PROCEEDINGS
OF THE MARINE SAFETY COUNCIL

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U.S. Department of Transportation **CG-129** United States Coast Guard

PROCEEDINGS

OF THE MARINE SAFETY COUNCIL

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Contents

features

departments

Cover

On February 8, 1979 the largest waterfront inferno in years was battled at Bush Terminal Pier in Brooklyn. This photo shows the cutter MAHONING, accompanied by New York harbor tugs, police and fire boats, fighting the blaze with streams of water. According to the Associated Press, 35 land based fire companies, an Army Corps of Engineers vessel and several civilian tug boat companies were involved in the two and one-half hour struggle to bring the fire under control.

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B: n(50); c(16); e(5); f(4); ghj(3); r(2); bkipq(1)
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D: adgklm(1)
E: mn(1)
F: bckp(1)
Lists TCG-06, CG-13

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maritime sidelights

CORRECTION TO ANNOUNCEMENT OF 1979 INTERNATIONAL ICE PATROL SERVICE

Please add the following frequencies and times to Maritime Command Radio Mill Cove/CFH Radiofacsimile Broadcasts (all frequencies kHz, all times GMT). The announcement appeared on pages 20-23 of the February 1979 Proceedings.

Times:
0000, 1300, 2200

Frequency:
6330 (continuous)
9890 (continuous)
13510 (1000 - 2200)

NATIONAL TRANSPORTATION WEEK

President Carter has proclaimed May 13 through 19 as National Transportation Week. Friday of that week, May 18, has been designated National Defense Transportation Day. This special observance should remind Americans that efficient transportation networks and systems have always played a vital role in our nation's development and security, whether moving people and products in peacetime or military forces and materials in times of war. During the two World Wars, a bridge of American ships stretched from the shores of the U.S. arsenal of democracy to the coast of Europe, pouring strategic commodities into that war-torn continent in sufficient quantities to overwhelm the Axis powers. Our inland and intracoastal waterways have also been instrumental to national defense, falling under jurisdiction of the Office of Defense Transportation in events of national crisis.

"Getting there" in a hurry has always been a primary objective of our Armed Forces. Today, the United States has a number of military weapons and vehicles that qualify as the fastest or biggest. In proclaiming National Defense Transportation Day this year, the President pointed out that our strides in military transportation systems significantly strengthen our defense. As we reflect on the importance of all transportation systems, we who are involved in marine transportation should be especially proud of the important role the marine industry plays in our nation's economy and defense.

VINYL CHLORIDE GUIDE

The Coast Guard has prepared an easy-to-use, illustrated booklet on the safe transportation and handling of vinyl chloride in bulk quantities. Vinyl chloride is an invisible gas under normal conditions, but is usually shipped as a liquid under pressure or under refrigeration. It is extremely flammable, toxic when inhaled (the higher the concentration, the more severe the reaction--from dizziness to death), and a suspected cancer-causing agent. Copies of this pamphlet are available free of charge from Commandant (G-MHM/3), U.S. Coast Guard, Washington, DC 20590.

COMMANDANT RENDERS DECISION ON REVIEW

On March 8, 1979 the Commandant signed Decision on Review No. 12 (Conley) which set aside an Administrative Law judge's order revoking a seaman's license and merchant mariner's document for a narcotic related offense. This is the first such "review decision" to be rendered in almost 10 years. Review decisions are identical in force and effect to the Commandant's decisions on appeal. They differ from appeals in that instead of being brought by the party found guilty of an offense, reviews are undertaken by the Commandant "on his own motion" pursuant to 46 CFR 5.35 to consider questions of law, fact, and policy.

In the Conley matter, the Commandant's review was "based solely upon a reading of the initial decision on the case" and concluded that the charge and specifications contained serious defects. The Commandant ruled "that the fatal deficiencies in the notice of hearing render the proceeding held a nullity."

This review decision, like appeal decisions, will be available for public reading at the offices of District Commanders and Officers in Charge, Marine Inspection. It establishes a governing precedent for future suspension and revocation proceedings and emphasizes dramatically the importance of careful thought in preparing charges and specifications.

Commandant's Bulletin, April 2, 1979

OFFSHORE OIL POLLUTION COMPENSATION FUND RULEMAKING

Anyone familiar with the Federal regulatory process can appreciate that to complete a significant new rulemaking in only 180 days is a difficult goal to meet. Yet the recent establishment of the final regulations implementing the new Offshore Oil Pollution Compensation Fund was done within the above time frame.

These rules were prepared by the project team chaired by Captain Gilbert P. Sherburne, Manager, Deepwater Ports Project, who is also Chairman of the OCS Lands Act/Superfund Task Force created to implement the new pollution fund. Regulatory Project Manager for the rulemaking was Mr. Frank A. Martin, who, with several other Coast Guard personnel, assisted the task group on a collateral basis.

The regulatory efforts of the task group are noteworthy for several reasons. Its regulatory package was the first developed and completed following, from start to finish, the new Department of Transportation regulatory policies and procedures for improving government regulations. The rulemaking was handled as

Continued on next page.....

"significant" under those policies and procedures, as well as the internal Coast Guard regulatory procedures of the Marine Safety Council. Also, the subject matter of the rulemaking, Title III of the Outer Continental Shelf Lands Act Amendments of 1978 (Public Law 95-372), enacted on September 18, 1978, requires that its rules and regulations be promulgated and effective on the 180th day after enactment of that title (March 17, 1979).

Normal rulemaking time frame in the Coast Guard for a significant new rulemaking, from conception to effective date, including the various procedural steps of planning, analysis, drafting, clearance, public hearings, comment, and evaluation, through final drafting, clearance and publication, far exceeds 180 days. Thus, without compromising adherence to the regulatory procedures, completing the offshore oil spill pollution fund regulations was indeed a remarkable accomplishment.

The benefits derived from this achievement will accrue primarily to the offshore oil production industry affected by the regulations. Timely publication of the final rule gives that industry the maximum time for planning their compliance with the rules while awaiting enactment of an appropriations act that is required before the new fund, and Coast Guard management have the authority to begin fund activity.

It is anticipated that a small staff element will be established soon in the Office of Marine Environment and Systems, called the Fund Management Staff, to manage the new Offshore Oil Pollution Compensation Fund. It is expected that this staff will also be responsible for and administer the Deepwater Ports Liability Fund. The fund staff will have field location support, primarily in the Eighth Coast Guard District, along with the contracting out of claims settlement services to a private nationwide adjustment firm.

Commandant's Bulletin, April 2, 1979

MORE ON "SUPERFUND"

On March 19, 1979 the U.S. Coast Guard issued final regulations for implementing a new Offshore Pollution Compensation Fund. The new fund will provide compensation, in certain situations, for damages resulting from oil spilled as a result of drilling and transportation activities on the Outer Continental Shelf. It is seen as a necessary adjunct to increased domestic exploration and production of petroleum.

Established by Title III of the Outer Continental Shelf lands Act Amendment of 1978 (Public Law 95-372), the fund is to be maintained at between $100 and $200 million, and will be financed primarily by assessment of fees on outer continental shelf oil production.

In a related effort, the Administration has proposed a "Superfund" to create a comprehensive system of compensation for oil spill clean-up costs and damages.

Administration witnesses testified last week in support of speedy passage of the proposed legislation, which would fold in the fund created for outer continental shelf activities as well as similar existing funds for the Alaska pipeline and for deepwater ports.

Admiral John B. Hayes, Commandant of the U.S. Coast Guard, stressed the importance of the legislation. "Only one significant gap remains in the national oil pollution program. A comprehensive system for compensating those suffering losses from oil spills is not now available under existing federal law," he said.

The proposed "Superfund" would be financed by fees paid by industry on domestic and imported oil. Relief will be available for a number of oil-related environmental damages which in the past have not been compensated.

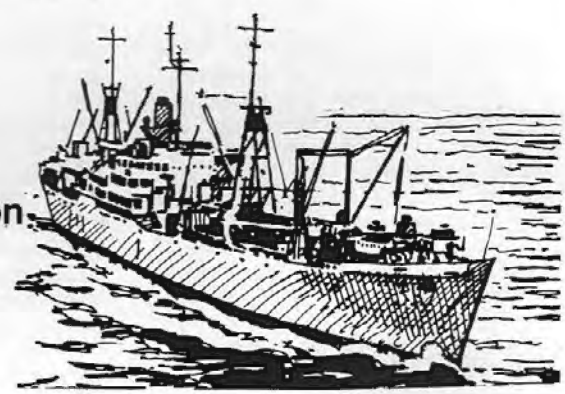
The new regulations for the offshore fund became effective on March 17, 1979 and were published in the Federal Register on March 19, but the new fund will not be operational until Congress passes an appropriate act authorizing fund management, claim settlement, and other related fiscal actions. The regulations include requirements for establishment of financial responsibility, settlement and adjudication of claims, notification of pollution incidents, designation of sources of pollution and advertisement of claims procedures.

The regulations, which primarily affect the owners and operators of outer continental shelf facilities, their guarantors and potential claimants for damages, also explain the Coast Guard's general procedures for management and operation of the fund.

Owners and operators of outer continental shelf facilities have until September 17, 1979 to apply for certificates of financial responsibility. Financial responsibility requirements for vessels are under the purview of the Federal Maritime Commission. The Treasury Department is responsible for collection of related fees and will announce its procedures once the appropriations are enacted.

Copies of the final regulations may be obtained by contacting the Regulatory Project Manager, Mr. Frank Martin, (202) 426-2606, or by writing to Commandant (G-WDWP/61), U.S. Coast Guard, Washington, DC 20590.

National Defense Transportation Day



key notes

All comments on proposed rulemakings should be submitted to:
Commandant (G-CMC/81)
U.S. Coast Guard
Washington, DC 20590

Comments are available for examination at the Marine Safety Council (G-CMC/81), Room 8117, Department of Transportation, Nassif Building, 400 Seventh Street, SW, Washington, DC 20590; phone (202) 426-1477.

QUALIFICATIONS OF THE PERSON IN CHARGE OF OIL TRANSFER OPERATIONS, TANKERMAN REQUIREMENTS CGD 74-44, 74-44a

These regulations would redefine and establish qualifying criteria for certifying individuals engaged in the carriage and transfer of the various categories of dangerous cargoes in bulk.

It has been found that most pollution incidents are the result of personnel error; consequently, the minimum qualifications of persons involved in handling polluting substances should be specified.

The Environmental Analysis and Inflationary Impact Statements were completed in February 1977. A notice of proposed rulemaking (NPRM) was subsequently published April 25, 1977 (41 FR 21190) and a public hearing was held the following June. Extensive comments on the first NPRM, new requirements imposed by the Port and Tanker Safety Act of 1978, and requirements of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978 have necessitated the withdrawal of the proposed rule in order that a new more extensive rulemaking project may be initiated.

REVISION OF ELECTRICAL REGULATIONS CGD 74-125

This regulation will constitute a general revision and updating of the electrical regulations to conform with latest technology. It will include steering requirements for vessels other than tank vessels.

This revision is occurring because industrial standards for electrical engineering have changed in the past few years, and the regulations must be brought up to date to reflect current industry practices.

An initial NPRM was published on June 27, 1977 (42 FR 32700). A supplemental NPRM will be issued due to the extensive changes necessary as a result of comments received on the first NPRM. As we go to press, this supplementary NPRM is expected to be published in late April 1979.

STANDARD FOR NEW SELF-PROPELLED VESSEL CARRYING BULK LIQUEFIED GASES CGD 74-289

These regulations would adopt the Intergovernmental Maritime Consultative Organization (IMCO) Resolution, the Code for Construction and Equipment of Ships Carrying Liquefied Gas in Bulk.

The increased use of liquefied gases for energy sources has produced a dramatic increase in the manufacture and use of vessels designed for the cargo. Due to the unusual and unique hazards associated with liquefied gases, these vessels must be addressed in regulations specially tailored to their unique situation.

The Economic and Environmental Impact Assessments and Negative Declarations were prepared before the NPRM was published on October 4, 1976 (41 FR 43822). A public hearing was held in November 1976. A final rule is anticipated in May of this year.

UPGRADE NEW TANK BARGE CONSTRUCTION CGD 75-083 UPGRADE EXISTING TANK BARGE CONSTRUCTION CGD 75-083a

This action is comprised of two regulatory projects centered on tank barge construction standards which resulted from a Presidential initiative of March 17, 1977, directing study of the tank barge pollution problem. One project will address new barge construction while the other will pertain to existing barges. Regulatory documents for both will be published at the same time and joint public hearings will be held.

Increased public awareness of the oil pollution problem, as well as international and domestic interest in this area, have made increased design standards necessary as a means of reducing the possibility of pollution.

The upgrade of tank barge construction standards was published as an NPRM in the Federal Register of December 24, 1971 (36 FR 24960). As a result of the 63 written comments received, it was decided that the standards needed to be studied further, especially as they would apply to existing barges.

In 1974, the Coast Guard and the Maritime Administration performed a joint study of the tank barge pollution problem which found that certain construction techniques might provide a significant advantage for eliminating oil pollution from tank barges. However, the study had several weaknesses and regulatory action was not taken.

In July 1977, the Coast Guard began a reexamination of the tank barge construction standards. It was determined that new construction would be treated separately from existing barges. An advanced notice of proposed rulemaking (ANPRM) will be issued to gather additional data and assess impacts related to existing barges.

As we go to press, the withdrawal of the old NPRM and announcement of the new ANPRM are expected to be published in April 1979.

POLLUTION PREVENTION, VESSELS AND OIL TRANSFER REGULATIONS CGD 75-124a

This regulation would reduce accidental or intentional discharge of oil or oily wastes during vessel operations.

The basis of this regulation is threefold. First, there is the need to reduce the number and incidence of oil spills. Second, this regulation will help to clarify the existing rules. Finally, this regulation covers the additional requirement for oil-water separators under the 1973 International Convention for the Prevention of Pollution from Ships.

The NPRM was published on June 27,1977 (42 FR 32670). A supplemental NPRM was published October 27, 1977 (42 FR 56625). Public hearings were held in New Orleans, Louisiana on November 22, 1977; St. Louis, Missouri on November 30, 1977; and Washington, DC on November 28, 1977. The draft of the final rule is currently being reviewed.

OFFSHORE OIL SPILL POLLUTION FUND CGD 77-055

This document establishes procedural rules concerning administration and operation of the fund, including liability limits for certain facilities, financial responsibility factors, damage claim settlement procedures, et. al.

This regulation was passed in order to implement administration of the fund by creating procedures for prompt settlement of claims arising from damage caused by oil pollution.

The NPRM was published December 4, 1978 (43 FR 56840). Public hearings were held in New Orleans, Louisiana on January 4, 1979 and in Washington, DC on January 8, 1979. The final rule was published in March 1979.

TANK VESSEL OPERATIONS REGULATIONS, PUGET SOUND CGD 78-041

This regulation would govern the operation of tank vessels in the Puget Sound area to protect against environmental harm resulting from vessel or structure damage, destruction, or loss.

Considered a significant rulemaking due to Congressional and public interest, this regulation was initiated in order to reduce the possibility of environmental harm resulting from oil spills in Puget Sound. This is to be accomplished by governing the operation of tankers and reducing the risk of collision or grounding.

Secretary of Transportation Brock Adams signed a 180-day Interim Rule on March 14, 1978 prohibiting entry of oil tankers in excess of 125,000 deadweight tons in Puget Sound; this appeared in the Federal Register of March 23, 1978 (43 FR 12257). An ANPRM was published March 27, 1978 (43 FR 12840) with a public hearing held April 20-21, 1978. An extension of the interim rule was published in the Federal Register in order to allow the Coast Guard adequate time to complete this rulemaking. Publication of final rules will not be possible prior to expiration of the extension on June 30, 1979.

The following three regulations make up the Tanker Safety and Pollution Prevention (TSPP) Regulations. Public hearings have been held on the package, comments were requested and many were received. Final rules on this package are expected the latter part of 1979.

INERT GAS SYSTEM CGD 77-057

This regulation would require certain oil tankers of 20,000 deadweight tons and over to be fitted with inert gas systems.

As part of the President's initiatives to reduce marine pollution, this regulation will reduce the possibility of in-tank explosions which have been the cause of some pollution incidents.

The Inflationary Impact Statement for this regulation was completed in May 1977. An NPRM was published May 16, 1977 (42 FR 24874). Public hearings were held in Washington, DC and San Diego, California in June 1977. Due to the Port Tanker and Safety Act (PTSA) of 1978 (enacted October 1978) a supplemental NPRM will be issued to reflect new legislation and international developments in this area. An NPRM was published February 12, 1979 (44 FR 8984). Hearings were held on March 21, 1979 in Washington, DC and on March 28, 1979 in San Francisco, California.

SEGREGATED BALLAST AND TANK CLEANING REGULATIONS GCD 77-058(b), (c) and (d)

This four-part regulation was initiated when President Carter directed the Secretary of Transportation to issue new rules for oil tanker standards, which were to include segregated ballast on all tankers and double bottoms on all new tankers which call at American ports. The provisions of these proposed regulations have been changed by the February 1978 Intergovernmental Maritime Consultative Organization (IMCO) Conference to include Crude Oil Washing (COW) and Clean Ballast Tanks (CBT).

The NPRM was published May 16, 1977 (42 FR 24868). As a result of the IMCO Tanker and Pollution Prevention Conference of February 1978, a new NPRM will be issued. This rulemaking was also mandated by the Port Tanker and Safety Act of 1978. An NPRM was published February 12, 1979 (44 FR 8984). Hearings were held on March 21, 1979 in Washington, DC and on March 28, 1979 in San Francisco, California.

STEERING GEAR DESIGN STANDARDS TO PROVIDE REDUNDANCY CGD 77-063

As part of the President's initiatives to reduce pollution, this regulation is needed to help reduce the possibility of a marine collision due to a loss of steering.

An NPRM was published May 16, 1977 (42 FR 24869). As a result of the IMCO Tanker Safety and Pollution Prevention Conference of February 1978, a new NPRM was issued on February 12, 1979 (44 FR 8984). Hearings were held on March 21, 1979 in Washington, DC and on March 28, 1979 in San Francisco, California.

Testing the Cascade System

Development of System for Entry into Confined/Enclosed Spaces in Large Tankers

Captain Billy Smith
Gulf Oil Company

Tanker incidents involving entry into cargo tanks or other enclosed spaces have, in the past, given great concern to the U.S. Coast Guard and ship operators alike. Regrettably, accidents and deaths arising from uncontrolled entry into enclosed spaces continue to occur despite wide publicity. The advent of U.S. flag VLCC's and the corresponding larger tank spaces involved has compounded the seriousness of the problem.

Applicable U.S. Coast Guard rules require two sets of approved fresh air breathing apparatus (FABA) strategically located on board the tanker. In machinery spaces where the allowable length of FABA air hose (120 feet) restricts the use of the equipment, a self contained breathing apparatus (SCBA) shall be carried and stowed convenient to, but outside of, machinery space. Most Coast Guard approved SCBA equipment has a maximum 30-minute air supply at normal consumption rates. For the larger tankers, particularly VLCC's, this approved equipment is not completely adequate.

Captain E. Marcus, Manager--Safety, Training and Environmental Affairs, assigned the following project to Mr. T. P. Leonard, Safety Engineer. In close cooperation with the Office of Merchant Marine Safety of the U.S. Coast Guard Headquarters and a well-known breathing apparatus manufacturer, Mr. Leonard set out to redesign the breathing apparatus used for cargo tank entry. Subsequently, permission was granted by the Coast Guard to equip AMERICAN SPIRIT with a prototype system for test purposes and evaluation. Full scale tests were programmed and carried out on AMERICAN SPIRIT in August 1978. These trials were attended by Captain Friel, Commander Brown, and Commander Boerger, representing the U.S. Coast Guard. Also attending was Captain Thomas Campbell of the Gulf Marine Department, along with Captain Austin Britton, Chief Mate James DeSimone, and Third Mate Fred Cafarelli of the AMERICAN SPIRIT. Based on these tests, Gulf Marine has developed "Procedures for Entry into Confined or Enclosed Spaces using the Cascade System."

It was determined that, to be successful and adequately protect shipboard personnel, the new breathing apparatus would need to have the following characteristics:

Continued on next page.....

Cascade System.....

1. A primary air supply capable of sustaining five men within an enclosed space for an indefinite period;

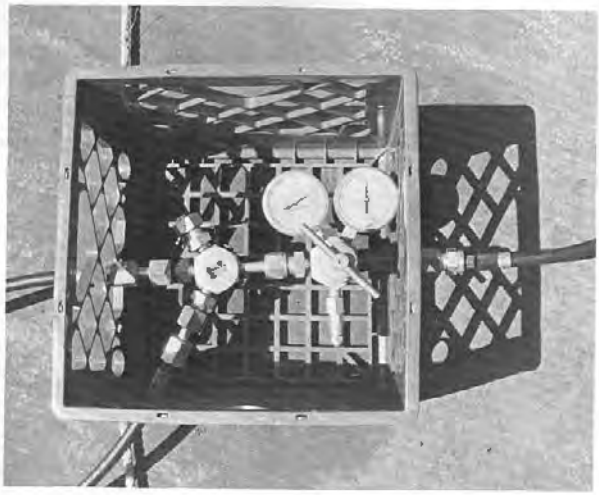
2. A means of recharging air tanks of the primary supply system, with an ability to substitute recharged tanks without interruption of air supply;

3. Primary air supply tanks fitted in racks with wheels, capable of being rolled throughout the vessel to within reasonable proximity of any enclosed space to be entered;

4. A flexible hose from the primary air tanks, of sufficient length to reach the furthermost point of the enclosed space to be entered;

5. This primary air hose would be fitted with a manifold arrangement that would allow the following:

   a. Crewmembers (up to five) could, upon entering the enclosed space wearing SCBA's, connect with the primary air supply hose and either replenish their SCBA bottle or operate directly off of the primary air supply. In the event that a crewmember became injured in a cargo tank, this would allow rescue units to enter the tank with spare face masks and/or SCBA's and permit an uninterrupted flow of air to the injured crewmember for an indefinite period of time. This would allow rescue parties to perform rescue functions in an orderly manner, eliminating the risk inherent with performing these operations under panic conditions. The lack of an adequate supply of fresh air would not then be a feature that could compound an already grave situation.



The Cascade System is based on a configuration of three 300-cubic-foot bottles connected by hoses to a combined pressure reducing regulator and air hose manifold located on deck (shown here). The manifold can supply up to five strings of air hose. Each string is made up of 50-foot sections of hose, the total length determined by the size of the tank involved.

The new breathing apparatus allows crewmembers wearing SCBA's to either replenish their SCBA bottles (such as those worn here) or operate directly off the primary air supply. Participating in the testing of the new system (left to right): Captain Friel, USCG; from the AMERICAN SPIRIT—Third Mate Fred Cafarelli, Chief Mate James DeSimone, and Captain Austin Britton; representing Gulf Marine—Captain Thomas Campbell. Photos courtesy of Gulf.

b. The rescue squad would be in a position to move about the tank without the encumbrances of fresh air hose supply line and/or lifeline, secure in the knowledge that an adequate supply of air was readily available within the tank (which could be used either as the primary source or could replenish SCBA's). This arrangement facilitates the continuation of work in any part of the tank and would, in an emergency, allow personnel to leave the enclosed space in a safe and orderly manner.

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Having established the necessary criteria for an adequate Cascade-type compressed air breathing apparatus, the hardware for this system is based on a configuration of three 300-cubic-foot bottles. Interconnection of these bottles is by two flexible hoses attached to "T" block assemblies. These assemblies incorporate check valves so that air flows in one direction only.

One length of air hose connects the first bottle of the three-bottle group to a combined pressure reducing regulator and air hose manifold located on deck.

The regulator is fitted with two gauges which measure the pressure on each side of the regulator. The inlet gauge reads from 0-4000 p.s.i. and the outlet gauge reads from 0-2000 p.s.i., the former indicating supply pressure from the bottles and the latter, discharge pressure to the manifold. Pressures should read 2,400 and 2,000 p.s.i., respectively, when the bottles are fully charged.

The air hose manifold can supply up to five strings of air hose. Each string is made up from individual 50-foot sections, the total length determined by the size of the compartment involved and ensuring that any part of the tank can be reached. Each air hose string terminates with a male coupling, facilitating connection to the female coupling ("pigtail") of an SCBA.

While proper equipment is essential to any safe tank entry program, no program would be complete without providing written tank entry procedures for use by the vessel crew to assure an orderly operation. The following is the procedure used by Gulf.

PROCEDURES FOR ENTRY INTO ENCLOSED SPACES

1. The deck officer of the watch must be informed of all proposed enclosed space entries irrespective of location. He will be responsible for advising the master and/or chief officer accordingly.

2. Before entry is permitted, the enclosed space must be fully ventilated and tested to ensure that the space is safe for entry, i.e., (a) the space contains at least 19.5 percent oxygen by volume, (b) the space does not contain combustible vapors above 10 percent LEL, and (c) the space does not contain toxic atmospheric contaminants above the appropriate threshold limit values (TLV's) for the substance.

3. If the above-mentioned conditions are not met, or in an emergency when time does not permit gas freeing, personnel entering such enclosed spaces shall be equipped with self contained pressure demand breathing apparatus (SCBA) for which they have received adequate training.

4. Testing procedures must include the use of properly calibrated test instruments, i.e., oxygen analyzer for oxygen deficiency, toxic gas instruments for toxic vapors, and combustible gas indicators for combustible vapors. Appropriate testing shall be subsequently conducted to ensure the conditions in number 2 above are maintained while persons are in the tank.

5. Mechanical ventilation must be maintained continuously while personnel are in the tank or enclosed space.

6. When SCBA's are required to be worn, as indicated in number 2 above, they shall be used in conjunction with the Cascade System in vessels where provided.

7. Before persons enter enclosed spaces, tank rescue equipment must be in the close vicinity of the enclosed space and checked out by the person in charge (see rescue equipment check list, below).

8. Where appropriate, hoisting equipment or tripod must be rigged above the tank hatch.

9. All personnel entering the enclosed space must wear safety harnesses. For routine entry, lifelines must be available at the entry point for all persons entering. For emergency entry, when atmospheres are expected to be hazardous, the lifelines must be attached.

10. All personnel entering the enclosed space must wear reflective tape.

11. A responsible crewmember must be in constant attendance outside the enclosed space and be fully conversant with emergency alarm procedures. In no circumstances should he enter the space until additional assistance has arrived, but he should at all times keep a careful and continuous watch or be in continuous communication with personnel within the enclosed space.

12. When the FABA or the Cascade System is being operated, an additional responsible crewmember shall be allocated the responsibility for handling the air pump or monitoring the air regulator gauges as appropriate.

13. A responsible crewmember shall be fully equipped, wearing an SCBA and immediately available for enclosed space rescue operations.

14. Communication must be clearly established and a system of signals agreed upon and understood by all personnel involved. Hand-held walkie-talkies, if used, must be certified intrinsically safe.

15. A separate means of access should be available where possible for use as an alternative means of escape in an emergency.

Continued on next page.....

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ENCLOSED SPACE RESCUE EQUIPMENT CHECKLIST

1. Tripod or other hoisting equipment rigged over tank hatch.
2. At least one spare SCBA fully assembled and checked, i.e., masks, gauges, low pressure alarms. (Two units in VLCC's.)
3. Resuscitation equipment available and checked for serviceability.
4. "Stokes" litter or other personnel stretcher available.
5. A minimum of one safety harness and line. (Two units in VLCC's.)
6. Spare approved lanterns with a minimum of two checked and operational.
7. Availability established of members of vessel's emergency team.

The U.S. Coast Guard expresses its appreciation to Gulf Marine Department for its work. The equipment is currently being reviewed with a view toward acceptance as a substitution for fresh air breathing apparatus.

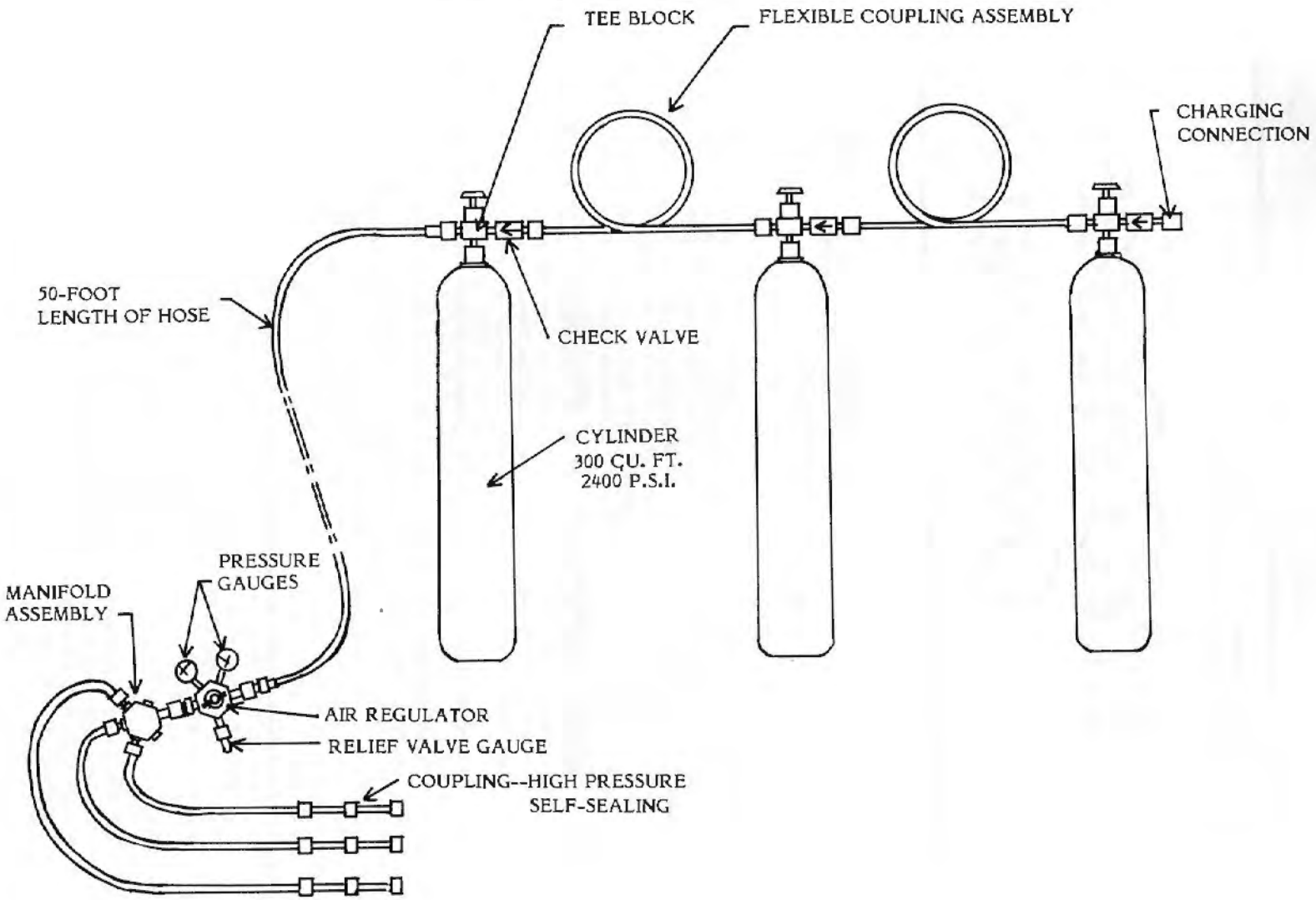
CASCADE BREATHING APPARATUS

PARTS LIST

NO.	DESCRIPTION	PART NO. (SCOTT)
Three (3)	300 cu. ft. Scott Air Cylinders	P/N 800257-00 -
Eighteen (18)	High Pressure Hose in 50 Lengths	P/N 6141-00 -
Three (3)	Tee Blocks	P/N 6173-00 -
Three (3)	Check Valves	P/N 800251-00 -
Two (2)	Flexible Coupling Assembly	P/N 800248-00 -
One (1)	Dust Cap	P/N 15678-00 -
One (1)	Victor Air Regulator equipped with CGA 1340 female air thread model SR-3-B-G; cylinder gauge pressure 0 to 4000 PSI; reducing gauge pressure 0 to 2000 PSI	
One (1)	Manifold Assembly	P/N 6699-00 -
One (1)	Nipple Assembly	P/N 6261-00 -
One (1)	Nut	P/N 6262-00 -
Four (4)	Connectors	P/N 6279-00 -
Two (2)	Plug ¼-inch NPT	P/N 18442-00 -
Three (3)	Auxiliary Pressure Hose	P/N 15523-00 -
	Complete with:	
1	Check Tee Assembly - P/N 6280-00 Hose - P/N 6176-09 Female Coupling - P/N 15487-00	
2	Male Coupling - P/N 15498-00 Swivel Joint - P/N 6290-00	

The auxiliary pressure hose is connected between the Scott Air Pack cylinder and the regulator (1). The male coupling and swivel joint (2) is connected to the last hose lowered into the tank.

BREATHING APPARATUS
AS TESTED ON THE AMERICAN SPIRIT
AUGUST 1978



U.S. COAST GUARD

LNG Research Overview

A. L. Schneider, Sc.D.
U. S. Coast Guard Headquarters
Washington, DC

INTRODUCTION

The U.S. Coast Guard is the chief regulator of the marine mode of transportation, and, by law, is charged with protecting people, property, and the environment from harm. In recent years, the number and volume of hazardous cargoes have increased--but none has caught the attention of the public as much as liquefied natural gas (LNG).

In 1968, foreseeing the large-scale importation of LNG, the Coast Guard began research into its hazards. The goal was to gain information on which to base a body of regulations; this goal has largely been met. Each research project is briefly described below. Further information about each project is available from the National Technical Information Service, Springfield, VA 22151. Please order using the title given in each project description.

SPILL TESTS

In 1968, the Coast Guard contracted with the U.S. Bureau of Mines to study LNG spill behavior. The vaporization rate of LNG on water was measured in an aquarium mounted on a load cell. A series of instantaneous spills, 4 to 500 liters, was performed in a small pond giving the LNG spill rate on water and data on vapor dispersion. No coherent ice layer was observed, suggesting that the vaporization rate per unit area is constant with time. In a second project, continuous spills of up to 10 m^3 were performed in a larger body of water. The vapor dispersion data indicated that the cold vapor forms its own thermal inversion, greatly increasing the travel distance downwind from that of a neutrally buoyant vapor; vapor concentration fluctuations were noted. A dispersion model was developed. Two underwater releases showed that the liquid completely vaporized before reaching the surface. One spill was ignited downwind of the spill point; no flame front acceleration was observed. The flameless explosion phenonmenon occurred but the definitive cause was not discovered. This work was reported in "Hazards of LNG Spillage in Marine Transport," by D. S. Burgess, J. N. Murphy, and M. G. Zabetakis (1970) and "Hazards of Spillage of LNG into Water," by D. S. Burgess, J. Biordi, and J. Murphy (1972).

FLAMELESS EXPLOSION

This phenonmenon sometimes occurs when LNG is spilled on water; an explosion-like event occurs, with significant overpressures but without fire. This is thought to be the result of the transition from film boiling to nucleate boiling occurring as the methane constituent of the LNG preferentially boils away, raising the boiling point of the cryogenic mixture. The lack of heterogeneous nucleii in the LNG-water interface causes a superheating in the methane-depleted LNG layer, eventually leading to homogeneous nucleation and boiling so rapid that an explosion seems to be occurring. This does not happen with LNG containing over 40 percent methane, nor does it appear likely to scale up with the quantity spilled. Garland and Atkinson of the University of Maryland experimentally studied the phenonmenon, examining the conditions that produce a flameless explosion. Overpressures were measured ranging up to eight atmospheres. This is reported in "The Interaction of Liquid Hydrocarbons with Water," by F. Garland and G. Atkinson (1971). The Coast Guard requested that the National Academy of Sciences examine the phenomenon. Their conclusion, still valid today, was that liquefied methane cannot undergo a flameless explosion unless the methane concentration in the LNG is very low. The work is

reported in "LNG-Water Explosions," by D. L. Katz (1972).

VAPOR CLOUD DISPERSION

The issue of how far downwind an LNG vapor cloud can travel and still remain flammable is a major safety concern. There are many models but few experimental data. To aid in resolving this issue, Professor J. A. Havens of the University of Arkansas examined seven models giving downwind travel distances from 1.2 km to 81 km, evaluating them for internal consistency and reasonability. He concluded that the computerized Science Applications, Inc. model and the Germeles model showed the most promise. His work, including a description of each model, is in "Predictability of LNG Vapor Dispersion from Catastrophic Spills Onto Water: An Assessment," by J. A. Havens (1977). In a further study he is examining these two promising models and studying the sensitivity of the results to various input parameters. This report is expected later this year.

California. Although the primary interest was LNG, several other fuels were tested, both to gain information about these substances and to permit generalizations about classes of commodities.

The question of unconfined vapor cloud deflagration and detonation was the major issue. While significant overpressures are possible in a deflagration, the overpressures are greater in a detonation, and the harmful effects extend beyond the detonating cloud. The effort included determining the effects of LNG vapor cloud deflagration, whether an LNG cloud can detonate, and, if so, what factors influence the detonation and what its properties are. Proving that LNG cannot detonate is extremely difficult, but it may be possible to show how difficult a detonation is. This work is composed of several parts.

First, a theoretical model of non-ideal explosions was prepared. Shock tube tests provided base line data for both detonation and deflagration; methane, propane, and ethylene oxide were tested. The experimental results agreed with acetylene. There were no accelerations to detonation. Obstacles had no effect. Two high energy tests of methane-air with 1.35 kg and 2.05 kg of the explosive Composition B failed to detonate. Since unconfined propane-air mixtures have detonated in actual accidents, mixtures of methane-propane-air were tested. Using 2 kg of explosive with the methane:propane ratio 90:10 failec to detonate, but 85:15 did. Further testing with methane-air is scheduled, with 22 kg of explosive. There is some theoretical justification for believing that an intermediate energy level may be able to detonate methane-air. To test this, a planar detonation wave will be introduced into a hemisphere containing methane-air. The question is whether the planar wave can transform itself into a spherical detonation wave; there is some theoretical justification for this type of experiment.

These hemisphere tests use an idealized cloud, with a level of homogeniety and stoichiometry that is not possible in an accident.

"In recent years, the number and volume of hazardous cargoes have increased--but none has caught the attention of the public as much as liquefied natural gas."

VAPOR CLOUD STUDIES

This program was a logical outgrowth of the Bureau of Mines work--once LNG spill behavior was understood, the next logical topic was the combustion of both the LNG pool on water and the LNG vapor cloud. The Coast Guard has had the financial support of several other organizations, and all work has been carried out at the Naval Weapons Center, China Lake,

calculated values, save for methane, whose detonation pressures and velocities were less than those calculated.

Unconfined vapor clouds were simulated by inflating 10 m and 20 m diameter plastic hemispheres with a fuel-air mixture. Three levels of initiation energies were used: low, intermediate, and high. Seventeen low energy tests used the fuels methane, propane, ethylene, ethylene-oxide, butadiene, and

To provide greater realism, real vapor clouds were produced by spilling up to 5.7 m^3 of LNG onto a pond. The LNG was spilled, allowed to evaporate, drift over land, and ignited. No rapid flame velocities were observed. In a similar manner, LPG vapor clouds were formed and ignited. Qualitatively the results were similar.

Continued on next page.....

Radiometer data and high speed movies were taken. Finally, vapor samples were taken to determine whether there was any preferential boiling.

To study the pool burning behavior, quantities of up to 5.7 m^3 of LNG were spilled onto the pond and ignited at the start of the spill. A similar series was run for LPG and, for comparison purposes, gasoline. Radiometer data and high speed movies were taken. During these tests an ice-like material was observed.

The last major area of study is that of hydrocarbon sensor development. In the past, vapor dispersion experiments have been hindered by the lack of adequate sensors. Several types of sensors were placed downwind of the pond and an LNG cloud was produced to drift past the sensors. During these tests, the ice-like material was closely photographed.

The theoretical analysis, the shock tube tests, and the low energy initiation hemisphere tests are reported in "Explosion Hazards Associated with Spills of Large Quantities of Hazardous Materials, Phase I," by C. D. Lind (1974) and "Explosion Hazards Associated with Spills of Large Quantities of Hazardous Materials, Phase II," by C. D. Lind and J. C. Whitson (1977).

CLOUD TO CLOUD DETONATION

It appears likely that in a real accident there would be effective separation of components during the vaporization process, due to the large differences between the boiling points of the constituents of LNG. This could lead to a vapor cloud with one portion that is virtually all methane, followed by another composed of higher hydrocarbons. Since unconfined propane clouds have detonated, perhaps the proper question to ask is whether a detonation wave in a propane cloud can propagate into a methane cloud. To answer this question, a dual Fuel-Air Explosive Test series was run at Sandia Laboratories, Albuquerque, New Mexico. Two clouds were created, one of LNG and one of propylene oxide. LNG was used due to its availability and propylene oxide due to its reliable detonability. After a short delay to permit some overlap between the two clouds, a small explosive charge was detonated within the propylene oxide cloud. This caused a detonation within the propylene oxide due to its reliable detonability. After a short delay to permit some overlap between the two clouds, a small explosive charge was detonated within the propylene oxide cloud. This caused a detonation within the propylene oxide cloud that decelerated through the overlap region. Preliminary analysis suggests that the LNG cloud did not detonate. A final report is expected by the middle of 1979.

FIRE SAFETY

University Engineers examined fires aboard ship in the first part of this work. Some topics considered included fire extinguishment regulations, the probability of variously sized spills, and the consequences of these spills. The report is entitled "Fire Safety Aboard LNG Vessels," by J. R. Welker, L. E. Brown, J. N. Ice, W. E. Martinsen, and H. H. West (1976). In the second part, several series of small scale tests were run, including extinguishing rates on pool fires for various dry chemicals, extinguishing fires in which obstacles were placed, and the effectiveness of water spray and fog on vapor dispersion. This work is reported in "Small Scale Tests on Control Methods for Some Liquefied Natural Gas Fires," by L. E. Brown, W. E. Martinsen, S. P. Mulkenkamp, and G. L. Puckett (1976).

SHIP DESIGN

The Ship Structure Committee is sponsored by the Coast Guard and several other organizations, and funds many research studies. One study, by Sanders Associates, examined the stresses that a vessel undergoes when an LNG tank fails and LNG escapes, including overpressurization of the bold spaces as the cargo vaporizes. The report is entitled "Thermoelastic Model Studies of Cryogenic Tanker Structures," by H. Becker and A. Colao (1973). a second study, by Southwest Research Institute, involved the sloshing forces experienced in an LNG tank. Existing design requirements were evaluated and reported in "A Study to Obtain Verification of Liquefied Natural Gas (LNG) Tank Loading Criteria," by R. L. Bass, J. C. Hokanson, and P. A. Cox (1976). This work is continuing.

CREW TRAINING

Many accidents can be traced to inadequate crew training. Operations Research Inc. and Engineering Computer Optechnomics, Inc., studied the tasks performed on LNG ships and prepared guidelines for training and licensing. Functional job analysis was the technique used. the results are found in "Recommendations for Qualifications of Liquid Natural Gas Cargo Personnel" by J. Porricelli, V. Keith, and B. Paramore (1976).

RESEARCH REVIEW

In 1978, a National Academy of Sciences Committee on Maritime Hazardous Materials was established. A panel on LNG was charged with evaluating the research needs of the Coast Guard. This panel of scientists and engineers contains experts on ship design, combustion, detonation, risk analysis, and cryogenics. Their recommendations are expected later in 1979.

CONCLUSION

The Coast Guard's research program has demonstrated that LNG can be safety transported. Furthermore, sufficient information has been gathered on which to base a coherent, rational body of regulations.

About the Author

Dr. Alan Schneider, a chemical engineer with the Coast Guard's Cargo and Hazardous Materials Division, frequently contributes material to the Proceedings. His last article, co-authored with Mr. Robert Lambert, appeared in the December 1978 issue ("Risk Analysis," p. 130).

Lessons from Casualties

A First Assistant Engineer died as a result of accidental electrocution while doing a routine shipboard welding job. The vessel was underway in the Pacific Ocean at the time.

The work consisted of welding a new elbow onto the bilge suction line which was located in the pumproom bilges starboard side, outboard of the propeller shaft. The area in which the First Assistant was welding was located beneath the pumproom floor plates. In order to weld properly, the First Assistant had to physically enter the bilge which contained oily water approximately 6 inches deep. Attempts had been made to reduce the level of water by running the bilge pump, but without the elbow in place a few inches of water always remained. As a precaution against electrocution, the First Assistant had worn rubber boots and placed a 5-foot-long two-by-four in the bilge to stand on.

The welding machine was set at 130 amps and was in good operating order. The welding lead had one taped patch over a worn section of insulation approximately 18 feet from the rod holder. The patched section was not in the area of work. The insulation over the holder rod clamps was worn away from the clamps, partially exposing them.

The First Assistant was last seen alive by the Junior Engineer, who was making a routine round of the engine spaces. At this time the First Assistant was preparing to re-enter the pumproom bilges. The Junior Engineer noted that the First Assistant's clothes were wet and that there was a few inches of water in the bilges. The Junior Engineer left the pumproom and approximately five minutes later the first Assistant was found lying face up in the bilges with the welding lead under his back. Attempts to resuscitate the First Assistant were unsuccessful.

This casualty demonstrates that great care should be exercised when welding in an area where there is water accumulating. The First Assistant should have devised a means to do the welding job without running the risk of getting wet. In addition, it is important to periodically check all welding equipment for wear which would expose wiring and create a hazard. Welding should not be permitted to become so routine that one forgets he is working with very high amperage electrical equipment.

Statistics of Casualties

1978

Annually the U.S. Coast Guard presents a statistical summary of commercial vessel casualties that were investigated by Coast Guard marine inspectors during the previous fiscal year. The public, industry, and the Coast Guard have used the findings of these investigations to establish standards and determine the need for legislation to improve the protection of safety of life and property at sea.

The master of a vessel is required by law to report a marine casualty as soon as possible after its occurrence to the Coast Guard Officer in Charge, Marine Inspection. Casualties involving commercial vessels are required to be reported to the Coast Guard whenever the casualty results in any of the following:

(a) actual physical damage to property in excess of $1,500;

(b) material damage affecting the seaworthiness or efficiency of a vessel;

(c) stranding or grounding (with or without damage);

(d) loss of life;

(e) injury causing any person to remain incapacitated for a period in excess of 72 hours, except injury to harbor workers not resulting in death and not resulting from vessel casualty or vessel equipment casualty.

The statistical summary on the following pages represents casualties to commercial vessels which meet the above criteria. It is important to note that the summary represents casualties reported to Coast Guard Headquarters in fiscal year 1978, which ended September 30, 1978. Statistics concerning noncommercial recreation boating accidents can be found in CG-357, Boating Statistics, published by the Office of Boating Safety.

During this particular fiscal year period, there were no casualties that warranted the convening of a Marine Board of Investigation.

Every event involving a vessel or her personnel which meets any of the conditions of a reportable casualty is of great concern to the Coast Guard. A number of reportable casualties are not investigated by the Coast Guard each year simply because they are not reported. Thus it is of primary importance that the masters of all vessels ensure that all casualties are reported and investigated. Through the cooperation of the masters, owners, and agents of commercial vessels many of the unreported casualties can be investigated.

This statistical tabulation is intended to summarize the casualty experience for the entire commercial fleet. Because this summary is so all-encompassing, the use of the statistics may lead to erroneous conclusions unless the limitations of the data are well understood.

The information and analysis Staff of the Office of Merchant Marine Safety will gladly assist in quantifying those limitations for each specific need. Comments and recommendations for changes or improvements to these statistics should be addressed to Commandant (G-MA/83), U.S. Coast Guard, Washington, DC 20590.

Statistical Summary of Casualties to Commercial Vessels

1 October 1977 to 30 September 1978 Fiscal Year 1978	Collisions; crossing, meeting and overtaking	Collisions while anchored, docking, or unmooring	Collision, fog	Collisions with piers and bridges	Collisions; all others	Explosion and/or fire—cargo	Explosion and/or fire—vessel's fuel	Explosions and/or fire—pressure vessels, boilers	Explosions and/or fire—structure, equipment, all others	Grounding with damage to vessel	Grounding without damage to vessel	Founderings, capsizings, and floodings	Heavy weather damage	Cargo damage	Material failure—structure and equipment	Material failure—machinery and engineering equipment	Casualty not otherwise classified	Total
Number of casualties	309	253	1	618	347	8	11	13	178	428	599	523	5	15	284	570	106	4268
Number of vessels involved	394	488	2	1244	585	11	12	13	193	700	908	651	7	16	309	602	243	7118
Number of inspected vessels involved	230	186	1	356	174	7	1	12	42	208	257	67	4	14	210	298	68	2131
Number of uninspected vessels involved	664	302	1	888	411	4	11	1	151	492	651	584	3	2	139	304	179	4987
PRIMARY CAUSE																		
Personnel fault:																		
Pilots—State	16	18	.....	30	5	.....	.....	.....	.....	7	31	2	.....	.....	1	.....	4	114
Pilots—Federal	5	2	.....	20	2	.....	.....	1	.....	7	11	.....	.....	.....	.....	.....	.....	48
Licensed officer—Documented seaman	140	118	1	369	118	1	1	1	3	172	195	43	.....	.....	10	5	25	1202
Unlicensed—Undocumented persons	76	31	.....	26	42	.....	.....	.....	5	90	95	68	.....	.....	6	3	7	447
All others	46	19	.....	32	12	2	.....	.....	13	12	38	13	.....	2	12	2	17	190
Calculated risk	1	.....	.....	.....	1	.....	.....	.....	.....	4	1	.....	.....	.....	.....	.....	2	9
Restricted maneuvering room	1	1	.....	2	5	.....	.....	.....	.....	3	3	1	.....	.....	.....	.....	1	17
Storms—adverse weather	6	8	.....	30	22	.....	.....	.....	.....	35	32	94	4	13	100	2	14	360
Unusual currents	.....	.....	.....	7	3	.....	.....	.....	.....	.....	3	8	.....	.....	1	.....	2	24
Sheer, suction, bank cushion	9	1	.....	3	1	.....	.....	.....	.....	3	3	.....	.....	.....	.....	.....	.....	20
Depth of water less than expected	.....	2	.....	.....	5	.....	.....	.....	.....	30	129	.....	.....	.....	.....	.....	.....	166
Failure of equipment	19	37	.....	53	21	3	3	9	62	37	37	76	.....	.....	109	598	10	1029
Unseaworthy—lack of maintenance	1	.....	.....	2	.....	.....	.....	.....	.....	3	1	102	1	.....	17	.....	1	128
Floating debris—submerged object	1	.....	.....	9	78	.....	.....	.....	.....	6	2	21	.....	.....	4	1	2	126
Inadequate tug assistance	1	2	.....	8	2	.....	.....	.....	.....	1	2	.....	.....	.....	.....	.....	.....	16
Fault on part of other vessel or person	586	437	1	642	244	3	1	.....	15	277	316	147	2	1	77	33	140	2922
Unknown—insufficient information	16	12	.....	11	24	2	7	2	95	13	9	76	.....	.....	14	8	18	307
TYPE OF VESSEL																		
Inspected vessels:																		
Passenger and ferry—large	2	4	.....	19	11	.....	.....	.....	2	2	4	2	.....	.....	6	14	1	67
Passenger and ferry—small	22	15	.....	9	22	.....	1	.....	11	24	9	28	.....	.....	10	85	6	242
Freight	36	44	1	111	39	1	.....	8	12	39	73	9	1	14	107	98	18	611
Cargo Barge	3	1	.....	7	3	.....	.....	.....	.....	3	1	.....	.....	.....	.....	2	.....	20
Tankship	14	34	.....	41	23	1	.....	4	8	19	43	7	2	.....	44	74	3	319
Tank Barge	162	78	.....	163	64	5	.....	.....	6	116	123	19	1	.....	38	12	34	799
Public	8	4	.....	3	1	.....	.....	.....	1	1	1	1	.....	.....	1	9	1	31
Miscellaneous	3	6	.....	3	11	.....	.....	.....	2	6	1	1	.....	.....	4	4	1	42
Uninspected vessels:																		
Fishing	117	80	1	23	70	.....	5	.....	68	127	172	224	.....	.....	44	221	26	1180
Tug/Towing	273	163	.....	471	173	2	1	.....	42	175	243	148	2	1	44	42	31	1811
Foreign	80	100	.....	63	38	.....	1	1	10	34	76	12	.....	.....	13	22	19	469
Other	194	159	.....	329	130	2	4	.....	31	136	160	200	1	1	38	19	103	1527
GROSS TONNAGE																		
300 tons or less	486	361	2	655	331	8	9	.....	140	319	373	507	2	1	110	358	83	3545
Over 300 to 1,000 tons	175	86	.....	392	73	3	2	.....	16	185	203	95	.....	.....	40	20	31	1373
Over 1,000 tp 10,000 tons	150	125	.....	231	114	3	1	3	26	140	173	37	2	4	78	66	40	1213
Over 10,000 tons	83	116	.....	146	65	1	.....	10	11	56	157	12	3	11	121	158	37	987
LENGTH																		
Less than 100 feet	409	298	.....	364	253	4	8	.....	130	275	331	460	.....	.....	83	334	68	3017
100 to less than 300 feet	384	245	2	663	227	3	3	.....	45	344	379	167	3	1	100	67	133	2766
300 to less than 500 feet	31	29	.....	48	42	2	1	1	6	21	38	12	1	1	27	25	5	290
500 feet and over	70	116	.....	169	63	2	.....	12	12	60	160	12	3	14	139	176	37	1045
AGE																		
Less than 10 years	462	282	1	546	279	5	4	4	76	305	389	153	2	7	135	275	103	3028
10 to less than 20 years	172	173	1	299	122	1	4	3	37	196	241	170	3	2	88	110	61	1683
20 to less than 30 years	87	96	.....	202	71	3	1	1	28	73	125	123	.....	2	44	77	36	969
30 years and over	173	137	.....	197	113	2	3	5	52	126	153	205	2	5	82	140	43	1438

Statistical Summary of Casualties to Commercial Vessels - Continued

1 October 1977 to 30 September 1978 Fiscal Year 1978	Collisions crossing, meeting and overtaking	Collisions while anchored, docking, or undocking	Collision, fog	Collisions with piers and bridges	Collisions all others	Explosion and/or fire--cargo	Explosion and/or fire--vessel's fuel	Explosions and/or fire--pressure vessels, boilers	Explosions and/or fire--structure, equipment, all others	Grounding with damage to vessel	Grounding without damage to vessel	Founderings, capsizings, and floodings	Heavy weather damage	Cargo damage	Material failure--structure and equipment	Material failure--machinery and engineering equipment	Casualty not otherwise classified	Total
LOCATION OF CASUALTY																		
Inland--Atlantic	34	52	.....	105	65	2	3	2	21	87	173	89	.....	2	31	56	14	736
Inland--Gulf	123	80	1	133	70	5	5	2	35	69	100	79	.....	.....	24	25	27	778
Inland--Pacific	22	36	.....	55	66	.....	2	.....	35	71	99	69	.....	.....	29	106	6	596
Ocean--Atlantic	17	8	.....	6	13	1	.....	3	14	23	15	31	1	3	32	94	6	309
Ocean--Gulf	18	13	.....	15	42	.....	.....	1	23	22	10	53	.....	.....	11	15	4	227
Ocean--Pacific	28	8	.....	13	21	.....	1	.....	20	36	14	69	4	8	66	200	6	494
Great Lakes	5	5	.....	68	14	.....	.....	6	3	25	38	7	.....	.....	46	46	5	260
Western Rivers	51	27	.....	189	32	.....	.....	.....	16	77	130	95	.....	.....	14	3	36	672
Ocean--other	6	14	.....	17	19	.....	.....	.....	9	14	11	7	.....	.....	9	13	.....	121
Foreign waters	5	10	.....	17	5	.....	.....	1	2	6	9	4	.....	.....	8	8	2	75
TIME OF DAY																		
Daylight	140	137	.....	323	203	6	8	7	104	175	304	293	2	3	161	393	54	2313
Nighttime	150	98	1	260	110	2	2	4	63	217	244	167	1	10	83	136	40	1588
Twilight	19	18	.....	35	39	.....	1	2	11	36	51	63	2	2	40	41	12	367
ESTIMATED LOSSES ($1000's)																		
Vessel	16311	6908	5	15295	9190	2716	6776	233	17575	41305	774	32477	38	23	6682	10066	2599	168975
Cargo	2678	595	0	1777	998	80	35	10	2967	4142	10	2140	35	655	14323	180	463	31090
Property	1225	1642	0	11699	4377	9999	7	10	671	663	40	1275	0	40	475	699	716	33490
VESSELS TOTALLY LOST																		
Inspected	3	1	.....	1	.....	.....	.....	.....	9	9	.....	10	.....	.....	.....	1	.....	29
Uninspected	12	5	.....	7	5	2	1	.....	31	28	1	97	.....	.....	3	.....	4	196

Statistical Summary of Deaths/Injuries Due to a Vessel Casualty

1 October 1977 to 30 September 1978 Fiscal Year 1978	Collisions crossing, meeting and overtaking	Collisions while anchored, docking, or undocking	Collision, fog	Collisions with piers and bridges	Collisions all others	Explosion and/or fire--cargo	Explosion and/or fire--vessels fuel	Explosions and/or fire--pressure vessels, boilers	Explosions and/or fire--structure, equipment, all others	Grounding with damage to vessel	Grounding without damage to vessel	Foundrings, capsizings, and floodings	Heavy weather damage	Cargo damage	Material failure--structure and equipment	Material failure--machinery and engineering equipment	Casualty not otherwise classified	Total
Number of casualties	27	4	0	3	6	6	1	1	21	3	3	59	0	1	6	5	4	154
Number of inspected vessels involved	6	0	0	2	2	4	0	1	8	0	1	4	0	1	2	2	0	29
Number of uninspected vessels involved	21	4	0	1	4	2	1	0	17	3	4	55	0	0	4	3	4	126
Number of persons deceased/injured	13/32	8/0	0/0	1/6	0/11	4/7	0/1	0/1	14/22	4/2	4/2	119/15	0/0	0/1	7/8	3/6	0/5	179/119
PRIMARY CAUSE																		
Personnel faults																		
Pilots--State	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Pilots--Federal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Licensed officer--Documented seaman	8	.....	.....	3	2	1	.....	.....	.....	1	.....	5	.....	.....	.....	.....	1	22
Unlicensed--Undocumented persons	8	.....	.....	1	2	.....	.....	.....	1	1	2	9	.....	.....	1	.....	.....	25
All others	.....	.....	.....	.....	.....	2	.....	.....	1	.....	.....	.....	.....	.....	1	.....	1	5
Calculated risk	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Restricted maneuvering room	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Storms--adverse weather	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20	.....	1	1	.....	.....	22
Unusual currents	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	1

Statistical Summary of Deaths/Injuries Due to a Vessel Casualty - Continued

1 October 1977 to 30 September 1978

Fiscal Year 1978

	Collisions; crossing, meeting and overtaking	Collisions while anchored, docking, or undocking	Collision, fog	Collisions with piers and bridges	Collisions all others	Explosion and/or fire--cargo	Explosion and/or fire--vessel's fuel	Explosions and/or fire--pressure vessels, boilers	Explosions and/or fire--structure, equipment, all others	Grounding with damage to vessel	Grounding without damage to vessel	Founderings, capsizings, and floodings	Heavy weather damage	Cargo damage	Material failure--structure and equipment	Material failure--machinery and engineering equipment	Casualty not otherwise classified	Total
Sheer, suction, bank cushion	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Depth of water less than expected	.....	.....	.....	.....	1	2	1	1	8	.....	.....	9	.....	.....	1	3	.....	24
Failure of equipment	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	.....	.....	.....	.....	.....	6
Unseaworthy--lack of maintenance	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
Floating debris--submerged object	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
Inadequate tug assistance	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1	23
Fault on part of other vessel or person	9	3	.....	.....	1	1	.....	.....	1	1	1	4	.....	.....	1	.....	1	27
Unknown--insufficient information	1	1	.....	.....	.....	1	.....	.....	10	.....	1	11	.....	.....	1	.....	1	27
VESSEL TYPE																		
Inspected vessels:																		
Passenger and ferry--large	.....	.....	.....	/1	/1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0/2
Passenger and ferry--small	3/2	.....	.....	/1	/4	.....	.....	.....	.....	.....	/1	1/3	.....	.....	/1	.....	.....	4/12
Freight	3/3	.....	.....	.....	.....	.....	.....	.....	2/2	.....	.....	2/2	.....	/1	.....	/4	.....	9/12
Cargo Barge	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0/0
Tankship	.....	.....	.....	.....	.....	/1	.....	/1	/2	.....	.....	.....	.....	.....	/6	.....	.....	0/10
Tank Barge	.....	.....	.....	.....	.....	1/3	.....	.....	2/	.....	.....	.....	.....	.....	.....	.....	.....	3/3
Public	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0/0
Miscellaneous	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0/0
Uninspected vessels:																		
Fishing	1/7	.....	.....	/1	/3	.....	/1	.....	2/3	1/	3/	77/2	.....	.....	.....	1/	/2	85/19
Tug/Towing	/1	1/	.....	/3	/3	3/	.....	.....	/5	3/2	/1	13/3	.....	.....	.....	.....	.....	20/13
Foreign	/6	.....	.....	.....	.....	.....	.....	.....	2/2	.....	.....	.....	.....	.....	2/	/2	/2	4/12
Other	6/13	7/	.....	1/	.....	/3	.....	.....	6/8	.....	1/	26/5	.....	.....	5/1	2/	/1	54/31
PARTICULARS OF PERSON DECEASED/INJURED																		
Papers of deceased/injured:																		
Licensed by Coast Guard	3/	.....	.....	/1	/1	2/	.....	.....	/1	1/1	.....	6/2	.....	.....	/1	.....	.....	12/7
Documented by Coast Guard	5/4	.....	.....	.....	1/	.....	/1	2/3	.....	.....	.....	7/3	.....	/1	1/6	/4	.....	16/24
No license or document	7/28	8/	.....	1/3	/10	1/7	/1	.....	9/14	3/1	9/2	106/9	.....	.....	6/1	3/	/3	146/81
Other--unknown--foreign	.....	.....	.....	.....	.....	.....	.....	.....	3/2	.....	.....	/1	.....	.....	2/	/2	/2	5/7
Status or capacity on vessel:																		
Passenger	1/15	5/	.....	/1	/6	.....	.....	.....	2/1	.....	/1	13/2	.....	.....	1/	2/	.....	24/24
Longshoreman--harbor worker	.....	.....	.....	.....	.....	/1	.....	.....	.....	.....	.....	.....	.....	.....	1/	.....	.....	1/1
Crewmember	14/16	3/	.....	1/3	/7	4/3	/1	/1	11/21	4/2	4/1	104/12	.....	/1	9/7	1/6	/4	130/89
Other	/1	.....	.....	.....	.....	/1	.....	.....	1/	.....	.....	2/1	.....	.....	1/1	.....	/1	4/5
Activity engaged in:																		
Off duty	1/3	.....	.....	.....	.....	/1	.....	.....	1/4	.....	.....	2/3	.....	.....	.....	.....	.....	4/11
Deck department duties	4/7	3/	.....	1/4	/3	/3	/1	.....	9/12	4/1	.....	35/5	.....	/1	2/5	/3	/3	53/48
Engine department duties	3/1	.....	.....	.....	/1	1/	.....	/1	1/3	.....	/1	.....	.....	.....	/2	/3	.....	5/12
Steward department duties	1/1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1/1
Handling cargo	.....	.....	.....	.....	.....	/1	.....	.....	.....	.....	.....	2/	.....	.....	.....	.....	.....	2/1
Fishing	/3	1/	.....	/1	/3	/1	.....	.....	.....	.....	1/	21/1	.....	.....	.....	1/	/1	24/10
Drills	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2/	.....	.....	2/
Passenger	1/13	4/	.....	/1	/4	.....	.....	.....	2/1	.....	/1	8/1	.....	.....	1/	2/	.....	18/23
Other and unknown	5/2	.....	.....	.....	.....	3/1	.....	.....	6/2	/1	5/	51/5	.....	.....	2/1	.....	/1	70/13
Location:																		
Great Lakes	.....	2/	.....	.....	.....	.....	.....	.....	/1	.....	.....	1/2	.....	.....	.....	/3	.....	3/6
Western Rivers	1/3	4/	.....	/3	.....	/1	.....	.....	.....	/1	.....	11/	.....	.....	.....	.....	.....	16/8
Inland	9/19	2/	.....	1/3	/8	4/3	/1	/1	14/13	4/1	4/2	78/9	.....	.....	4/1	3/2	/3	123/73
Ocean	/1	.....	.....	.....	/3	/1	.....	.....	/2	.....	.....	18/4	.....	/1	3/6	.....	/2	21/20
Foreign and unspecified	5/9	.....	.....	.....	.....	.....	.....	.....	/1	.....	.....	11/	.....	.....	/1	/1	.....	16/12
PART OF BODY INVOLVED																		
Head	/6	3/	.....	/1	/3	.....	.....	.....	4/4	.....	/1	.....	.....	.....	1/	.....	/1	8/16
Back	/6	.....	.....	.....	/2	.....	.....	.....	/2	/1	.....	/1	.....	.....	/2	.....	.....	/14
Chest	/3	.....	.....	/1	.....	.....	.....	.....	/1	.....	.....	/3	.....	/1	/1	/1	.....	/11
Extremities	/8	.....	.....	/3	/3	/2	.....	/1	/11	/1	.....	/4	.....	.....	/4	/3	/4	/30
Illness	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1/	.....	.....	.....	.....	.....	.....	1/
Drowning	10/	4/	.....	1/	.....	.....	.....	.....	2/	4/	3/	86/	.....	.....	3/	3/	.....	116/
Unspecified and miscellaneous	5/9	1/	.....	.....	.....	4/3	/1	.....	8/4	.....	/1	33/7	.....	.....	3/1	.....	.....	54/28

Statistical Summary of Deaths on Board Commercial Vessels Not Involving a Vessel Casualty

1 October 1977 to 30 September 1978

Fiscal Year 1978

	Natural cause	Homicide	Suicide	Disappearance	Slips and falls—ladders	Slips and falls—gangways	Slips and falls—on deck	Slips and falls—other	Falls from vessel—into water	Falls into holds or tanks	Struck by objects falling, dropped or moving	Exposure and asphyxiation	Struck against, crushed, bumped into objects	Operating machinery and tools	Burns and scalds (other than electrical)	Electrical shock and burns	Caught in lines, chains or wire ropes	Pinching or crushing	Heavy weather	Overexertion, sprains and strains	Cuts, lacerations, bruises, and punctures	Altercations and misconduct	Unknown or insufficient information	Total
Number of deaths	118	3	4	3	8	1	0	10	93	6	34	15	1	2	1	1	2	2	0	0	0	0	10	319
Number of uninspected vessels involved	39	1	2	1	6	1	0	7	79	3	22	10	0	1	1	0	2	2	0	0	0	0	5	180
Number of inspected vessels involved	79	2	2	2	2	0	0	3	19	3	12	5	1	1	0	1	0	0	0	0	0	0	5	139
CAUSE OF DEATH																								
Intoxication	1	....	....	....	....	....	....	....	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Physical deficiency or handicap	117	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	118
Unsafe movement or posture	....	....	....	....	2	....	....	....	7	....	....	1	1	....	....	....	....	....	....	....	....	....	....	11
Psychological--immaturity, insanity	....	....	8	....	....	....	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9
Unsafe practice	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	1	3
Violation of law or regulation	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Human errors	....	....	....	....	9	1	....	6	91	3	22	6	....	1	1	1	1	2	....	....	....	....	2	91
Decks slippery or cluttered	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Weather conditions	....	....	....	....	....	....	....	....	3	....	1	....	....	....	....	....	....	....	....	....	....	....	....	4
Poor maintenance or housekeeping	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	2
Inadequate lighting	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Inadequate rails or guards	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Failure of equipment	....	....	....	....	....	....	....	2	2	....	6	....	....	....	....	....	....	....	....	....	....	....	....	10
Inadequate supervision	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	2
Inadequate life preservers	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Inadequate tools or equipment	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Inadequate protective equipment	....	....	....	....	....	....	....	1	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	3
Improper use of tools or equipment	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Miscellaneous causes	....	2	....	3	1	....	....	1	28	2	1	6	....	1	....	....	1	....	....	....	....	....	7	53
TYPES OF VESSELS INVOLVED																								
Inspected vessels:																								
Passenger and ferry--large	11	2	2	1	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	20
Passenger and ferry--small	18	....	....	....	1	....	....	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	25
Freight	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Cargo Barge	32	....	....	....	3	....	....	2	4	3	8	2	....	1	....	....	....	....	....	....	....	....	4	59
Tankship	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Tank Barge	15	....	....	1	....	....	....	1	2	....	....	....	....	....	....	1	....	....	....	....	....	....	....	20
Public	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Miscellaneous	3	....	....	....	....	....	....	....	2	....	4	3	1	....	....	....	....	....	....	....	....	....	1	14
Uninspected vessels:																								
Fishing	15	....	2	....	....	....	....	....	23	....	3	5	....	....	....	....	2	....	....	....	....	....	3	55
Tug/Towing	11	....	....	1	....	....	....	....	20	1	3	....	....	....	....	....	....	1	....	....	....	....	2	39
Foreign	10	1	....	....	0	1	....	1	5	2	8	2	....	....	....	....	....	....	....	....	....	....	....	34
Other	3	....	....	....	....	....	....	6	29	....	8	3	....	1	1	....	....	1	....	....	....	....	....	52
TIME OF DAY																								
Daytime	70	2	3	2	5	....	....	7	43	4	23	8	....	2	1	1	1	1	....	....	....	....	2	175
Nighttime	43	1	....	....	3	1	....	3	47	2	7	5	1	....	....	....	1	1	....	....	....	....	9	119
Twilight	5	....	1	1	....	....	....	....	4	....	4	2	....	....	....	....	....	....	....	....	....	....	9	25
PARTICULARS OF PERSON DECEASED																								
Papers of deceased:																								
Licensed by Coast Guard	23	....	....	....	....	....	....	....	5	1	1	....	....	....	....	....	....	....	....	....	....	....	....	32
Documented by Coast Guard	30	1	....	1	2	....	....	2	7	1	3	1	....	....	....	....	....	1	....	....	....	....	6	53
No license or document	59	2	4	2	4	....	....	8	81	2	28	12	1	2	1	1	2	1	....	....	....	....	6	216
Other--unknown--foreign	6	....	....	....	2	1	....	....	5	2	2	2	....	....	....	....	....	....	....	....	....	....	....	18
Status or capacity on vessel:																								
Passenger	37	2	2	1	1	....	....	....	17	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1	61
Longshoreman—harbor worker	....	....	....	....	2	....	....	2	3	1	13	....	....	1	....	....	....	....	....	....	....	....	....	23
Crewmember	78	1	2	2	4	....	....	3	70	4	15	9	....	....	1	....	2	2	....	....	....	....	8	201
Other	3	....	....	....	1	1	....	5	8	1	6	5	1	1	....	1	....	....	....	....	....	....	1	34
Activity engaged in:																								
Off duty	42	1	....	....	2	....	....	....	7	....	....	1	....	....	....	....	....	....	....	....	....	....	2	55
Deck department duties	17	....	....	2	3	....	....	4	37	3	15	3	1	1	....	....	2	1	....	....	....	....	2	91
Engine department duties	9	....	....	....	....	....	....	....	3	....	....	3	....	....	1	....	....	1	....	....	....	....	....	17
Steward department duties	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Handling cargo	....	....	....	....	1	....	....	2	1	2	12	....	....	1	....	....	....	....	....	....	....	....	1	20
Fishing	16	....	1	....	....	....	....	....	13	....	4	....	....	....	....	....	....	....	....	....	....	....	....	34
Drills	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Passenger	26	2	2	....	1	....	....	....	16	....	....	1	....	....	....	....	....	....	....	....	....	....	....	48
Other and unknown	3	....	1	1	1	1	....	9	21	1	3	7	....	....	....	1	....	....	....	....	....	....	5	51
Location:																								
Great Lakes	7	....	....	1	....	....	....	....	6	....	1	....	....	....	....	....	....	....	....	....	....	....	....	15
Western Rivers	9	....	....	....	....	1	....	3	24	2	6	....	....	....	1	....	....	....	....	....	....	....	2	48
Inland	67	3	3	....	7	....	....	6	63	1	17	13	1	2	....	....	2	1	....	....	....	....	3	189
Ocean	20	....	1	1	....	....	....	....	3	1	2	....	....	....	....	....	....	....	....	....	....	....	....	29
Foreign and unspecified	15	....	....	1	1	....	....	1	2	2	8	2	....	....	....	1	....	....	....	....	....	....	5	38

Statistical Summary of Deaths on Board Commercial Vessels Not Involving a Vessel Casualty - Continued

1 October 1977 to 30 September 1978
Fiscal Year 1978

PART OF BODY INVOLVED	Natural cause	Homicide	Suicide	Disappearance	Slips and falls--ladders	Slips and falls--gangways	Slips and falls--on deck	Slips and falls--other	Falls from vessel--into water	Falls into holds or tanks	Struck by objects; falling, dropped or moving	Exposure and asphyxiation	Struck against, crushed, bumped into objects	Operating machinery and tools	Burns and scalds (other than electrical)	Electrical shock and burns	Caught in lines, chains or wire ropes	Pinching or crushing	Heavy weather	Overexertion, sprains and strains	Cuts, lacerations, bruises, and punctures	Altercations and misconduct	Unknown or insufficient information	Total
Head	1	1	....	....	3	....	....	6	....	3	19	1	....	....	....	....	....	2	....	....	....	....	....	36
Back	1	....	....	....	1	....	....	2	....	1	5	....	....	....	....	....	....	....	....	....	....	....	....	9
Chest	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Extremities	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Illness	113	....	....	....	....	....	....	....	98	....	1	6	....	....	....	....	....	....	....	....	....	....	1	114
Drowning	....	....	3	....	3	1	....	1	6	2	9	10	1	1	1	1	....	....	....	....	....	....	2	111
Unspecified and miscellaneous	2	2	1	3	1	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7	67

Statistical Summary of Personnel Injuries on Board Commercial Vessels Not Involving a Vessel Casualty

1 October 1977 to 30 September 1978
Fiscal Year 1978

CAUSE OF INJURY	Natural cause	Homicide	Suicide	Disappearance	Slips and falls--ladders	Slips and falls--gangways	Slips and falls--on deck	Slips and falls--other	Falls from vessel--into water	Falls into holds or tanks	Struck by objects; falling, dropped or moving	Exposure and asphyxiation	Struck against, crushed, bumped into objects	Operating machinery and tools	Burns and scalds (other than electrical)	Electrical shock and burns	Caught in lines, chains or wire ropes	Pinching or crushing	Heavy weather	Overexertion, strains and strains	Cuts, lacerations, bruises, and punctures	Altercations and misconduct	Unknown or insufficient information	Total
Number of injuries	2	0	2	0	128	17	217	107	7	13	313	4	130	34	47	10	41	57	6	173	65	38	29	1440
Number of uninspected vessels involved	1	0	1	....	9	1	25	15	6	4	67	1	13	7	5	2	19	8	0	16	9	2	5	216
Number of inspected vessels involved	1	0	1	....	119	16	192	92	1	9	246	3	117	27	42	8	22	49	6	157	56	36	24	1224
Intoxication	....	....	....	....	6	2	2	1	....	....	1	....	1	....	....	....	....	....	....	1	....	1	1	16
Physical deficiency or handicap	2	....	....	....	4	....	4	....	....	....	....	....	2	1	....	....	....	....	....	20	....	....	....	33
Unsafe movement or posture	....	....	....	....	20	1	17	18	1	3	13	....	18	....	2	....	6	4	....	21	2	1	2	179
Psychological--immaturity, insanity	....	....	1	....	....	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	1	34	....	38
Unsafe practice	....	....	....	....	6	....	9	12	3	3	52	2	4	3	13	5	3	5	1	18	10	....	6	161
Violation of law or regulation	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	1	4
Human errors	....	....	1	....	74	11	117	49	....	6	171	1	73	22	21	3	30	41	1	57	37	....	10	725
Decks slippery or cluttered	....	....	....	....	8	1	48	5	....	1	....	....	6	....	....	....	....	....	....	2	....	....	1	72
Weather conditions	....	....	....	....	3	....	14	10	1	....	13	....	19	....	....	....	....	5	6	2	9	....	....	73
Poor maintenance or housekeeping	....	....	....	....	1	1	....	2	....	....	7	....	....	....	....	....	....	....	....	....	....	....	....	11
Inadequate lighting	....	....	....	....	2	....	1	2	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	6
Inadequate rails or guards	....	....	....	....	2	....	....	....	....	....	2	....	....	....	....	....	....	1	....	....	....	....	....	4
Failure of equipment	....	....	....	....	....	....	2	6	2	....	34	....	2	3	6	2	....	....	....	1	3	....	2	62
Inadequate supervision	....	....	....	....	....	1	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	6
Inadequate life preservers	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Inadequate tools or equipment	....	....	....	....	....	....	....	....	....	....	2	....	....	3	....	....	....	....	....	....	1	....	....	6
Inadequate protective equipment	....	....	....	....	....	....	....	....	....	....	5	....	....	....	3	....	....	....	....	....	....	....	....	9
Improper use of tools or equipment	....	....	....	....	1	....	2	1	....	....	7	1	....	....	2	....	....	1	....	1	3	....	1	26
Miscellaneous causes	....	....	....	....	....	....	....	1	....	....	2	....	....	....	....	....	....	....	....	....	1	....	7	4

Statistical Summary of Personnel Injuries on Board Commercial Vessels Not Involving a Vessel Casualty - Continued

1 October 1977 to 30 September 1978 Fiscal Year 1978	Natural cause	Homicide	Suicide	Disappearance	Slips and falls--ladders	Slips and falls--gangways	Slips and falls--on deck	Slips and falls--other	Falls from vessel--into water	Falls into holds or tanks	Struck by objects falling, dropped or moving	Exposure and asphyxiation	Struck against, crushed, bumped into objects	Operating machinery and tools	Burns and scalds (other than electrical)	Electrical shock and burns	Caught in lines, chains or wire ropes	Pinching or crushing	Heavy weather	Overexertion, sprains and strains	Cuts, lacerations, bruises, and punctures	Altercations and misconduct	Unknown or insufficient information	Total
TYPES OF VESSELS INVOLVED																								
Inspected vessels:																								
Passenger and ferry--large	....	....	....	....	4	....	9	2	1	....	6	....	10	1	....	....	....	3	....	5	4	1	....	46
Passenger and ferry--small	....	....	....	....	2	....	7	1	....	....	6	....	....	....	....	....	1	1	....	1	2	2	2	25
Freight	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Cargo Barge	....	....	1	....	88	13	126	71	....	8	163	2	86	21	29	8	13	38	5	111	36	25	13	839
Tankship	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Tank Barge	1	....	....	....	24	1	42	8	....	....	49	1	16	1	12	....	5	5	1	30	10	6	7	219
Public	....	....	....	....	1	....	5	1	....	....	5	....	1	1	....	....	....	1	....	8	1	2	1	27
Miscellaneous	....	....	....	....	....	....	3	9	....	1	17	....	4	3	1	....	3	1	....	2	3	....	1	48
Uninspected vessels:																								
Fishing	1	....	....	....	3	....	8	3	1	1	27	1	9	3	....	....	11	3	....	6	3	....	3	78
Tugs	....	....	1	....	3	1	12	8	1	1	26	....	7	4	2	1	6	4	....	10	4	2	1	94
Foreign	....	....	....	....	2	....	....	1	1	2	6	....	....	....	1	....	1	....	....	....	....	....	....	14
Miscellaneous	....	....	....	....	1	....	5	3	3	....	8	....	2	....	2	1	1	1	....	....	2	....	1	30
TIME OF DAY																								
Daytime	2	....	2	....	73	7	139	73	4	10	244	3	93	28	33	8	34	39	6	140	49	14	12	1015
Nighttime	....	....	....	....	45	10	63	27	2	3	52	1	29	6	6	2	7	10	....	23	13	22	5	328
Twilight	....	....	....	....	10	....	13	7	1	....	17	....	6	....	8	....	....	8	....	10	3	2	12	97
PARTICULARS OF PERSON INJURED																								
Papers of person injured:																								
Licensed by Coast Guard	....	....	....	....	19	1	31	20	....	2	83	1	20	6	15	3	4	5	....	23	8	7	3	213
Documented by Coast Guard	1	....	2	....	98	16	137	69	1	7	206	1	93	22	26	5	19	45	6	134	48	30	18	1004
No license or document	1	....	....	....	11	....	29	18	5	2	64	2	17	6	5	2	17	7	....	14	9	1	8	218
Other--unknown--foreign	....	....	....	....	....	....	....	....	1	2	....	....	....	....	1	....	1	....	....	....	....	....	....	5
Status or capacity on vessel:																								
Passenger	....	....	....	....	1	....	14	4	1	....	5	....	5	....	....	....	....	1	....	3	3	....	2	39
Longshoreman--harbor worker	....	....	....	....	1	....	1	3	....	....	12	....	2	....	....	....	....	....	....	....	1	....	....	20
Crewmember	2	....	2	....	123	17	199	93	6	12	290	3	123	33	44	9	40	55	6	169	59	36	27	1330
Other	....	....	....	....	1	....	3	7	....	1	6	1	....	1	3	1	1	1	....	1	2	2	....	31
Activity engaged in:																								
Off duty	....	....	1	....	20	16	12	10	1	....	9	....	12	....	1	....	....	4	....	7	6	21	1	121
Deck department duties	....	....	1	....	47	1	102	50	4	10	182	2	49	13	12	1	30	23	3	88	18	6	7	651
Engine department duties	....	....	....	....	27	....	33	24	....	1	64	1	36	17	25	8	1	12	1	46	22	2	5	327
Steward department duties	....	....	....	....	14	....	29	3	....	....	17	....	19	....	4	....	....	10	1	16	9	4	6	134
Handling cargo	....	....	....	....	....	....	3	1	....	....	5	....	1	....	....	....	2	....	....	....	....	....	....	12
Fishing	....	....	....	....	2	....	2	3	....	1	21	....	3	1	....	....	8	1	....	5	5	....	....	52
Drills	....	....	....	....	1	....	2	1	....	....	2	....	2	1	....	....	....	3	....	4	....	....	....	16
Passenger	....	....	....	....	....	....	14	3	1	....	4	....	5	....	....	....	....	1	....	1	1	....	2	32
Other and unknown	2	....	....	....	17	....	18	10	1	1	9	1	3	....	3	1	....	3	1	6	4	5	8	93
Location:																								
Great Lakes	....	....	....	....	3	....	9	2	1	2	7	....	1	....	3	1	4	6	....	4	....	....	....	43
Western Rivers	....	....	....	....	....	....	6	4	2	2	14	....	8	1	1	1	2	2	....	2	....	....	5	55
Inland	1	....	1	....	33	6	64	39	2	6	113	3	30	10	14	4	23	15	1	49	19	12	6	453
Ocean	1	....	....	....	33	....	64	27	1	2	66	1	50	10	12	1	1	16	5	53	26	3	8	380
Foreign and unspecified	....	....	1	....	52	11	74	35	1	1	113	....	41	13	17	3	11	18	....	65	20	23	10	509
PART OF BODY INVOLVED																								
Head	....	....	....	....	25	3	39	23	2	3	83	....	26	1	18	4	2	3	1	9	6	21	4	275
Back	....	....	....	....	24	2	56	10	1	1	7	....	16	1	....	....	1	1	....	71	1	2	2	194
Chest	....	....	....	....	20	2	29	14	2	5	19	....	20	2	3	....	1	2	....	35	1	6	1	160
Extremities	....	....	2	....	34	10	92	56	1	4	199	1	67	30	25	3	37	51	5	57	56	10	16	776
Illness	2	....	....	....	....	....	....	....	1	....	1	2	....	....	....	....	....	....	....	....	....	....	....	6
Drowning	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0
Unspecified and miscellaneous	....	....	....	....	5	....	3	2	....	....	4	1	1	....	1	3	....	....	....	1	1	1	6	29

Tankerman's Fable

Once upon a Time a Great Big  Oil Tanker was loading Fuel Oil which is Nasty Black Gooey Stuff. A Big Man  called a Mate was in charge. Another Big Old Man  called a Wharfman was Pumping the Oil aboard with a Tiny Weenie Pump  The Wharfman got Tired of using the Tiny Weenie Pump and started to use a Great Big Pump  The Oil came MUCH faster and What do You Think Happened? That's Right, the Tank Spilled Over and the Mate found a Lot of Nasty Black Gooey Stuff up around his Knees

That made the Mate Very Unhappy and Besides it ruined HIS PANTS  It took a Lot of People a Long Time to Clean up All the Nasty Black Gooey Stuff  and when the Mate saw this and had another look at His PANTS  he decided he would NEVER let another tank Spill Over, Especially if he was Standing Beside It.

— MORAL —

You can never tell what some bird in a pumphouse a mile away is going to do, so watch all tanks being loaded.

Reprinted courtesy of the Chevron Shipping Company Safety Bulletin.

Oil Bubbles

Captain G. Kirk Greiner, Jr.

The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Commandant or the Coast Guard at large.

In the investigation of oil pollution in cases originating during the bunkering of a ship, usually from a tank barge, the excuse has often been "an air bubble." Theories expounded by the person in charge of bunkering as to the source of the bubble have varied from "a change in list caused by cargo handling must have released entrapped air which carried oil with it out the vent piping" to "the tank bulkhead must have popped." (The author has never given much credibility to these excuses.)

While in fact an air bubble may have caused oil to rise in a tank vent and be expelled onto deck, ordinary precautions can and must be taken by shipboard personnel to prevent this type of spill. There are two practices which lead to these incidents and which must be modified. Lighters, because of Customs regulations, will usually have on board only the amount of fuel to be delivered to a vessel taking bunkers. This fuel may be contained in many tanks in the lighter. The practice of the lighter tankerman is usually to empty and strip each tank in turn. During the stripping process, air is pumped to the receiving vessel and delivered to the bottom of the tank or tanks being filled.

Before we examine what happens to this air and its effect, let's examine the second practice, that of the ship's engineer in taking bunkers. Double bottoms with their vents rising to the main deck level are commonly pressed up when receiving bunkers, with the oil rising part way up the vent. As long as there are other tanks open receiving fuel which are not topped off, the pressure in the topped off double bottom will not be sufficient to cause the oil to flow out of its vents or overflow. (The author does not recommend this practice of filling tanks but knows that in fact it does take place.)

Now the stage is set for the entrance of our air bubble. If air enters a topped off tank, it will seek to escape by rising to the surface and then up the vent. If the volume of air is sufficient, the oil already in the vent will be carried out of the vent, hopefully into the container located under the vent required in accordance with 33 CFR 155.320. However, if the volume or velocity is sufficient this oil may be spilled onto the deck and into the water, creating a pollution incident.

Even if the tank is not full, air passing into a nearly full tank will rise from the bottom, expanding as the pressure decreases and causes a welling of oil at the surface. Under the right conditions, i.e., specific gravity, ullage, air volume, etc., the oil can be carried into the vent and expelled to the atmosphere on deck.

The problem is identifying the cause. What can be done to prevent this type of incident? First, let's attack the source of the air. The lighter tankermen should not indiscriminately strip tanks without the knowledge or permission of the person in charge of the vessel receiving the oil. It is recommended that no tank in the lighter be pumped down to less than three feet, or such other appropriate level that will cause air to be sucked into the pumping system, until all tanks are pumped out. Stripping of all tanks can then be done at a slow flow rate. During the stripping, the discharge should be into an almost empty deep tank or settler. The current requirements for oil transfers set forth in 33 CFR, 156.120(q) require that the person in charge of the loading and the person in charge of the discharge hold a conference which, among other things, sets forth the sequence of transfer operations as

Continued on next page.....

well as any other requirements. Further, a declaration of inspection form must be signed which includes the details of the conference. The "conference" and "declaration" are the avenues through which agreement can be reached and recorded.

The second identified cause of "oil bubbles" is the pressing up of tanks. This practice can no longer be condoned. It is hazardous with respect to spills, and procedures will have to be developed to accurately permit the ship's engineer to load only to 98 percent or, even better, 95 percent capacity in each tank.

Ship operators must also share some of the responsibility. No longer can they expect their ships to top off all tanks without increasing the probability of a spill. There should be a tank, perhaps a settler, which is not to be filled during the bunkering, and into which the discharge can be directed when the supplying barge is stripping her tanks.

A spill can only be an act of God under the most unusual circumstances. Almost without exception a spill results from the act of a person, usually by his failure to take adequate precautions in handling the product. The Coast Guard will not accept "air bubble" as an excuse for pollution. It may be the cause, but it could have been prevented if proper procedures were agreed upon before starting the fuel transfer and adhered to during the transfer.

* * * *

The views expressed in the above article are those of one Coast Guard officer whose duties include enforcing pollution prevention laws. Perhaps some of our readers may wish to submit written comments from the point of view of the terminal operator, tankerman, etc. Such comments are welcome and may be used in whole or in part in a possible future follow-up column. Our address is listed inside the front cover.

Former Marine Safety Council Executive Secretary, Captain G. Kirk Greiner, Jr., is presently serving as Commanding Officer, Marine Safety Office and Group Commander in Portland, Oregon. He has had broad experience in the marine inspection field, having filled assignments as Senior Inspector of Material, Senior Investigating Officer, Senior Inspector of Personnel, Boiler and Deck Inspector, and Marine Investigating Officer at the Marine Inspection Offices in Seattle, New York and Juneau. Past assignments also include several billets on board Coast Guard cutters and positions of increasing responsibility at the Coast Guard Reserve Training Center, Yorktown, Virginia, including Executive Officer.

Captain Greiner holds a Juris Doctor degree from Georgetown Law School, Washington, DC. He is a member of the Propeller Club and the Society of Port Engineers.

Corrected List: Effective Navigation and Inspection Circulars

One section of effective navigation and inspection circulars (NVC's) was unintentionally omitted from the list published on pages 4 and 5 of the January 1979 Proceedings. Also, two new circulars are now in effect. The NVC's listed below complete the previously published list. These circulars are available individually or by subscription, free of charge, from Commandant (G-MP-4/82), U.S. Coast Guard, Washington, DC 20590.

7-56	Manned LST's; structural reinforcement and drydocking; hull inspection requirements
10-60	Placards, forms, and instructions required to be posted aboard vessels; alternate materials and methods
11-61	Fire Hose
12-61	Inspection procedures for approved inflatable life rafts held in storage
2-62	Watertight Bulkheads in All Inspected Vessels - Maintenance of Watertight Integrity
4-62	Renewal of deck officers' licenses--Great Lakes
5-62	Renewal of deck officers' licenses--Western Rivers
9-62	Liquefied Compressed Gas Cargo Hose
1-63	Notes on Inspection and Repair of Wooden Hulls
2-63	Guide for Inspection and Repair of Lifesaving Equipment
10-63	Typical Class A-60, A-30, A-15 and A-0 Steel Bulkheads and Decks
11-63	LST's as unmanned barges; structural reinforcement and drydocking; hull inspection requirements
1-78 CH-1*	Automation of Offshore Supply Vessels of 100 Gross Tons or Over
1-79	Literature Concerning Hazardous Cargoes
2-79	Aluminum Bus Bars

*Please note change

The three letters which follow are comments on an article printed in the February 1979 Proceedings, "Abandon Ship or Action Stations?" by Commander Hugh Williams, USCG. Further responses are welcome and may be sent to the editor through the address listed inside the front cover.

in response to

"Abandon Ship or Action Stations?"

R. B. Moss
Captain, USNR
Director, Ocean Engineering and Supervisor of Salvage:

I have reviewed Commander Williams' article "Tanker Casualties and Pollution Prevention: Abandon Ship or Action Stations?" and have found it to be innovative and thought-provoking. Clearly the crews should be trained in damage assessment and pollution prevention. I think the idea of providing a portable pumping capability is good, and would encourage Commander Williams to further explore the concept of the insurance rebate or lowering of rates as this might help to reduce the overall cost to the owner of providing the pumping systems. I do have some technical comments concerning Commander Williams' approach and offer them for your consideration.

First, in any grounding situation, it is of utmost importance to ensure that the ship is not driven further aground or allowed to broach. The importance of this aspect varies, of course, depending on the location of the grounding; i.e., on a sheltered mudflat, in a channel, or on a rocky-exposed coastline. A portable pumping capability could be useful in this case to add ballast to the ship as long as the ballasting operation does not cause undue stressing of the ship's hull. An alternative would be the deployment of anchors, but it is unlikely that a self-contained system would be feasible for a tanker and would require tug assistance.

Another reason that the idea of having preloaded portable pumps aboard is considered sound, is that it reduces the scope of the often arduous task of transferring pumps from an assist-ship to the tanker. The utilization of the pumping system must be approached with caution, however. A tanker in a grounded condition no longer obeys the physical laws of afloat buoyancy and stability and the usefulness of the installed load calculating systems is greatly reduced, if not eliminated. The ultimate hazard is that, unless great and knowledgeable care is exercised, the ship could be overstressed; a break in other tanks could occur, and the salvage of the ship become greatly complicated. The questions of what to move, where to move it, and how much to move should only be answered by those trained or qualified to do so. Although I am not personally knowledgeable of the marine engineering education level of the officers in the Merchant Marines, I suspect it does not involve much in the way of damage stability and salvage engineering. For that reason I am reluctant to agree with Commander Williams that these actions should be within the capabilities of all tanker crews. I would recommend, however, that the ship owner ensure that he has a trained professional salvage engineer available that is capable of responding to his needs at a moment's notice.

In summary then, I agree with Commander Williams that the crews should be educated in the area of damage assessment, be trained to take some damage control and/or pollution abatement action, and that the tankers be fitted with portable pumping systems. The relocating of product to taking on of ballast in a stranded condition, however, should be done only under the direction of a trained professional.

Continued on next page.....

Alex Rynecki
Alex Rynecki, Inc.
Sausalito, California:

Commander Williams has developed an interesting scenario for damage assessment and a hopeful outline for action by the ship's crew. While I commend his considerations, I also find them optimistic and counter to hard commercial reality.

Seamen on board the modern tanker, for the most part, are not directly related to seamen of former days--the foc's'l of old has vanished and so have the seamen who frequented it. Today, ships are manned by technicians who, depending on the owner and the vessel's flag, are of a wide variety of competence and motivation. In catastrophic casualty situations the first action is: "Let's get off this bucket!" There is little loyalty by the crew to the owner, less to the flag, and little, if any, true concern for environmental matters. "We are not paid for extraordinary actions" seems the motto of the day. Abandonment cases are legion; situations involving ships with their main engines operating and the crew in lifeboats are annual occurrences.

It is in the light casualty where most can be accomplished. Commander Williams is correct in asserting that the crew could be of immense assistance as they, after all, should know the ship best. In any instance, the owner's superintendent and competent salvors should be called to the scene immediately. In any stranding, time is of the essence and the situation only deteriorates; there is no improvement with time. Action by a joint force of the salvage party on board and the ship's company can lead to good results in freeing the stranded vessel.

Automatic actions, such as described in transferring weights aft, should only be undertaken by expert salvors in concert with the crew. Too many cases have been experienced where broaching of the ship, further stranding, or structural problems have resulted from poor use of weight management in offloading and shifting cargo on board casualties.

Before the days of strong environmental concern, it was not uncommon for the salvage officer to order many hundreds of tons of oil pumped overboard to lighten the ship, allowing the use of the incoming tide to free the stranded vessel. Who would have the courage today to order the pumping overboard of 20,000 tons of cargo from a stranded tanker to free the ship quickly, perhaps within the scope of one or two tides, and save the potential loss of 100,000 tons of cargo if the ship broke up? Would the master of the ship take this action, the owner, the on-scene commander for the U.S. Coast Guard, or the Commandant of the Coast Guard himself? Probably none of these. Such courage to act, even if judiciously used, has been lost.

Much of the tanker fleet today, because of the depressed tanker market, has a relatively low value per ship. Recently, a 7-year-old VLCC, in working order, was sold to the breakers; there are similar stories of other relatively new tonnage going at low prices. Therefore, Commander Williams' suggested package of $50,000 per ship would hurt the individual owners and probably not add too

Continued on next page.....

About the Authors

For five years prior to his 1970 retirement from the Navy, Captain W. F. Searle, Jr. was the Navy's Supervisor of Salvage. He spent the major portion of his Naval career in the sub-specialty, Salvage and Diving. Since retirement, Captain Searle has served as a consultant to the United Nations and to the general marine transportation industry in matters relating to salvage and port clearance. He is a Visiting Professor of Ocean Engineering at MIT and lectures at Webb Institute of Naval Architecture and the Maine Maritime Academy. He is the Chairman of the Panel on Salvage and Rescue Towing of the Society of Naval architects and Marine Engineers (SNAME).

Alex Rynecki, principal of Alex Rynecki Ocean Engineers, has been a privately practicing consulting engineer in marine salvage for over 15 years. Between 1960-1963 he served in U.S. Navy Pacific Fleet salvage ships as a diving and salvage officer.

Mr. Rynecki has authored 10 books on ship salvage and over 100 technical papers in the field of ocean engineering, and has served as consultant in over 200 ship casualty salvage operations. A registered professional engineer and certified marine surveyor, he is a member of numerous professional societies including the National Society of Professional Engineers, Society of Naval Architects and Marine Engineers (SNAME), American Society of Military Engineers (ASME), Marine Technology Society, and the National Association of Marine Surveyors.

Captain Robert Moss, USNR, has been the Director of Ocean Engineering (Supervisor of Salvage USN) since June 1976. Prior to becoming Director he served as Deputy for a period of five years, serving concurrently since 1973 as Head, Ocean Engineering Support Department, Navy Experimental Diving Unit. A native of Fort Dodge, Iowa, Captain Moss is an alumnus of Washington State College. He has also attended the U.S. Naval School of Diving and Salvage.

In 1957 Captain Moss was released to inactive duty in the Naval Reserve. As a civilian he was self-employed as an engineering contractor in the San Diego area. He worked as a test lab engineer for General Dynamics Astronautics and as head of the Naval Architecture Branch, Supervisor of Shipbuilding, Conversion and Repair, USN, San Diego, until 1967 when he was recalled to active duty.

much to the ship's ability to free itself from stranding.

Action stations? Yes, but with all batteries loaded and a chance to win. Anything less will most likely lead to defeat, to greater pollution, and to loss of tankers.

W. F. Searle, Jr.
USN (Ret.)
Cambridge, Massachusetts:

I hesitate to make any substantive comment on Commander Williams' article for fear of seeming to imply some objection to it. The fact is, I fully concur with what he has said and applaud the principal point that he makes; namely, that tankers ought to have good damage control books and that the officers and crews should be exercised in realistic damage control drills.

In particular, I fully support Commander Williams' suggestion that tankers (presumably of all types--LNG included) be provided, as a part of their damage control gear, portable submersible pumps for the purpose of over-the-top transfer and offloading of cargo. Portable hydraulic-driven submersible pumps with their own diesel-driven powerpacks are much more appropriate than electric submersible pumps. These pumps, such as ADAPTS, STOPS, APTS and others, are available right now for use on oil tankers.[1] Two or more complete units ought to be carried (at least one forward, one aft) along with the long-employed "regular" electrical or air-driven submersible pumps intended for dewatering or light firefighting. The tanker damage control teams should be frequently exercised in their use for over-the-top pumping.

Realistic damage control drills, based on a well conceived "casualty scenario," need to be conducted, as Commander Williams states, as training to cope with both major and minor pollution-generating casualties; the "soft" grounding (minor pollution, if any), as well as the "hard" grounding. Damage control drills limited to "pat" scenarios such as "fire in the galley" or "loss of steering control" miss the point. the point to be emphasized is that the ship's force has a very vital role to play in the game of pollution prevention/control. I view this role as having two facets.

First, the ship's force is, by definition, "first on the scene." They often can take corrective action quickly enough so that a minor incident never becomes major; so that a salvor is never needed. If the ship's force "catches" the casualty quickly enough, the odds are improved that once actual salvage work commences there is a good chance for success.

The second facet which the ship's force plays in the game of pollution prevention/control is that of supplying assistance--indeed, guidance--to the salvors. The tanker is a very specialized ship and one will do well to avoid the assumption that salvors fully understand either her systems or her operational (viz--when under tow) characteristics. The tanker crew, in the execution of damage control procedures (particularly as regards the cargo) provides both the initial set-up for the salvors as well as ongoing guidance.

But more. Captain Hugh Spicer of Mobil, who is the Chairman of the AIMS Tanker Salvage Committee, has long preached that the tankers' people need to be on board to guide the salvors in a technical and procedural sense. (These comments should be read with the understanding that contractual and legal considerations are something else!) I fully concur with him that the situation is usually too critical and too complex to allow time for the salvor to "get up on the learning curve." Besides, it makes nothing but good sense to marshall all the talent available in order to solve the pollution/salvage problem at hand.

Damage control is thus seen as being considerably more than ship's force, self-help or first-aid procedures. Damage control is the interface or bridge between, on the one hand, the ship's force's address to a casualty situation and, on the other hand, the salvor's address to the situation. There is no clean cut (in the technical and operational sense) relieving-of-the-watch where salvor takes over and ship's force retires. The transition from the damage control phase (ship's force dependent) to the salvage phase (salvor plus, perhaps, owner's representatives) needs to be carefully and smoothly executed. There are tales aplenty of ship salvage jobs which were troubled (and worse) because there was no such smooth transition.

Another important point which might be accentuated in connection with Commander Williams' article deals with the vital aspects of the decision-making process. Again by definition, the ship's force is "first on the scene." And the damage control phase is the first of several distinct phases of a ship's "passage" through the trauma of a casualty such as grounding, collision or fire. Consequently, the decisions made by those leading the damage control effort will produce waves, ripples or ground swells throughout the other phases. Or, and often more disastrously, the lack of decisions during the damage control phase often plagues the subsequent salvage work as well as the still later clearance or rehabilitation work. The damage control leader has to recognize that he is a very key decision maker.

That brings me, finally, to the concept of "triage" as it applies to the management of ship--particularly tanker--casualties. Triage is a word used by physicians. The concept of triage is said to have been developed by French military medicine during the Napoleonic Wars. Simply described, it means the making of tough life-or-death, gutty decisions in the heat of battle. For example, visualize a battlefield hospital. There is a receiving tent to which the medics bear all the wounded. In this receiving tent there is a physician in

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[1]The EL PASO LNG tankers serving Cove Point, Maryland and Savannah, Georgia each carry a special portable electrically driven submersible pump.

front of whom "the buck" really "sits." The function of this decision maker is to make an on-the-spot evaluation and more or less instant decision, directing the bearers to carry the wounded campaigner to one of three hospital areas: one area is for the "He's not so bad off; this case can wait for attention" type patient. Another area is for the "He's a hopeless case; to devote our resources to him would be to the detriment of others." And the third is for the wounded for whom, with skilled attention and often heroic procedures, there is a chance of success.

It will be appreciated that the person or organization making the triage decision has to be not only gutty, but also very competent. The key words are: on-the-spot evaluation; resources available; skilled attention; heroic procedures.

It will also be appreciated that society (read "society" to include the news media, the Marine Board of Investigation, the courts; the Reporting Senior, etc.) has to fully appreciate the whole scene in which the triage decision is made and, most important, protect and judge the decision maker accordingly.

A triage decision to send a badly wounded trooper to the third or "Let's try to save him" area, and the subsequent radical or heroic procedures such as amputation, may well be the proper on-the-spot decision, quite aside from whether or not the patient lives; and whether or not the amputation might have been inappropriate heroics in the more sophisticated operating room of a major medical center staffed with a team of specialists and equipped with the best of special life-supporting apparatus.

A similar triage-type decision to jettison cargo off a stranded tanker may, likewise, be the proper on-the-spot decision, whether or not the tanker and the bulk of her cargo is saved; whether or not a major pollution event subsequently occurs.

The question is, when must the triage decision be made? Who has the "buck" in front of him at that moment? Is it the leader of the damage control effort--such as the tanker's master? Should, for instance, the master of ARGO MERCHANT have made a triage-type decision to jettison cargo immediately after he went aground, while he still had power to the pumps and the cargo was still warm? What would have been the reaction of the news media? The State of Massachusetts? The Coast Guard? The tanker's owner and underwriter? Certainly, such action would have to be classed both as appropriate action and heroic. Such action by the ship's master would not, in the legal sense of the word, be a salvage[2] action. Rather, it would have to be classed as damage control.

Assuming the master of ARGO MERCHANT did not, for one reason or another, make the suggested heroic triage decision, who next sat behind the "buck"? The Coast Guard's Strike Team? The owner's representative (with his squad of lawyers) when they boarded later in the day? The commercial salvor hired by the owner? The Navy's Supervisor of Salvage, to whom the Coast Guard eventually turned?

Perhaps one or the other of these might make a decision to take heroic action once the buck stops squarely in front of him. But more than likely, the time for the triage decision will have passed by and, like the ARGO MERCHANT, it will be too late for heroic ship-saving or pollution-preventing action.

It should be apparent, then, that the concept of triage, whether applied to battlefield personnel casualty management or ship and tanker casualty response and oil pollution control (note: not merely salvage), involves a time-window in which decisions have to be made. That time window usually starts the instant the casualty occurs. This instant is also when the damage control phase commences. How long the triage time window remains "open" and whether it extends into the salvage phase is a function of many things, chief of which is the weather. In the case of ARGO MERCHANT, the time window was very short (if it existed at all) and was totally within the damage control phase. In the case of METULA the opposite was true.

These remarks focus on the ship's master as the spot where the "buck" first resides. Is your damage control organization capable in an organizational and operational sense? Further, is your understanding of the implications of a casualty sufficiently developed and exercised that you are prepared to make a triage-type decision? Had you been the master of ARGO MERCHANT could you have, first of all, sized up the situation and defined the problem as requiring a decision to jettison cargo? If so, what would have been your decision? Would you have ordered the jettisoning of cargo? Or would you have finessed or opted to "pass the buck"? And to whom?

Finally, you might reply "okay, so assume that I, as master of ARGO MERCHANT, make the tough, gutty, heroic, on-the-spot decision to jettison cargo. But what then happens to me if the beaches of the great State of Massachusetts are spoiled with oil? Or what happens to me and my career even if only a few seagulls are fouled? What happens to me--the gutty leader of the damage control evolution--even if the ship and 90 percent of her cargo is saved?--let alone what happens to me if, as happened, the ship is lost and the entire cargo spilled?

Tough questions, these. Questions which need to be addressed by the news media, the states, the owners and underwriters, the Coast Guard, the Congress and the international shipping community in general.

In the meantime, keep in mind that damage control is primarily a ship's force evolution. It is during this initial phase of the casualty response evolution that the triage decision time clock begins to tick. Don't let the spring wind down on your watch!

[2] In current international law, the act of salvage is defined as a voluntary response to a maritime peril by other than the ship's own crew, and from which the ship or property could not have been saved without the effort of the salvor. Attention to the control of a casualty which precedes salvage and which is performed by other than "volunteers" is called damage control. Work to remove a wreck subsequent to or in lieu of a salvage effort is ordinarily called clearance or wreck removal.

Nautical Queries

The following items are examples of questions included in the Assistant Engineer--Uninspected Motor Vessels examinations and Third Mate through Master examinations.

DECK

(1) The deck load capacity of a compartment into which you intend to load a cargo of soft brick is 380 lb. per sq. ft. The stowage factor of the brick is 21.3. Disregarding broken stowage, what is the maximum height the brick may be stacked without endangering the ship's structure?

A. 1.7 feet
B. 3.6 feet
C. 5.0 feet
D. 7.1 feet

Reference: Marine Cargo Operations by Sauerbier

(2) The joint formed when two steel plates are placed end to end is called a

A. butt.
B. seam.
C. bevel.
D. bond.

Reference: Introduction to Steel Shipbuilding (Baker)

(3) Purposes of the flame safety lamp include which of the following?

I. Determine the presence of inflammable or toxic gases.
II. Determine the presence of sufficient oxygen to sustain life.

A. I only.
B. II only.
C. Both I and II.
D. Neither I nor II.

Reference: Merchant Marine Officers Handbook

(4) Close link chain not less than 3/4" is required when lashing deck cargoes of lumber, or flexible wire rope of equivalent strength. What size flexible wire rope would provide strength equivalent to 3/4" chain, using a safety factor of 5?

A. 9/16"
B. 1"
C. 1 ¼"
D. 1 3/8"

Reference: Merchant Marine Officers Handbook Edition 1950

(5) If a ship is proceeding toward the magnetic equator, the uncorrected deviation due to permanent magnetism

A. increases.
B. remains the same.
C. decreases.
D. is unimportant and may be neglected.

Reference: Bowditch

ENGINEER

(1) The pyrometers which measure exhaust temperatures on a diesel engine

A. are connected to a 24-volt D.C. supply.
B. are self-actuated consisting of a thermocouple, selector switch, and indicator.
C. produce a voltage inversely proportional to the temperature difference between the heated end and the end connected to the voltmeter.
D. must read 0 degrees Fahrenheit when the engine is shut down.

Reference: Osbourne, Vol. II, p.22-23

(2) Black exhaust smoke may be caused by

A. excessive scavenging air pressure.
B. burning lube oil.
C. insufficient fuel.
D. a clogged air cleaner.

Reference: Diesel Engine Handbook, p. 325

(3) The proper fuel to be used in a flame safety lamp is

A. naptha.
B. gasoline.
C. kerosene.
D. both A and C.

Reference: Osbourne, Vol. I, pp. 1-15

(4) Water in the fuel may prevent the engine from starting, cause it to fail to develop full power, or

A. run at an irregular speed.
B. create high lube oil temperature.
C. cause the engine to overspeed.
D. cause blue smoke in the exhaust.

Reference: Maleev, Vol. II, p. 347

(5) Air compressor air filters

A. protect against "suction valve float."
B. are normally cleaned with kerosene.
C. are connected directly to the first stage intercooler.
D. protect against explosive dust concentrations in the cylinders.

Reference: Osbourne, Vol.I, pp. 6-123

ANSWERS

Deck
1. B, 2. A, 3. B, 4. B, 5. C

Engineer
1. B, 2. D, 3. A, 4. A, 5. D

MERCHANT MARINE SAFETY PUBLICATIONS

The following publications may be obtained from the nearest marine safety office or marine inspection office of U.S. Coast Guard. Because changes to the rules and regulations are made from time to time, these publications can be kept current between revisions only by referring to the Federal Register. (Official changes to all federal regulations are published in the Federal Register, printed daily except Saturday, Sunday, and holidays.) Following the title of each publication in the table below are the date of the most recent edition and the dates of the Federal Registers affecting each.

The Federal Register may be obtained by subscription ($5 per month or $50 per year) or by individual copy (75 cents each) from SupDocs, U.S. Government Printing Office, Washington D.C. 20402.

CG No.	TITLE OF PUBLICATION
101-1	Specimen Examinations for Merchant Marine Deck Officers (2d and 3d Mate) (4-1-77).
101-2	Specimen Examinations for Merchant Marine Deck Officers (Master and Chief Mate) (4-1-76).
108	Rules and Regulations for Military Explosives and Hazardous Munitions (4-1-72). F.R. 7-21-72, 12-1-72, 6-18-75.
115	Marine Engineering Regulations (8-1-77). F.R. 9-26-77, 3-12-79.
123	Rules and Regulations for Tank Vessels (8-1-77). Ch-1, 4-28-78). F.R. 8-17-77, 9-12-77, 9-26-77, 10-25-77, 12-19-77, 3-12-79.
169	Navigation Rules - International - Inland (5-1-77). F.R. 7-11-77, 7-14-77, 9-26-77, 10-12-77, 11-3-77, 12-6-77, 12-15-77, 3-16-78.
*172	Rules of the Road - Great Lakes (7-1-72). F.R. 10-6-72, 11-4-72, 1-16-73, 1-29-73, 5-8-73, 3-29-74, 6-3-74, 11-27-74, 4-16-75, 4-28-75, 10-22-75, 2-5-76, 1-13-77, 11-3-77, 12-6-77.
174	A Manual for the Safe Handling of Flammable and Combustible Liquids and Other Hazardous Products (9-1-76).
176	Load Line Regulations (2-1-71). F.R. 10-1-71, 5-10-73, 7-10-74, 10-14-75, 12-8-75, 1-8-76.
182-1	Specimen Examinations for Merchant Marine Engineer Licenses (2d and 3d Assistant) (2-1-78).
182-2	" " " " " " " (First Assistant) (3-1-78).
182-3	" " " " " " " (Chief Engineer) (3-1-78).
184	Rules of the Road - Western Rivers (8-1-72). F.R. 9-12-72, 12-28-72, 3-8-74, 3-29-74, 6-3-74, 11-27-74, 4-16-75, 4-28-75, 10-22-75, 2-5-76, 3-1-76, 6-10-76, 7-11-77, 12-6-77, 12-15-77.
*190	Equipment Lists (5-1-75). F.R. 5-7-75, 6-2-75, 6-25-75, 7-22-75, 7-24-75, 8-1-75, 8-20-75, 9-23-75, 10-8-75, 11-21-75, 12-11-75, 12-15-75, 2-5-76, 2-23-76, 3-18-76, 4-5-76, 5-6-76, 6-10-76, 6-21-76, 6-24-76, 9-2-76, 9-13-76, 9-16-76, 10-12-76, 11-1-76, 11-4-76, 11-11-76, 12-2-76, 12-23-77, 4-4-77, 4-11-77, 4-21-77, 5-19-77, 5-26-77, 6-9-77.
191	Rules and Regulations for Licensing and Certification of Merchant Marine Personnel (11-1-76). F.R. 3-3-77, 8-8-77.
227	Laws Governing Marine Inspection (7-1-75).
239	Security of Vessels and Waterfront Facilities (5-1-74). F.R. 5-15-74, 5-24-74, 8-15-74, 9-5-74, 9-9-74, 12-3-74, 1-6-75, 1-29-75, 4-22-75, 7-2-75, 7-7-75, 7-24-75, 10-1-75, 10-8-75, 6-3-76, 9-27-76, 2-3-77, 3-31-77, 7-14-77, 7-28-77, 9-22-77, 9-26-77, 12-19-77, 1-6-78, 1-16-78, 3-2-78, 11-16-78.
257	Rules and Regulations for Cargo and Miscellaneous Vessels (9-1-77). F.R. 9-26-77, 9-29-77, 12-19-77, 3-12-79.
258	Rules and Regulations for Uninspected Vessels (4-1-77); Ch-1, 3-17-78). F.R. 9-26-77.
259	Electrical Engineering Regulations (7-1-77). F.R. 9-26-77.
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293	Miscellaneous Electrical Equipment List (7-2-73).
323	Rules and Regulations for Small Passenger Vessels (Under 100 Gross Tons) (7-1-77). Ch-1, 3-17-78). F.R. 9-26-77, 12-15-77, 12-19-77, 7-17-78, 3-12-79.
329	Fire Fighting Manual for Tank Vessels (1-1-74).
439	Bridge-to-Bridge Radiotelephone Communications (12-1-72). F.R. 12-28-72, 3-8-74, 5-5-75, 7-11-77.
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497	Rules and Regulations for Recreational Boating (7-1-77). F.R. 7-14-77, 8-18-77, 3-9-78.

*Temporarily out of stock.

Changes Published During March

CG-115, Federal Register of March 12
CG-123, Federal Register of March 12
CG-257, Federal Register of March 12
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