance. She successfully evacuated 70 crewmen from the distressed vessels. The AMVER System's quick response to the distress averted great tragedy.

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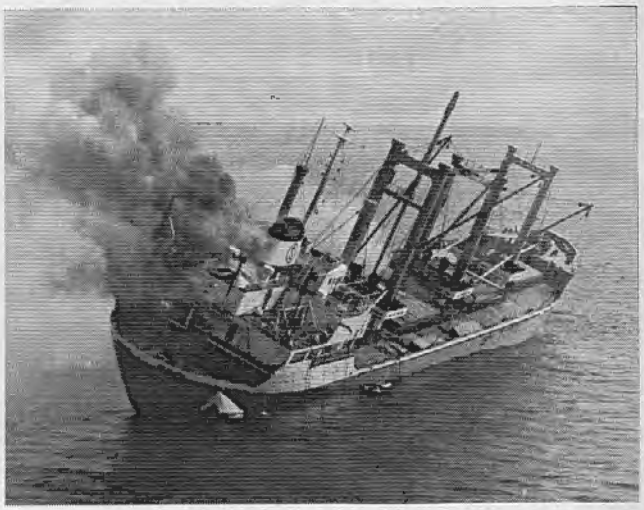
T. A. DeNardo, *Acting Editor*

FREQUENT AMVER PARTICIPANTS HONORED AT COAST GUARD LUNCHEON

Rear Admiral B. F. Engel, Commander, Coast Guard Eastern Area and Search and Rescue Coordinator for the Atlantic Maritime Region, displays a ship's certificate for outstanding AMVER participation.



The freighter Don Jose Figueras *lists, afire, in the Pacific. This was only one of several prominent distress incidents to which the AMVER System has responded with success. Some 40 persons were saved from this vessel through the cooperation of the worldwide maritime industry.*

Computerized lifesaving at sea and the cooperation of the worldwide maritime industry that supports it, was the subject of a special recognition luncheon recently in New York. Approximately 80 representatives of numerous shipping corupanies and other maritime-affiliated industries joined the Coast Guard in a salute to the AMVER System.

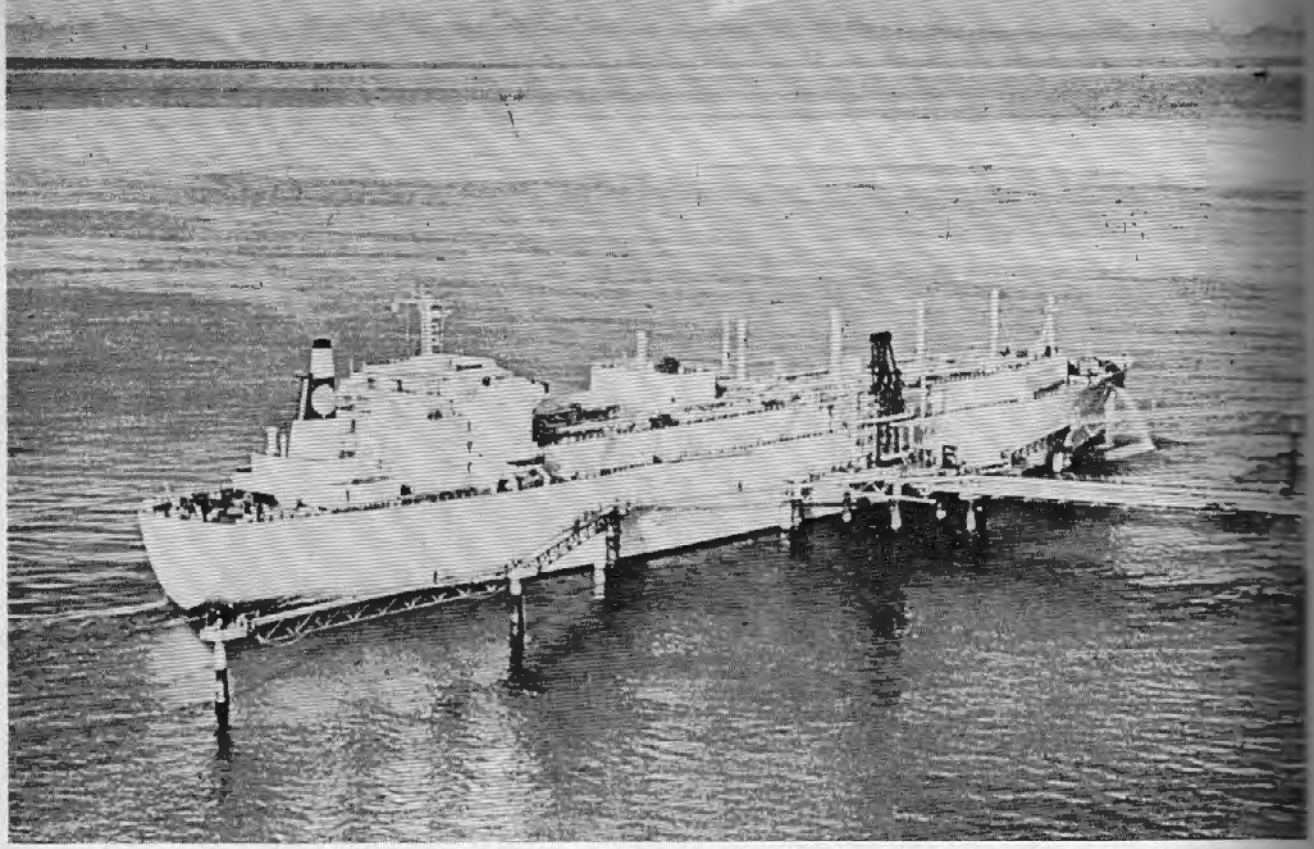
Those attending the luncheon were among the most active AMVER supporters in the maritime community having been awarded special Coast Guard pennants, certificates, and letters of appreciation from the AMVER System. Speaking at the luncheon were Coast Guard Assistant Commandant, VADM Thomas R. Sargent, the keynote speaker; CAPT John V. Caffrey, Chief of the System; and RADM B. F. Engel, Commander, Coast Guard Eastern Area and Search and Rescue Coordinator for the Atlantic Maritime Region.

The AMVER System, which uses a computer and sophisticated electronic equipment in its headquarters on Governors Island, can quickly predict the location and rescue facilities of merchant ships near a distressed vessel anywhere in the world. The entire program, however, depends on the regular participation of merchant vessels which provide the center with such information as course and speed, port of destination, and onboard medical facilities. Once furnished, the computer keeps the information current by automatic updates every 12 hours, utilizing periodic position reports submitted by participating vessels approximately every 36 hours while underway. The ships transmit this information via a worldwide network of cooperating radio stations, each of which relays the transmission to the AMVER Center.

Printouts or SURPIC's, standing for SURface PICtures, are available to any rescue center throughout the world. These SURPIC's provide a computer-predicted listing of all ships calculated to be near the scene of a high seas emergency, as well as their particular search and rescue capabilities. The rescue center can then decide which vessel is best equipped to provide assistance, and can request that vessel to go to the aid of the stricken ship.

To date, according to AMVER's statistics, about one-fourth of all worldwide shipping major ocean-going vessels, or about 5,000 vessels,

(*Continued on page 168*)



The Polar Alaska, *a Liquefied Natural Gas vessel, utilizes the gravity tank type stowage system. Its 70,000 cubic meter capacity is slightly more than half of that envisioned for the new LNG supertankers which may pose great hazards to ports if not properly regulated.*

VESSEL TRANSPORTATION AND HAZARDS OF LIQUEFIED NATURAL GAS

LCDR H. D. Williams, USCG

Chief, Chemical Engineering Branch, Hazardous Materials Division, Headquarters

From an address before the Eighteenth Western Safety Congress, Anaheim, Calif., on May 12, 1971.

THE SUBJECT OF marine transportation of liquefied natural gas is an important one. I shall discuss those areas of the subject which "regulators" are particularly concerned about.

The Federal Power Commission is currently being petitioned by various firms, four to date, for licenses to import LNG. Such licenses will be granted if it is not in the public interest to deny them. However, the Federal Power Commission must consider both the economic and technical aspects of the public interest. Technical advice is sought from the Department of Transportation and, therefore, a deeper interest in the chemical and physical properties of LNG as well as the vessels designed to transport it, has developed within the Department of Transportation.

In the past, regulations for marine transportation of a product have evolved through standards of good practice. Today, however, new cargoes are proposed for shipment in large bulk quantities before all aspects

of the transportation scheme can be evaluated. Supertanker shipments of LNG are one good example. Shipment of cryogenic (very low temperature) cargoes such as propane, ammonia, butane, propylene, and ethane has posed a challenge in the past which has been met with notable success. The safety record of LPG/NH_3 vessels authorized to trade in the United States is unblemished. But adding methane (LNG) to the list of gases seems to be taking a giant step into the field of cryogenic cargoes which requires some careful analysis prior to bringing the other foot forward.

The pertinent physical properties of LNG at cryogenic conditions can be presented very quickly. Table 1 lists these physical properties:

The basic regulations for a vessel to carry liquefied flammable gases are found in Part 38 of the Tank Vessel Regulations, Subchapter D. Subchapter D comprises Parts 30 through 40 of Title 46 of the Code of Federal Regulations. Part 38 does not contain all of the specific requirements, cross references being made to other subchapters covering marine engineering requirements and electrical engineering requirements, for example. Part 38 is written to cover the broad category of liquefied flammable gases (those flammable gases with a Reid vapor pressure exceeding 40 pounds which have been liquefied).

Subchapter O, "Certain Bulk Dangerous Cargoes on Unmanned Tank Barges," Part 151 of Title 46, also contains regulatory requirements relative to liquefied flammable gases. However, those liquefied flammable gases included in Subchapter O are gases which possess some hazard characteristic such as toxicity corrosivity or reactivity, in addition to flammability. At the present time LNG has not been found to possess such an additional characteristic and will, therefore, continue to be regulated within Subchapter D.

TABLE 1

Some Physical Properties of LNG

Composition of Commercial LNG:

Methane	94.9%
Ethane	5.5%
Propane	0.6%
Butane	trace
Carbon dioxide	trace

Density of LNG: 0.42 g/cc
Boiling Point of Methane: −258.68° F
Freezing Point of Methane: −296.46° F
Ambient Vapor Pressure: 2000 psia
Flash Point: −306° F
Flammable limits in air: 5–15%
Vapor density: 0.55 (air=1)

The physical properties of LNG, in comparison with those of other LFG's, indicate that LNG tests the requirements of Part 38 and in many areas causes an "equivalent safety" determination to be made. By this I mean an alternative to a required procedure which provides an equivalent degree of safety. Without going too deeply into detail I should like to point out some of the areas where an interpretation of an equivalent has been necessary.

Lieutenant Commander Williams is a 1960 graduate of the Coast Guard Academy. After service on board the USCG Cutter Yakutat *and a tour of LORAN duty in Italy, he was assigned as an instructor at the USCG Officer Candidate School. From 1966 to 1968 he was a postgraduate student at the University of Maryland where he was awarded a Master of Science Degree in Chemical Engineering. Following postgraduate training he was assigned to the Chemical Engineering Branch within the Cargo and Hazardous Materials Division in the Office of Merchant Marine Safety. LCDR Williams is a member of the American Institute of Chemical Engineers and serves on two panels dealing with safety in the handling and transportation of liquefied natural gas.*

HEAT TRANSMISSION

Adequacy of the inner and outer vessel hulls must be determined via a heat transmission study utilizing 0° F. air temperature and 32° F. water temperature ambients. Depending upon the arrangement and insulation material effectiveness, low temperature steel may or may not be required in certain areas of the inner or outer hull. To avoid the high cost of special steel for such purpose, some credit has been given to local heating schemes to protect longitudinal cofferdams, etc., from possible brittle fracture.

SECONDARY BARRIER

Part 38 states that pressure vessels used for cargo containment will by themselves constitute the cargo containment system and usually will not require a secondary barrier. Alternatively, a gravity or prismatic tank would require a secondary barrier. However, pressure vessels designed to contain methane in large bulk shipment have not been proposed and are not anticipated considering the expense of constructing large tanks for such high pressure service.

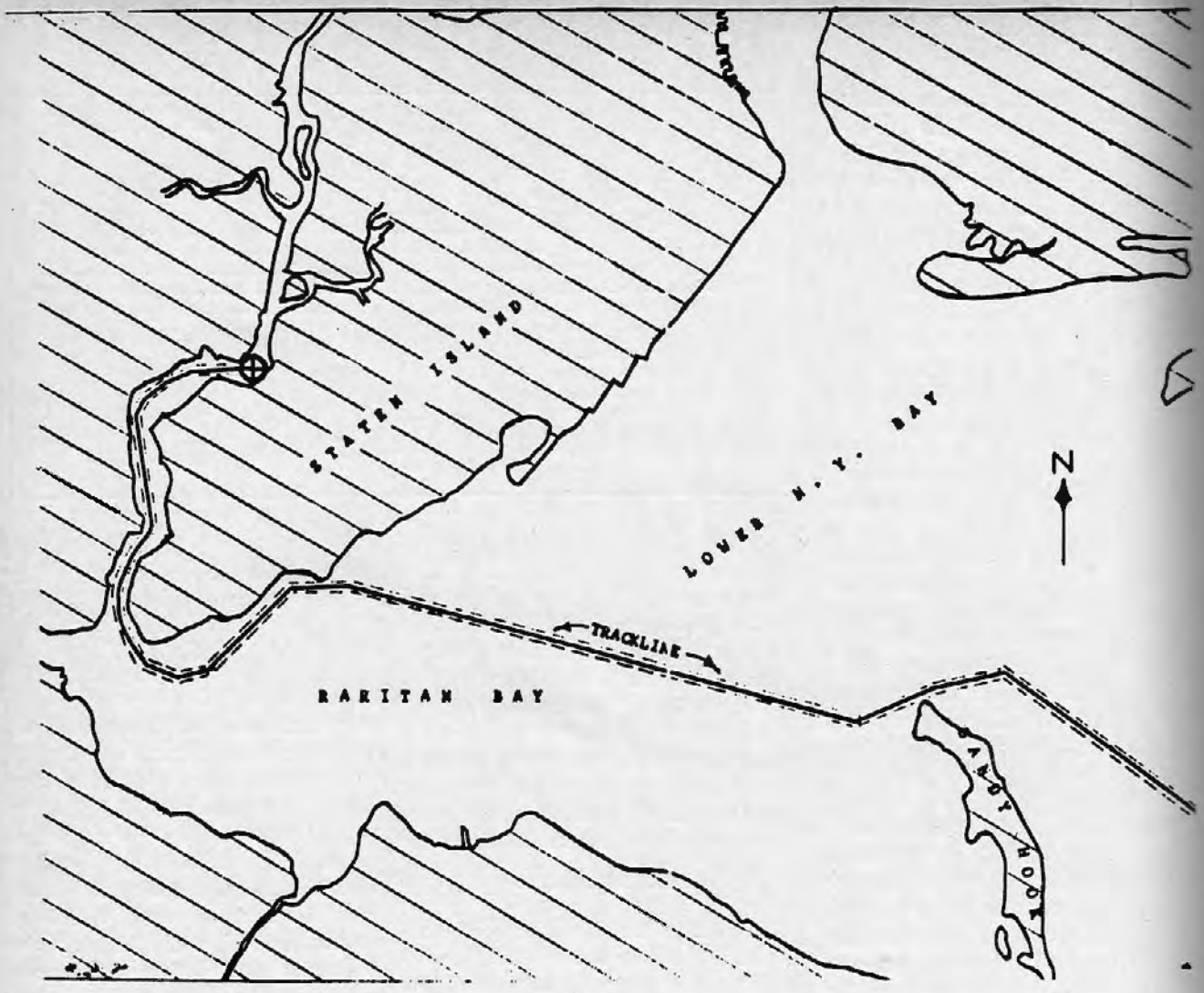


Figure 1

But pressure vessels of some intermediate pressure (between 14.7 and the vapor pressure of methane) have been proposed, primarily to preclude the requirement for a secondary barrier. Considering the higher degree of stress analysis and reliability of pressure vessels vs. prismatic tanks, such proposals have been favorably considered. In certain cases, however, spray protection, on a low temperature steel protective barrier, has been required between the pressure vessels and the inner hull.

VAPOR BOILOFF CONTAINMENT

Part 38 states that a system of cargo containment which allows the gas to warm up and increase in pressure may be acceptable. However, the tank design pressure and insulation must provide a suitable margin for the operating time and temperatures involved. This provision is one method included with two others as possible solutions to the vapor boiloff problem. The other choices are reliquefaction and utilization of boiloff as vessel fuel. If the vessel is not designed to use the vapor boiloff as fuel, then reliquefaction is required. Finally, mention is made that other systems may be accepted by the Commandant. Vapor boiloff containment is one of the most difficult pro-

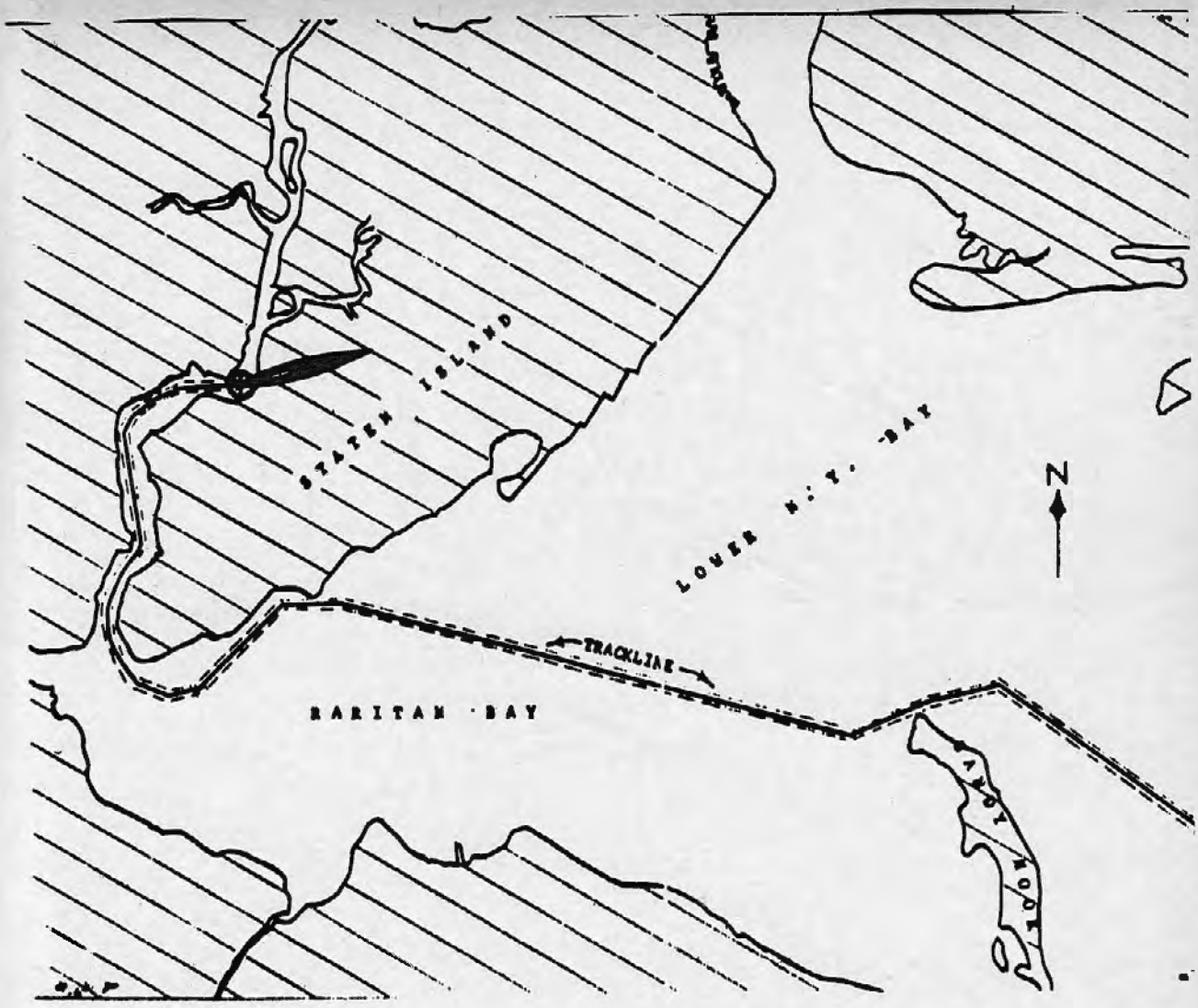


Figure 2

visions designers have had to face. Since neither pressurized nor gravity containment systems have been developed which provide total cargo containment, the problem of boiloff applies to either design. Although most vessels use boiloff as fuel, the burning of boiloff in the boiler at reduced speeds creates an excess of steam which can not be used in the turbine. Unless some other method of coping with the additional steam, or heat if you prefer, can be provided, then the methane boiloff must be vented to atmosphere. Current solutions to venting comprise:

a. boiler fuel with excess steam led to turbine. Excess power generated would be dissipated through a variable pitch propeller.

b. boiler fuel with excess steam (heat) to be discharged through a heat exchanger or dumped to the harbor.

c. vapor combustion in a combustion chamber designed to fully burn all boiloff and discharge exhaust at a temperature below 1,000° F.

d. vapor combustion through an underwater combustion apparatus or torch. Heat of combustion would be lost to surrounding water.

The schemes outlined above are general and imply a time independent solution to boiloff in that no raw methane would be discharged

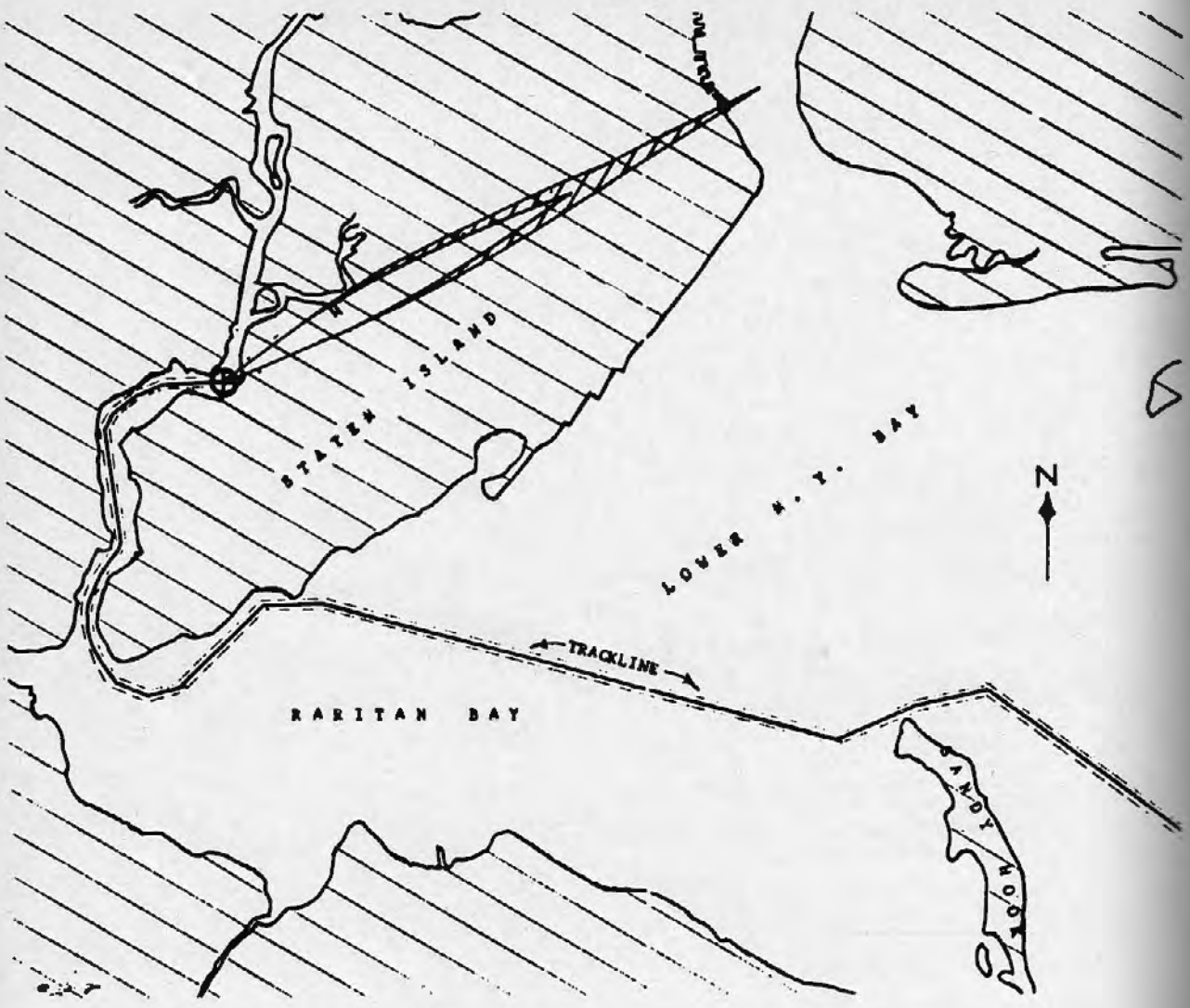


Figure 3

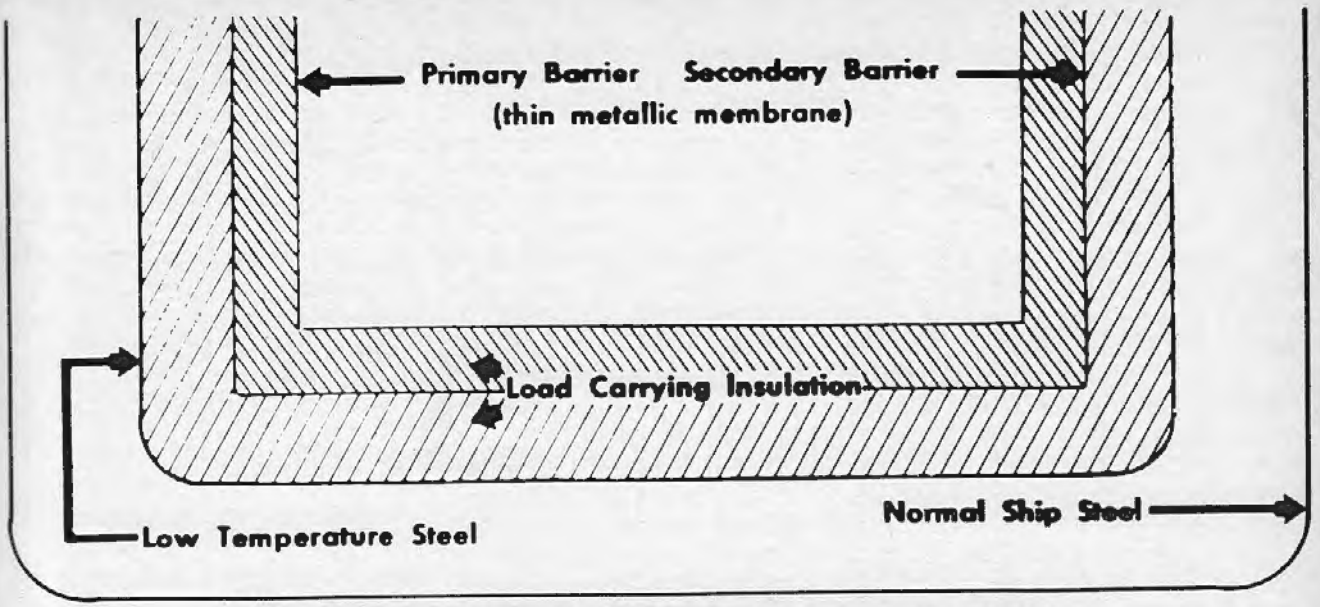
unless a breakdown of a vessel system occurred. These requirements appear to be logical aboard self-propelled, manned tank vessels but not for unmanned barges. Considering that reliquefaction / refrigeration equipment costs are currently prohibitive for barges and that other systems are impractical, some other provision has been sought to prevent uncontrolled boiloff on coastwise barge shipments of LNG. The system considered equivalent appears to be a combination design/operational control arrangement. Current thinking would require the barge to be designed to contain the LNG, without boiloff release, for twice the maximum duration of a voyage or 45 days, whichever period is greater. The barge would be moved by a dedicated tug which would remain attached to the barge throughout the entire voyage. It is envisioned that certain operational controls would be necessary to insure a safe barge movement. Such controls could consist of:

a. Notification to the Coast Guard of intention to load.

b. Loading at designated waterfront facilities with vapor return lines provided.

c. Departure only with favorable weather forecasted.

d. Departure message to Coast Guard including:



LNG Containment in Membrane Tank with Secondary Barrier

Figure 4

1. Intended route
2. Departure time
3. Tank pressure and liquid temperature

e. Harbor control in congested areas or Coast Guard escort.

f. Daylight traverse of restricted areas.

g. Periodic position reports including tank pressure and changes in ETA.

Review of such barges would also include examination of facility piping and transfer apparatus to insure that equipment was capable of handling any increase in vapor pressure during voyage which could cause venting during transfer operations.

Generally the problem areas in the provisions for carriage of LNG in ships and barges have now been covered. The other subparts of Part 38 have been applied in vessel design with no problems in interpretation. One important reason for this is the fact that our regulations are only directly applicable to U.S.-flag vessels and today no U.S.-flag LNG vessels exist!

Part 2.01–13(a) of Title 46 Code of Federal Regulations states:

> "Foreign vessels registered in countries which are parties to the effective International Convention for Safety of Life at Sea are normally subject to the examination provided for in Chapter I of that Convention. However, in the case of any vessel involving novel features of design or construction, upon which that Convention is silent or which involve potential unusual operating risks, a more extensive inspection may be required when considered necessary to safeguard the life or property in United States' ports where such vessel may enter. In such a case, pertinent plans and/or calculations may be required to be submitted sufficiently in advance to permit evaluation before inspection."

The submission of pertinent plans and/or calculations has been referred to as foreign vessel "plan review." Plan review and a subsequent arrival inspection are currently required for 39 chemicals, among which is methane. Completion of plan review and an inspection by U.S. Coast Guard Marine Inspection and Captain of the Port personnel will qualify the vessel for a Letter of Compliance, attesting that the vessel complies with plans approved by the Coast Guard and may carry the cargoes listed on the Letter in U.S. ports.

The criteria used in reviewing foreign plans or calculations are those included in U.S. Regulations for U.S.-flag vessel construction. The use of our regulations established minimum standards and insures no double

standards exist for foreign and U.S. construction. Viewing such foreign vessels from an office at U.S. Coast Guard Headquarters, it appears that the construction of gas ships is booming. Unfortunately for some aspects of the U.S. economy, all the now operating liquefied flammable gas ships fly foreign flags. However, if these sophisticated gas ships did not exist, exports of liquefied gas cargoes would not occur. Now we face importation of a liquefied gas to satisfy a recognized demand. This gas presents a greater hazard than those liquefied gas cargoes carried in bulk previously.

Let us consider the hazards posed by a 120,000 cubic meter (m^3) LNG vessel delivering a cargo in New York. We will assume that this ship contains five membrane type tanks (*see figure 4*), 24,000 m^3 of LNG in each. *Figure 1* is a chart of New York harbor and has been marked to indicate the vessel's track to an offloading terminal on Staten Island.

In our hypothetical illustration, the following conditions prevail:

Time of day: Night time
Air temp: 70° F.
Water temp: 60° F.
Surface wind: 260° T, 8. KTS
Sea condition: Calm
Current: Slack Water
Tide: Slack Water
Visibility: Cloud Coverage 4/8

In *Figure 2*, the LNG tanker has collided with an outbound vessel in Port Reading Reach, near Smoking Point, Staten Island, and one tank has been breached, releasing 24,000 m^3 of liquefied natural gas onto the water. The cross sectional area of the spill has been drawn in, plus the vapor plume. The shaded area in the plume represents the explosive range, 5.3–14.3% methane in air. *Figure 2* represents the vapor plume characteristic which would evolve from vaporization from a quiescent liquid-methane interface as determined experimentally. This would be a "minimum" size vapor plume. The plume shown in *Figure 2* was based upon a continuous vaporization of the LNG at a rate of 2,000 m^3/min or a 12 minute duration. The plume as a result of instantaneous vaporization would appear as indicated in *Figure 3*. The plume in *Figure 3* illustrates the "maximum" plume length. Actually the plume, for the conditions anticipated, would lie between the plumes shown. Vaporization would be accelerated by wave action or chop which would tend to increase heat transfer area and prevent the formation of ice.

The Bureau of Mines did a study on the "Hazards of LNG Spillage in Marine Transportation" for the Coast Guard. One hazard which I have not mentioned, but which has been widely publicized is the flameless explosion phenomenon observed by the BUMINES investigators for this study. Current thinking is that this phenomenon is the result of superheating of the liquid natural gas and subsequent violent vaporization. A great deal of effort is being expended by several large companies plus the Government through BUMINES to determine conclusively the cause of the explosion and what methods can be used to prevent it. One way of preventing superheating might be the adulteration of the LNG with an innocuous substance which would provide nucleate boiling sites and thus prevent any possibility of superheating.

Another consideration regarding the hypothetical release of LNG from the tanker in New York is the question of brittle fracture of the tanker's inner or outer hull due to contact with the cargo, either within the hull or on the surrounding water. The question to be resolved is how effective a heat sink is the surrounding water in preventing brittle fracture of the tanker's hull. The BUMINES study indicated that LNG does not flash immediately but forms an ice/hydrate layer which then vaporizes.

The hazards associated with the marine transportation of liquefied natural gas have been very briefly outlined. Each particular hazard including those of plume characteristic and vapor dispersion increases in magnitude and importance with each new LNG vessel. Considering the quantities of gas aboard one LNG supertanker, no one wants to "learn from experience" what may happen if a casualty occurs.

AMVER

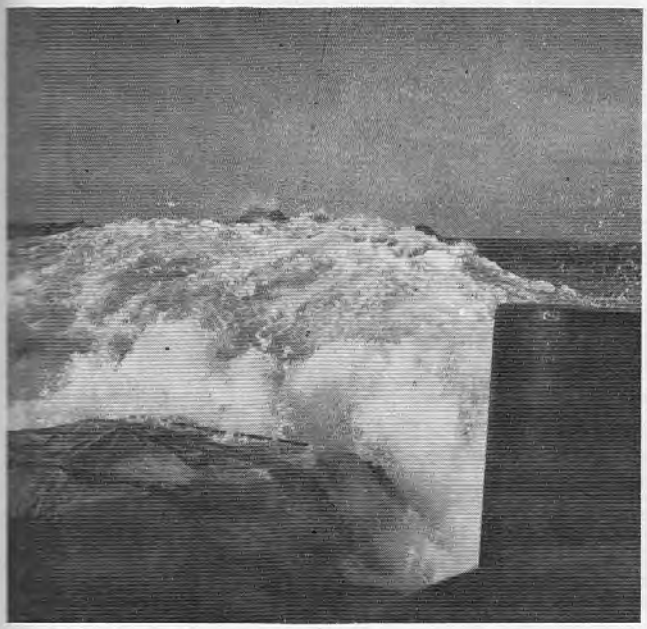
(*Continued from page 161*)

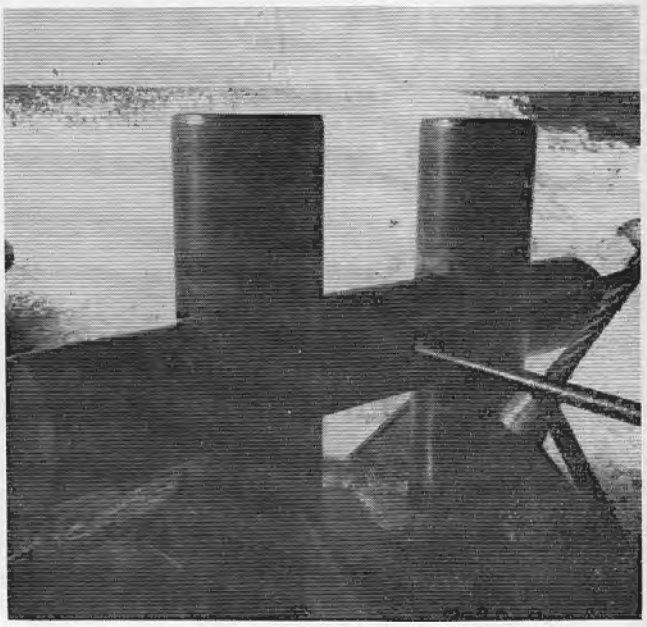
are participating in the AMVER program. Last year, the center provided more than 1,500 SURPIC's and figured in such prominent cases as the 1970 Atlantic rescue by the *S/S President Jackson* of seven people from the schooner *Tina Marie Doncine,* 135 miles northeast of Bermuda and in the saving of some 40 persons from the blazing freighter *Don Jose Figueras,* 900 miles at sea in the Pacific.

In commenting on the effectiveness of AMVER, RADM Engel added that "Casualties at sea among the merchant fleet have persisted at an alarming level. The Coast Guard's activity in this field has consequently remained high, and vessels of many countries cooperating with AMVER have offered much assistance. This luncheon enables us to acknowledge the contribution of vessels from over 60 nations plotted by our computer."

Details of AMVER System operations may be obtained from Commander, Eastern Area, U.S. Coast Guard, Governors Island, New York, N.Y. 10004 and from Commander, Western Area, U.S. Coast Guard, 630 Sansome St., San Francisco, Calif. 94126.

THE TRAGEDY OF THE *M/V MARJORIE McALLISTER*





Green water pours over the port quarter of the Marjorie McAllister's *sister ship,* Helen McAllister. *Much heavier seas than these 6 footers inundated the stern of the* Marjorie McAllister *on the night of the casualty.*

ON 2 NOVEMBER 1969, a motor towing vessel, the *M/V Marjorie McAllister,* sank off the coast of North Carolina with the loss of all hands. Since there are no witnesses to the casualty, and since the vessel itself has not been located, the piecing together of exactly what happened that day involves a large measure of speculation.

What is actually known of the casualty is that the *Marjorie McAllister* departed New York City shortly before noon on 30 October, bound for Jacksonville, Fla. She was making this voyage without tow. The voyage went routinely until the first of November. About 1000 that day, her Master reported via radiotelephone to the dispatcher's office in New York that she was 50 miles south of Chesapeake Light in 8-foot seas with 25-knot winds. The Master did not report any problems; he was informed that one of the company's other tugs had sought refuge in Morehead City, N.C., due to high winds and mountainous seas. He was also informed that gale warnings were posted from Florida to Cape Hatteras. The Master said that he would continue south, as the weather was not too bad in his present position, and that he intended to put into Morehead City if refuge from the weather became necessary. The Master, both mates, and a deckhand, all lived within 20 miles of Morehead City. Had the Master known what lay ahead for the tug and her crew of six, his decision would undoubtedly have been different.

The weather along the Atlantic Coast on the evening of 1 November and in the early morning of 2 November was severe. By 1200, 1 November, gale warnings had been posted for the entire coast from Virginia Beach, Va., to Charleston, S.C.

At midnight on 1 November, the salvage vessel *Curb*, located approximately 60 miles southeast of the last known position of the *Marjorie McAllister*, logged its weather as wind northeast, force 10 (48 to 55 knots), height of seas, 30 to 35 feet. The *Curb*'s log shows that by 0300 on the second, the wind had increased to force 13 (in excess of 70 knots).

At about 1630 on 1 November, the Master again reported to his dispatcher. The tug had made headway to a position 14 to 17 miles south of Diamond Shoals, near Cape Hatteras, N.C. She was now in southeasterly winds of about 23 knots. At 0025 on 2 November, the U.S. Coast Guard Group, Fort Macon, N.C., received radiotelephone communication from the *Marjorie McAllister*. She was in distress she reported, taking on water in her engineroom and experiencing electrical difficulties. She gave her position as 6 miles west of Cape Lookout Shoals Buoy 14. This position, incidentally, lies along the trackline normally used by vessels approaching Morehead City from the north. The vessel indicated to Group Fort Macon that no Coast Guard assistance was needed, but she requested that the Coast Guard station standby on 2182 kHz.

Only 24 minutes later the vessel again contacted the Coast Guard at Fort Macon and requested assistance. At the request of the towing vessel, an attempt was made to shift frequencies. During the course of the attempted shift, all communications between the vessel and the Coast Guard were lost. The *Curb*, however, had overheard the transmissions between the distressed tug and the Coast Guard. Her Master called the *Marjorie McAllister* from about 60 miles away and volunteered to relay her position and any other information to the Coast Guard. The tugboat acknowledged this transmission and asked the *Curb* to standby. This was the last word heard from the *Marjorie McAllister*.

An extensive air and surface search was initiated. Equipment and debris, identified as coming from the *Marjorie McAllister* were recovered from the general vicinity of her last known position. Included among the recovered items were several life-preserving devices, none of which was apparently used by the crew. This fact attests to the probability that the vessel sank suddenly. No bodies were recovered; the six crew members are presumed dead.

The above account of the casualty relates all of the confirmed details. It obviously leaves the reader with many questions. They can be answered only by putting together bits of information regarding the tug's construction and her crew and then eliminating the least probable occurrences. The story that evolves from these deductions is one of a chain reaction ending in tragedy.

Neither the *Marjorie McAllister* nor her Master were veterans of this type of voyage. The towing vessel had made only two coastwise voyages since her delivery trip from New Orleans to New York in 1968. Each of those trips was made with tow. Although not required to be inspected by the Coast Guard, she was classed for "Unrestricted Ocean Service" by the American Bureau of Shipping. ABS had issued her a valid load line certificate under the provisions of the International Load Line Convention, 1966. However, since her keel was laid prior to the effective date of that Convention, she was built to meet the requirements of the 1930 International Load Line Convention. Her Master held an expired license as "Master of Uninspected Motor Fishing Vessels of not Over 500 Gross Tons upon Coastwise Water not to exceed (50) fifty miles offshore and tributary waters from Eastport, Maine to Port Isabel, Texas". He held no current Coast Guard issued license, and none was required for his current employment. He had been a pilot of fishing vessels for about 20 years in the Beaufort-Morehead City, N.C., area, and he had 5½ years of experience on tugboats, 2½ of them as a Master. This, however, was his first coastwise offshore voyage on a tugboat.

The vessel which he commanded was a welded steel, single-screw diesel-propelled, 3,600 hp towing vessel. She was 198.3 gross tons, 111.5 feet in length, 30.0 feet in breadth, and 10.51 feet in depth. A freeboard at the stern of about 2.5 feet was considered normal.

The vessel had automated controls so that the machinery could be controlled directly from the pilothouse or at the automation control panel located in the upper engineroom in addition to local control in the lower engineroom. Therefore, no regular engineroom watchstander was necessary, and the tug usually proceeded without one. This was especially true at night.

Perhaps because of the Master's inexperience with this type of vessel in coastwise sailing and his desire to put into a port close to home—if he had to put into port at all, the Master proceeded into the adverse weather, into rougher and rougher seas, and by late the night of 1 November decided to head into Morehead City for refuge. For some time the ship had endured the heavy seas, but the tug had been running into the southeasterly swells. Changing course to head for Morehead City would drastically alter the effects of the mountainous seas on the tug. Now the seas would be striking the vessel from astern. With a freeboard aft of only 2.5 feet, the stern of the *Marjorie McAllister* would be awash much of the time. The builders of the tug had provided for this by building in very large freeing ports astern. But even in lesser seas than the tug was now encountering, as much as 6 inches of green water would rush up to the after end of the deckhouse before receding again.

At the afterend of the deckhouse was a towing winch. The winch was surrounded on three sides by bulk-

This photograph of the Marjorie McAllister *shows her low freeboard aft, an element of her design which investigators determined to have contributed to her sinking off Point Lookout, N.C., on 2 November 1969.*

heads; only the afterend of this enclosure was open. But within the enclosure was a watertight door leading into the engineroom. This door was customarily hooked back in an open position by an automatic hook. Two forced air ventilators with no permanent closures were located port and starboard within the towing winch enclosure. The ventilators were 2 feet in diameter and terminated 4 feet above the deck in the enclosure. They provided ventilation through six outlets in the engineroom. Two of these outlets, one port and one starboard, were located directly over the main engine generators. The lack of permanent closures on these ventilators would not be construed as a violation of the Load Line Regulations (Title 46, Subchapter E, Code of Federal Regulations) nor of the vessel's load line certificate, since they were not located in an "exposed" position as those regulations have been interpreted.

With the above known, and with the addition of a degree of speculation, the following series of events emerges as the most probable.

The Master had changed course for Morehead City. Huge seas poured green water over the stern of the tug. The load of water was too voluminous for the freeing ports, and the water, trapped on deck by 30-inch high bulwarks, was able to gather in the towing winch enclosure to such a height as to pour into the vessel through the open watertight door to the engineroom. Even if the door was closed, enough water could have collected in the enclosure to enter the tug through the forced air ventilators. The water cascaded in over the generators and the ship experienced electrical difficulties. With the generators shorting out, someone looked into the engineroom. He reported the tug was taking on water fast and the Coast Guard was contacted. It was felt that the crew could handle the situation, as the automatic electric bilge pump is backed up by additional pumps located on the diesel generator engines. These backup pumps had to be primed and manually started. Since they were rarely used as bilge pumps and since their use as bilge pumps necessitated several changes in valve openings and closures, activating them for emergency backup services to the automatic bilge pump would have been time consuming. The crew was unable to activate the pumps; water continued to flood the engine-

room. The assistance of the Coast Guard was requested, but communications were lost. The crew continued to struggle to activate the pumps as the Master requested the *Curb* to standby to relay transmissions to Fort Macon. Suddenly all electrical power was lost as the two 75 KW generators were completely shorted out along with the in port and emergency 30 KW generator located at the same level in the same compartment. Steerage was lost due to the electrical failure, and the tug was helpless against the elements and continued to flood. The battery system which provided emergency power for the radio was also located in the engineroom and was rendered useless when that space was flooded. The severity of the weather and the suddenness of the tug's foundering prevented the crew from saving themselves. How ironic that among the few traces of the *Marjorie McAllister* ever found was the fully inflated, but unused liferaft.

The National Transportation Safety Board wrote in its report on the casualty:

> The National Transportation Safety Board finds that the probable cause of the loss of this vessel was foundering. Extremely adverse weather, flooding of the engineroom, and the sudden capsizing of the vessel were the causes of the foundering and the loss of all hands. Other contributing factors were:
>
> a. The Master's decision to proceed south into the storm in lieu of seeking refuge in the Chesapeake Bay area;
>
> b. The apparent change in course to proceed into Morehead City, which created a following sea condition;
>
> c. The design of the vessel in regard to its freeboard, the area of the freeing ports, and the location of vents, without permanent closing devices on the weather deck where boarding seas could accumulate sufficiently to inundate the vents;
>
> d. The fact that all three generators were located at the same level in one engineroom, thereby greatly increasing the probability of losing all sources of power at the same time;
>
> e. The loss of electrical power as a result of partial flooding, which would have caused a loss of steerage and rendered the automatic electric bilge pump inoperative;
>
> f. The combination of adverse conditions which greatly increased the possibility that the operating personnel were unable to place the two emergency bilge pumps in operation;
>
> g. The fact that the door between the engineroom and the towing winch enclosure was routinely latched open while the tug was underway, thus exposing the engineroom to boarding seas.

The U.S. Coast Guard Marine Board of Investigation concluded, among other things regarding the casualty:

* * * * *

> 2. The possibility of the entrance of water due to a structural defect in the hull is quite remote. The vessel was essentially double hulled due to the number of double bottom tanks and wing tanks throughout most of the vessel. The closed fresh water engine cooling system and the limited number of branch lines and valves from a single sea chest reduced the probability of flooding due to failure of salt water piping or fittings. Although the scantlings, construction, and basic design of the vessel appear suitable for Ocean Service, certain features such as the low freeboard, low forecastle, open foredeck, pilothouse windows, and the location of vents, louvers, and doors on the weather decks are more compatible with a tug in Harbor or Inland Service. The vessel was equipped with the required amount of approved lifesaving equipment and there is no evidence that the failure of any this equipment contributed to the casualty.

* * * * *

> 6. This casualty may have been prevented if the *Marjorie McAllister* had sought shelter after the Master became aware of the heavy weather ahead or if she had been designed in such a manner as to be able to withstand the extremely adverse wind and sea conditions without shipping large quantities of water while underway. A vessel design that would have allowed the vessel to remain hove to without power in seas of the type encountered may also have prevented the casnalty. In particular, the casualty might have been prevented if the air intakes to the engineroom had been located at a point other than in a partially enclosed space into which seas from the stern or quarter could break and build up. Although the means by which the water entered the vessel have not been precisely determined, it is possible that the casualty could also have been prevented by the elimination of the after watertight door from the towing winch enclosure to the engineroom.

The *Marjorie McAllister,* being a diesel-propelled towing vessel of under 300 gross tons, was not subject to U.S. Coast Guard inspection and certification. The Coast Guard Marine Board of Investigation recommended that action be taken to require licensing by the Coast Guard of Masters of towing vessels and that the Coast Guard seek legislation for the inspection of all towing vessels operating in Ocean or Coastwise Service. The National Transportation Safety Board concurred in these recommendations. They also recommended that the Coast Guard, in its special study of towing vessels, also analyze the casualties involving towing vessels operating in Inland Waters to determine whether there is a need for legislation requiring inspection of all towing vessels. The Safety Board was able to cite six casualties to this type of vessel which have occurred since 9 January 1969, and they stated, "This casualty is only one of several which have occurred within the past 2 years, and further illustrates the need for safety regulations specifically directed to this type of vessel." (See "M/V *Southern Cities* Disappearance," "Proceedings" of the Merchant Marine Council, Vol. 25, No. 8, p. 155 (August 1968) and "Marine Casualties—Prevention Through Legislation," "Proceedings", Vol. 28, No. 1, p. 3 (January 1971).)

The Commandant, U.S. Coast Guard, took action concerning the

(*Continued on page 176*)

NO SUPERVISION, TRAINING–BENZENE KILLS DECK HANDS

The 100-foot tug was bound for Texas pushing six empty tank barges which she had picked up in West Virginia. What should have been a routine voyage down the Mississippi River and the Gulf Intracoastal Waterway was disrupted by disaster. Two young deckhands, new to sailing and filled with confidence for the future, lost their lives.

Twenty days out of a West Virginia port, the Master and the two young hands made an inspection tour of the barges. In two cargo tanks they discovered small quantities of liquid benzene. The Master informed his men that they would have to strip the tanks should the benzene not evaporate overnight. The following morning the two informed the Master that they were going out to the barge to strip the tanks. The Master voiced no objection, but neither did he give the men instruction or supervision. He watched them carrying cleaning equipment toward the barge. He was the last man to see them alive.

It must have been only minutes after they entered the nongas-free tank that the two men were overcome by the high concentration of benzene fumes. Exposures of more than 5 to 10 minutes to atmospheres containing as few as 20,000 parts per million of benzene is fatal. The tank the men were stripping proved to contain 22,000 ppm even after 8 hours of forced air ventilation. Ninety minutes passed before the men were missed, searched for, and found collapsed at the bottom of the poisoned tank.

The two men were ages 18 and 20. They had had a total of 105 days of tank barge experience between them. They had not been thoroughly trained in safety. Neither their company nor the Master of the vessel had established a planned safety program for the crew and moreover, neither had stressed the fatal effects of benzene fumes. Yet these two men were permitted, without experience, training, or supervision to enter a fatal nongas-free tank to strip it, using standard mop and bucket procedure.

These two young men could still be alive. Experienced supervision would have saved them. A training program, which had included the use of safety equipment or the hazards of the cargoes with which they would be working should have saved them. With the omission of both, these men were left defenseless in a deadly compartment. ⚓

WHAT HAPPENED?

On 19 November 1969, a 628-foot oil tanker carrying a full load of Alaskan crude oil suffered a violent explosion and flash fire in the midship shelter deck. The explosion lifted the entire midship house off the deck about 27 inches and resulted in injuries to seven crew members. The extensive damage, the injuries, and the resulting time lost might have been averted.

The morning of the explosion, three men entered the shelter deck to begin work. They noticed that a small amount of crude oil, about a half pint, had seeped out around the starboard butterworth plate on one of the cargo tanks. One of the men was instructed to tighten the plate and to put sawdust on the spilled oil. He did so. As he finished, he stood up to stow the unneeded sawdust. Suddenly he found himself, clothes afire, blown out the afterhatch of the shelter deck. He suffered third degree burns, as did the two men with him. Other injuries included assorted back, arm, and rib injuries. The blast and the ensuing flash fire caused severe damage to the ship.

The question on everyone's mind was, "What happened?" None of the three men in the shelter deck had been smoking, and none could remember smelling any oil odors. Investigation showed that only the afterstarboard hatch of the shelter deck was open at the time of the blast. No other ventilation had been provided. It was noted that the two 18-inch diameter natural ventilators from the boat deck to the shelter deck had been painted over.

Officials concluded that ignition of an accumulation of explosive crude oil vapors in the shelter deck caused the explosion. The vapors probably seeped into the enclosed compartment from the poorly fastened butterworth plate. They theorize, from the reported high incidence of strong static electricity charges in the climate, that a spark of static from the nylon shirt or nylon parka worn by one of the men in the compartment was the source of ignition.

It would be simple to attribute this accident to a mere freak of nature under extraordinary circumstances. Yet it is clear that the covering of the natural ventilators inhibited adequate ventilation and contributed to the causing of the accident. The ventilators had been covered, according to the vessel's Master, to prevent seawater from entering the shelter deck during rough weather. (Following the casualty, a new design for the equipment was found to permit ventilation while keeping out seawater.) Although their covering was not considered negligence in this case, the accident and its results clearly point to the need for adequate ventilation of compartments adjacent to tanks containing potentially explosive mixtures. ⚓

SAFETY AWARD

The S.S. Christopher Lykes *earned the highest safety ratings in the Lykes Fleet during 1970 for the second consecutive year. Members of the crew and company representatives photographed at the award ceremony recently in New Orleans were, front row, left to right: Wiper Omer L. Taylor, Steward Sherman Howard, Cook Charles Roland, Engineering Cadet Bruce Manos, Deck Cadet Peter Mitchell, Engineering Cadet John Hickman, Fireman-Water Tender Lafus Hill and Wiper James Jones. Back row, from left, are Port Steward E. F. Spears, First Assistant Engineer Earl Heckman, Captain E. B. Hendrix, Manager of Marine Division; Chief Engineer Euel Phillips, Captain C. H. Waring, Manager of Accident Prevention Division; Captain George Roberts, Master; Stevedoring Safety Inspector D. B. Edwards, Electrician Felder Waller, R. T. Reckling, Vice President-Operations, Third Mate Joseph McDonald, Second Electrician Bob Lee Tims, and Chief Mate Gerald Olson. Absent from the photograph were Captain George A. Madison, now retired, who served as Master during 1970 and James McConnell, the regular Chief Engineer.* ⚓

Quick Thinking Saves Shipmate's Life

Two seamen, whose quick thinking helped save the life of a shipmate, recently received commendations from American Mail Line officials. Alfred W. Wheel and Ted Costigan, both able-bodied seamen aboard the SS ALASKAN MAIL, administered first aid by applying tourniquets to the shattered leg of Third Mate Morton E. Olson following an accident as the ship was departing from Yokohama on January 20, 1971.

Paul Stumpf, safety director for American Mail Line, presented the commendations aboard the ship.

Both men feel their actions were spontaneous, and "something we would do for any shipmate," as Costigan put it.

Neither man has had formal first aid training; however, both were exposed to general first aid practices in the service. Wheeler learned basic first aid while serving in the Navy and Coast Guard; Costigan acquired his knowledge in the Navy.

The commendations, signed by Capt. H. A. Greenwood, AML's Vice-President, Operations, read as follows:

"For centuries, men have sailed together to virtually every navigable spot on earth. As ships became more modern, jobs on board became more specialized, and maybe a certain amount of the adventure might have been lost from the legends surrounding the sea.

"However, the stature of the men who sail the ships has remained virtually unchanged, and never was it more apparent than in the actions you performed following the accident to Third Mate Morton E. Olson. Because of your efforts, Mr. Olson is alive today.

"And though words can hardly describe the heartfelt appreciation we feel here at American Mail Line, we do want you to know that we recognize the calibre of men like yourself, and are proud that they, as you do, sail with American Mail Line." ⚓

—The Channel
Pacific Maritime Assn.

New Maritime Weather Service Broadcast To North Atlantic

A new weather service for North Atlantic mariners is now being transmitted from the Coast Guard Radio Station at Boston, Mass.

Two weather maps prepared by the U.S. Weather Service are broadcast daily at 1730 G.m.t. on frequencies nf 8502 khz and 12750 khz covering almost the entire North Atlantic and including all major shipping lanes between the United States and Europe. The first gives weather, wind and sea conditions over the area for 1200 G.m.t. on the day of the broadcast. The second provides a 24-hour forecast for 1200 G.m.t. on the following day. Both give storm centers, heights of waves, speed and direction of wind, isobars and major fronts. Time required for transmission is approximately 20 minutes.

This service, initiated on June 16th, is the first facsimile broadcast of marine weather from a U.S. Radio Station that is intended for ships without a trained meteorologist on board. Appropriate facsimile receivers are currently in use on many merchant ships and government vessels. Ships without radio officers aboard, previnusly unable to receive forecasts broadcast in code, now have an alternative means of receiving weather information. Radio officers as well should find this service a time saver in their duties.

This pilot program will lead to a more comprehensive service in the summer of 1972 in the Eastern North Pacific with the completion of the Coast Guard's long range radio station near San Francisco. With this expanded service, up to 8 hours a day of environmental broadcasts will be scheduled consisting largely of facsimile weather charts supplemented by voice and morse telegraphy broadcasts.

Full scale service will be made available to other areas as additional Coast Guard radio stations are modified. ‡

INLAND RULES OF THE ROAD

Q. You are in a meeting situation and see a green running light off your starboard bow, you should:

(a) Sound two blasts on your whistle.

(b) Come right and sound one blast.

(c) Stop your engines.

(d) Sound three blasts and back down.

A. (a) Sound two blasts on your whistle.

Q. You are under way in fog and hear a signal somewhere ahead, you should:

(a) Answer it.

(b) Back down full.

(c) Stop your engines.

(d) Continue as you were with extreme caution.

A. (c) Stop your engines.

Q. While underway at night you observe a vessel range light in line off your starboard beam you should:

(a) Come right.

(b) Sound the danger signal.

(c) Continue as you were.

(d) Come left.

A. (c) Continue as you were.

Q. Two vertical amber lights indicate:

(a) A tug pulling two tows.

(b) A vessel at anchor.

(c) A vessel unloading dangerous cargo.

(d) A tug towing by pushing ahead.

A. (d) A tug towing by pushing ahead.

INTERNATIONAL RULES OF THE ROAD

Q. Three black balls in a vertical line mean:

(a) A vessel aground.

(b) Not under command.

(c) A pilot aboard.

(d) Distress.

A. (a) A vessel aground.

Q. Three vertical lights at the masthead of a tug means:

(a) More than one tow.

(b) A tow of more than 600 feet.

(c) She's aground.

(d) SOS.

A. (b) A tow of more than 600 feet.

Q. You have a vessel astern of you and you desire to make a right turn, you should:

(a) Sound one blast and come right.

(b) Sound one bast and wait for his answer.

(c) Sound two blasts and come right.

(d) Sound two blasts and wait for his answer.

A. (a) Sound one blast and come right.

Q. You have a sailing vessel under sail and steam approaching off your port bow, you should:

(a) Come left and pass astern.

(b) Stop your engines.

(c) Come right to pass well clear ahead.

(d) Hold your course and speed.

A. (d) Hold your course and speed.

Q. Upon making an approach to a harbor you sight a buoy with black and white vertical stripes, you:

(a) Should pass it to starboard.

(b) Should pass it to port.

(c) Can pass on either side.

(d) Are required to report its position to the Coast Guard.

A. (c) Can pass on either side.

AMENDMENTS TO REGULATIONS

Title 46 Changes

Chapter I—Coast Guard, Department of Transportation

SUBCHAPTER N—DANGEROUS CARGOES

PART 146—TRANSPORTATION OR STORAGE OF EXPLOSIVES OR OTHER DANGEROUS ARTICLES OR SUBSTANCES, AND COMBUSTIBLE LIQUIDS ON BOARD VESSELS

Difluoromonochloroethane in Tank Trucks

This amendment allows the carriage of difluoromonochloroethane on deck in the open on board trailerships and trainships in motor vehicle tank trucks complying with Department of Transportation regulations. This amendment modifies the descriptive name of the article to clarify what isomer is covered and to provide an additional shipping name.

At page 13093 of this issue of the FEDERAL REGISTER, the Hazardous Materials Regulations Board of the Department of Transportation is amending 49 CFR Parts 172 and 173 to allow shipments of difluoromonochloroethane in specification MC 330 and MC 331 cargo tanks and 105A100W tank car tanks. For reasons fully stated in that document, the Board changed its proposal to allow a lower design pressure for 105A100W tank car tanks and modified the shipping name of difluoromonochloroethane.

The Board's amendment to the hazardous materials regulations of the Department of Transportation in Title 49 applies to shippers by water, air, and land and to carriers by air and land. This amendment to Title 46 applies to carriers by water.

Interested persons were afforded an opportunity to participate in the making of this rule. This amendment was published as a notice of proposed rule making (CGFR 71–22) on March 27, 1971 (36 F.R. 45132) and a hearing was held on this amendment on May 4 ,1971 at Washington, D.C.

Accordingly, § 146.24–100 of Title 46, Code of Federal Regulations, is amended as follows:

1. By revising the descriptive name of the article in the first column of Table G from "Difluoromonochloroethane" to "Difluoromonochloroethane (1,1 difluoro 1-chloroethane)."

2. By adding in the fourth column (CARGO VESSEL) of Table G Compressed Gases (for the table entry "Difluoromonochloroethane (1,1 difluor 1-chloroethane)" under the caption "Authorized for stowage 'On deck in open' only" the words: "Motor Vehicle tank trucks complying with DOT regulations (trailerships and trainships only)."

(R.S. 4472, as amended; sec. 1, 19 Stat. 252, sec. 6(b)(1), 80 Stat. 937; 46 U.S.C. 170, 49 U.S.C. 1655(b)(1); 49 CFR 1.46(b))

Effective date. This amendment shall become effective on August 31, 1971.

Dated: July 7, 1971.

W. F. REA III,

Rear Admiral, U.S. Coast Guard, Chief, Office of Merchant Marine Safety.

(FR Doc.71–9843 Filed 7–13–71;8:45 am)

(Federal Register of July 14, 1971.)

NAVIGATION AND VESSEL INSPECTION CIRCULAR 5–71

July 1, 1971

Subject: Index to 46 CFR Part 151 (Certain Bulk Dangerous Cargoes on Unmanned Tank Barges), Subchapter O

PURPOSE

The purpose of this circular is to provide a useful index to Subchapter O for unmanned tank barges.

ACTION

Any additions or corrections should be addressed to U.S. Coast Guard (MHM/83), 400 Seventh St. SW., Washington, D.C. 20590.

Copies of this circular with enclosure (1) may be obtained at the local marine inspection office or by writing U.S. Coast Guard (CAS–2/81), 400 Seventh St. SW., Washington, D.C. 20590.

M/V MARJORIE McALLISTER

(*Continued from page 172*)

recommendations of the Coast Guard Marine Board of Investigation as follows:

> 1. The Coast Guard has consistently and strongly supported legislative efforts dedicated to the several aspects of towboat safety. During the course of hearings on the subject in 1968, the Coast Guard indicated that an operator licensing program would be a significant first step toward reversing the casualty trend on towboats and that once the program was in effect, both the impact on maritime safety as well as any need for supplemental legislation could be more accurately assessed.
>
> 2. This casualty amply demonstrates that, although a licensing program would address one of the most significant causes of casualties on uninspected vessels—personnel fault—mandatory inspection is necessary to encompass solutions to the full range of towboat risk problems.
>
> 3. Accordingly, the Coast Guard will undertake a review of pending legislative proposals in light of recent casualties which have occurred to towing vessels operating on Oceans and Coastwise Waters.

Perhaps increased safety for the vessels and the men who sail the seas will mitigate the tragedy of the *M/V Marjorie McAllister.*

NOTE: The above article is based upon the Marine Casualty Report of the incident, comprised of the U.S. Coast Guard Marine Board of Investigation Report and Commandant's Action and the Action by National Transportation Safety Board released 29 June 1971. Copies of the Marine Casualty Report may be obtained by writing U.S. Coast Guard (MVI–3/83), 400 Seventh Street SW., Washington, D.C. 20590.

MERCHANT MARINE SAFETY PUBLICATIONS

The following publications of marine safety rules and regulations may be obtained from the nearest marine inspection office of the U.S. Coast Guard. Because changes to the rules and regulations are made from time to time, these publications, between revisions, must be kept current by the individual consulting the latest applicable Federal Register. (Official changes to all Federal rules and regulations are published in the Federal Register, printed daily except Sunday, Monday, and days following holidays.) The date of each Coast Guard publication in the table below is indicated in parentheses following its title. The dates of the Federal Registers affecting each publication are noted after the date of each edition.

The Federal Register will be furnished by mail to subscribers, free of postage, for $2.50 per month or $25 per year, payable in advance. The charge for individual copies is 20 cents for each issue, or 20 cents for each group of pages as actually bound. Remit check or money order, made payable to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Regulations for Dangerous Cargoes, 46 CFR 146 and 147 (Subchapter N), dated January 1, 1971 are now available from the Superintendent of Documents price: $3.75.

CG No.	TITLE OF PUBLICATION
101	Specimen Examination for Merchant Marine Deck Officers (7–1–63).
108	Rules and Regulations for Military Explosives and Hazardous Munitions (5–1–68). F.R. 6–7–68, 2–12–69, 10–29–69.
115	Marine Engineering Regulations (7–1–70). F.R. 12–30–70.
123	Rules and Regulations for Tank Vessels (5–1–69). F.R. 10–29–69, 2–25–70, 6–17–70, 10–31–70, 12–30–70.
129	Proceedings of the Marine Safety Council (Monthly).
169	Rules of the Road—International—Inland (9–1–65). F.R. 12–8–65, 12–22–65, 2–5–66, 3–15–66, 7–30–66, 8–2–66, 9–7–66, 10–22–66, 5–11–67, 12–23–67, 6–4–68, 10–29–69, 11–29–69, 4–3–71.
172	Rules of the Road—Great Lakes (9–1–66). F.R. 7–4–69, 8–4–70.
174	A Manual for the Safe Handling of Inflammable and Combustible Liquids (3–2–64).
175	Manual for Lifeboatmen, Able Seamen, and Qualified Members of Engine Department (3–1–65).
176	Load Line Regulations (2–1–71).
182	Specimen Examinations for Merchant Marine Engineer Licenses (7–1–63).
184	Rules of the Road—Western Rivers (9–1–66). F.R. 9–7–66, 5–11–67, 12–23–67, 6–4–68, 11–29–69, 4–3–71.
190	Equipment Lists (8–1–70). F.R. 8–15–70, 9–29–70.
191	Rules and Regulations for Licensing and Certificating of Merchant Marine Personnel (5–1–68). F.R. 11–28–68, 4–30–70, 6–17–70, 12–30–70, 6–17–71.
200	Marine Investigation Regulations and Suspension and Revocation Proceedings (5–1–67). F.R. 3–30–68, 4–30–70, 10–20–70.
220	Specimen Examination Questions for Licenses as Master, Mate, and Pilot of Central Western Rivers Vessels (4–1–57).
227	Laws Governing Marine Inspection (3–1–65).
239	Security of Vessels and Waterfront Facilities (5–1–68). F.R. 10–29–69, 5–15–70, 9–11–70, 1–20–71, 4–1–71.
249	Marine Safety Council Public Hearing Agenda (Annually).
256	Rules and Regulations for Passenger Vessels (5–1–69). F.R. 10–29–69, 2–25–70, 4–30–70, 6–17–70, 10–31–70, 12–30–70.
257	Rules and Regulations for Cargo and Miscellaneous Vessels (8–1–69). F.R. 10–29–69, 2–25–70, 4–22–70, 4–30–70, 6–17–70, 10–31–70, 12–30–70.
258	Rules and Regulations for Uninspected Vessels (5–1–70).
259	Electrical Engineering Regulations (3–1–67). F.R. 12–20–67, 12–27–67, 1–27–68, 4–12–68, 12–18–68, 12–28–68, 10–29–69, 2–25–70, 4–30–70, 12–30–70.
266	Rules and Regulations for Bulk Grain Cargoes (5–1–68). F.R. 12–4–69.
268	Rules and Regulations for Manning of Vessels (5–1–67). F.R. 4–12–68, 4–30–70, 12–30–70.
293	Miscellaneous Electrical Equipment List (9–3–68).
320	Rules and Regulations for Artificial Islands and Fixed Structures on the Outer Continental Shelf (11–1–68). F.R. 12–17–68, 10–29–69, 1–20–71.
323	Rules and Regulations for Small Passenger Vessels (Under 100 Gross Tons) (7–1–69). F.R. 10–29–69, 2–25–70, 4–30–70, 10–31–70, 12–30–70.
329	Fire Fighting Manual for Tank Vessels (7–1–68).

CHANGES PUBLISHED DURING JULY 1971

The following has been modified by Federal Register:
Subchapter N of Title 46 CFR, Federal Register July 14, 1971.