Proceedings

of the Marine Safety Council

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When you have finished reading this issue, please pass it on.

Contents

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Cover

A Gulf Strike Team member attired in protective clothing prepares to join the cleanup effort in Houston. Aluminum phosphide pellets, the RIO NEUQUEN's cargo, could have produced phosphine gas, a toxic vapor. (Aluminum phosphide is also discussed in this issue's "Chemical of the Month.") The story begins on page 135. Photo by PA2 Keith Spangler, 8th District, USCG.

A Toxic Bomb in Houston

LTJG Dan Watton
Gulf Strike Team
U.S. Coast Guard

Editor's Note: Aluminum phosphide, the chemical mentioned in this article, is also featured as our "Chemical of the Month."

Photo by PA2 Keith Spangler, 8th District.

The force of the explosion tore the steel doors off the 20-foot-long container box. The rectangular box, bloated by the blast, resembled a large, sausage-shaped balloon. Its contents of 7,000 aluminum flasks were strewn about the ship's upper-tween deck in cargo hold #2. Toxic vapors filled the air. One longshoreman was killed, and three others were injured.

The incident occurred on a Friday afternoon, July 27, 1984, onboard THE M/V RIO NEUQUEN of Argentina. The ship was being offloaded at City Dock #9 in Houston, Texas, when the explosion occurred. The flasks contained aluminum phosphide pellets, a pesticide commonly used to fumigate grain. Aluminum phosphide generates a poison gas, phosphine, and a potentially explosive vapor when exposed to oxygen, water, or high temperatures — all of which were present and compounded the hazards on this humid and hot summer day. Exposure to these vapors in high concentrations can cause dizziness, nausea, and death.

Captain Joel Sipes (Captain of the Port, Houston) requested the assistance of the

Coast Guard's Gulf Strike Team (GST) and hired a private hazardous material cleanup contractor the same day the incident occurred. Emergency money was provided by the "Superfund" of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) which is administered by the U.S. Environmental Protection Agency.

That night, GST worked with the Coast Guard Port Safety Station, Houston, to establish a site safety plan. A 1-mile radius was secured around the RIO NEUQUEN to protect personnel from the toxic vapors and to allow for a potential blast radius. A decontamination area where workers could be washed down after chemical exposure was quickly established. Workers suffering heat stress were also washed down to lower body temperatures. Emergency medical technicians remained on scene to provide medical monitoring of GST and cleanup personnel during the hazardous material removal operations.

GST entry teams maintained a continuous watch on the cleanup contractor's personnel for safety considerations and to monitor phosphine gas levels in the vessel. Both GST and cleanup personnel wore special chemical protective suits and breathed supplied air to prevent exposure.

The cleanup operation took place during daylight hours only. At night, the cargo hold was closed and nitrogen gas was pumped in to cool the product and displace oxygen, thus eliminating the chance of autocombustion.

The flasks of aluminum phosphide pellets were individually removed from the cargo hold and placed in 85-gallon hazardous material recovery drums with a lime packing. After 6 days of "kid glove" removal, the entire cargo of aluminum phosphide was removed from the RIO NEUQUEN, and plans were begun to dump the dangerous material at sea. Ocean dumping was selected because an alternate method was not approved. The product was still generating low levels of phosphine gas, and transporting this potentially explosive material through congested highways, business districts, and residential areas was too risky.

On August 3, 1984, the dangerous cargo was loaded onto M/V STATE IVORY, an offshore support vessel, and was escorted to an EPA-authorized hazardous material dump site in the Gulf of Mexico by the USCGC BUTTONWOOD. Once on scene, disposal began inmmediately. GST and cleanup personnel once again suited up in chemical protective equipment and assured that each aluminum phosphide flask had its top removed. One-inch holes were punched in the flasks, which were then thrown overboard. The disposal operation could only be performed into the wind inside the 10-mile-square dump site. Positioning was verified by the BUTTONWOOD and a daily visit by a Coast Guard HU25 Falcon with SATNAV navigation.

During the disposal operation, GST monitoring personnel were issued a 12-gauge shotgun to destroy any flasks that would not sink. GST also continuously monitored for phosphine gas concentrations, provided decontamination to entry crews, and assured good safety practice during the entire operation.

The BUTTONWOOD maintained a constant vigil (at a reasonable distance) at the disposal site. BUTTONWOOD's buoy deck was converted into a hazardous material response equipment platform and supported the GST air compressor for fillng bottles of breathing air. This eliminated the chance of filling air bottles with contaminated air onboard the STATE IVORY. An inflatable 17-foot ZODIAC boat provided transportation at sea between the BUTTONWOOD and the STATE IVORY. BUTTONWOOD also provided medical supplies and maintained communications with shore.

By the afternoon of August 8, 1984, 2 weeks after the incident occurred, the hazardous cargo was committed to the deep without any injuries to response personnel during the entire project. Once again, City Dock #9 was open for business, and the RIO NEUQUEN was on her way home.

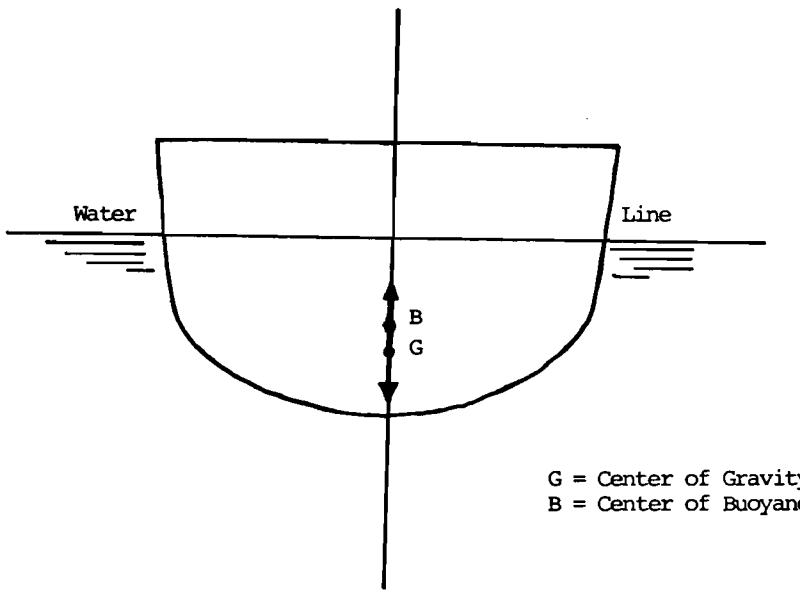
Reprinted from ***Commandant's Bulletin,*** *No. 20-84, September 28, 1984.*

Fishing Vessel Safety

LCDR Christopher Walter
Investigations Department
Marine Safety Office Hampton Roads

A number of recent fishing vessel casualties investigated by Marine Safety Office Hampton Roads highlighted lack of knowledge and improper operating practices that caused or could have caused the casualty or which hampered the mariners' ability to survive.

Figure 1 Even Keel Equilibrium



Vessel Stability

A vessel's most important characteristics are that it floats and that it floats upright. Even though this sounds very simple — and it is — many fishermen are not aware of the measures they must take to keep a vessel from capsizing.

Vessel stability is determined first by the vessel's center of gravity, that point from which all of the vessel's weight can be considered to act. The second determinant is the vessel's center of buoyancy, the center of the underwater body of the vessel and the point upon which the floating forces supporting the vessel are considered to act. When the vessel is on an even keel, these two points are lined up vertically, and the vessel is in equilibrium (it will not roll unless some outside force acts on the vessel, such as waves or winds. See figure 1.)

When the vessel is rolled by wind or wave action, the center of gravity and the center of buoyancy are no longer lined up vertically. The center of gravity remains in the same position; however, the center of buoyancy changes because the shape of the vessel's underwater body changes when the vessel rolls.

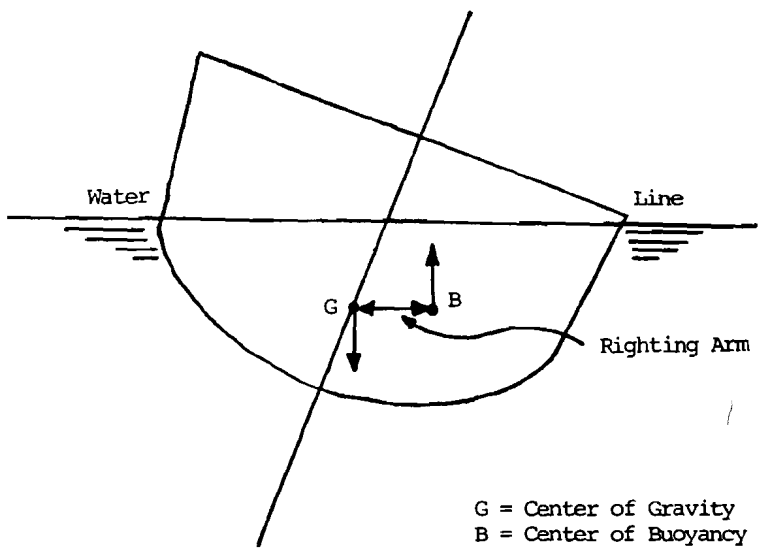
The force of gravity on the center of gravity acts in a downward direction. The buoyant forces on the center of buoyancy act in an upward direction. When the vessel is in a normal condition of stability, the forces on the center of buoyancy and the center of gravity cause the vessel to return to an even keel or equilibrium position. (See figure 2.)

The horizontal distance between the center of gravity and the center of buoyancy is

called the righting arm. The greater this distance, the greater the force which will move the vessel back into equilibrium.

When weight is added high in the vessel or when weight is taken away low in the vessel, the center of gravity moves up. This has the effect of making the righting arm smaller. (See figure 3.) When the righting arm is reduced, the force moving the vessel back into equilibrium is less, and stability is less. This undesirable condition can be the result of stacking crab pots on deck, stowing large catches of fish in places other than the fish hold, emptying fuel and water tanks, or taking on ice on the superstructure in winter. Also, loose water trapped on deck by plugged scuppers or elsewhere on the vessel will reduce both the righting arm and stability. Even loose water deep in the vessel, such as in the engine room bilges, will reduce stability since this water has a tendency to surge. This surge, or free surface effect, is similar to carrying a long cake pan full of water and trying not to spill it.

Figure 2 Righting arm under normal loading conditions



Recognizing A Reduced Righting Arm

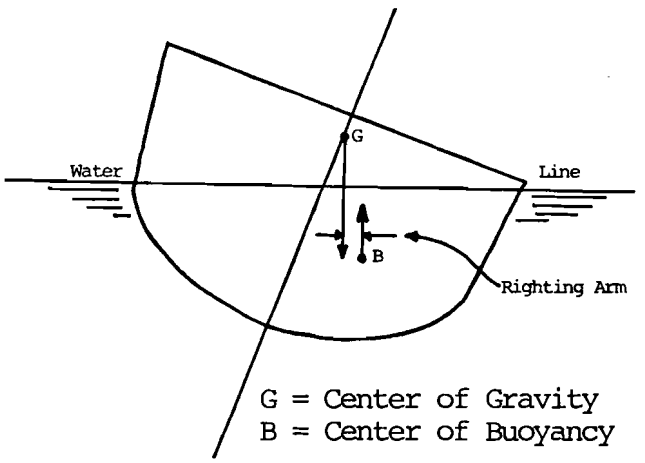
The signs of a reduced righting arm and loss of righting stability are (1) a long, slow roll compared to that which would be ordinarily expected for the wind and sea conditions and (2) the vessel's hanging at the end of the roll without quickly snapping back to an even keel. The longer and slower the roll, the greater the danger of capsizing. In fact, if the period of roll doubles from the addition of weight high in the vessel, stability is reduced by 75 percent.

Reducing the Danger of Capsizing

Having loaded the vessel "good and deep" is not an indication of adequate stability. To reduce the danger of capsizing, weight must be removed high in the vessel, or weight (but not free water) must be added low in the vessel. One preventive measure is to keep scuppers unplugged unless a catch is actually being brought onboard. This will reduce weight high in the vessel by allowing water on deck to be drained off. Another preventive measure is to keep all watertight doors and hatches securely dogged to prevent water from entering the vessel.

A vessel and its crew can do a lot to help themselves in the event of trouble. The first step is to have an accurate position to report to other vessels and the Coast Guard. It is difficult to find a vessel when no one knows where to search. Navigational equipment that is properly and

Figure 3 Reduction in righting arm when center of gravity is shifted upward by a large deck load, empty fuel or water tanks, or water trapped on deck.



periodically serviced is essential to establish an accurate position.

A vessel can also have a reporting schedule with someone on shore. Reports should be made promptly at regular intervals and should include the vessel's position. If a vessel does not make a regularly scheduled report, the shore contact will know to alert rescue personnel immediately. This will save valuable time in beginning the search for a vessel that may be in distress and unable to broadcast.

The vessel should report all difficulties immediately. The vessel should let others know of any event that affects its seaworthiness and should schedule radio contacts until it is out of danger. Other vessels should report to the Coast Guard immediately if they suspect another vessel is in trouble or if they cannot reestablish contact with a vessel which has reported difficulties.

Crew lists for each trip should also be maintained by the vessel's owner. This will ensure that all persons are accounted for and will prevent a search from continuing unnecessarily.

Perhaps the most important piece of equipment a vessel's owner can invest in is an EPIRB (Emergency Position Indicating Radio Beacon). This device is designed to float free of a sinking vessel, and it activates a radio signal which can be received by aircraft and satellites. It serves as a notice that a vessel has sunk and indicates the starting point for a search. An EPIRB placed in the vessel's liferafts will greatly increase chances of rescue. Compared with the cost of replacing a modern fishing vessel, an EPIRB's cost is insignificant. (See figure 4.)

Finally, since fishing vessels are not required to have Coast Guard-approved liferafts onboard (or any life rafts, for that matter), owners who do supply them will sometimes provide rafts which do not have a great deal of drinking water and other provisions. These rafts are lighter and easier to handle because they do not have the added weight of provisions, but without these provisions, the chances of survival are reduced.

Important Points for the Captain. . . .

The captain of a fishing vessel must keep his vessel properly loaded so that its stability is not impaired. Scuppers should not be left unplugged. Reduced stability can be detected by a long, slow roll and a lack of "snap" at the end of the roll. The vessel should make regular reports to someone on the shore. If the vessel has radio capability, the captain should notify the Coast Guard or other vessels when the vessel is in trouble. The captain should send a crew list to the owner before leaving on a fishing trip.

. . . . and the Owner

The owner should provide loading and stability conditions to his captains. The owner should require regular reports from the vessel including its position. The owner can also dramatically increase the chances of locating a vessel in trouble if EPIRBs have been provided and the vessel's navigation and communication

Figure 4 **Emergency Position Indicating Radio Beacon (EPIRB)**

equipment is well maintained and serviced. The owner should require a crew list from his captains before each trip. And, finally, the liferafts used on the vessels should be fully provisioned.

Fishermen and owners of fishing vessels who follow these common-sense suggestions will reduce the chances of capsizing and increase the chances of survival.

Additional information on safety and stability for fishing vessels is contained in Navigation and Vessel Inspection Circulars published by the Coast Guard, as listed below:

No. 3-76, "Stability of Fishing Vessels," $4.50.

No. 4-80, "Installation of Retroreflective Material and PFD Lights on Lifesaving Equipment," $2.75.

No. 4-82, "Uninspected Commercial Vessel Safety," $2.25.

No. 17-82, "Intact Stability of Small Vessels; Recommendations," $2.00.

No. 12-83, "Intact Stability of Towing and Fishing Vessels; Research Results,: $1.25.

Requests for back issues of 1983 and earlier Navigation and Vessel Inspection Circulars should be sent, along with a check or money order payable to "Treasurer of the United States," to:

Commandant (G-MP-4/1400)
U.S. Coast Guard
2100 Second Street, SW
Washington, DC 20593

Navigation and Vessel Inspection Circulars published in 1984 and later are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Ship and Equipment Design

How well are mariners' requirements taken into account when ships are designed and fitted out? On the premise that feedback from professionals could forestall future problems, a London-based organization solicited the views of its seafaring members.

Part X
Other Concerns

Compiled by E. J. Riley
from responses to the
Nautical Institute questionnaire

1. Alleyways

Problem: Carpeted alleyways provide more work where cleaning is concerned.

Remedy. Non-slip, easy-to-clean linoleum should be fitted.

2. Ballast tanks

During initial fitting-out stage it is advantageous if the insides of the tanks are sprayed with a coating of protective fluid, e.g., "Floatcoat."

3. Cargo office general working alleyway

Problem: One common irritant in shipboard life in port is the intrusion of shore personnel into the accommodation areas. This results in a greater cleaning workload, disturbance of sleeping crew members, and increased pilferage and theft. Frequently, the ship's design makes such intrusions inevitable.

Remedy. There should be careful, initial design of a "working alleyway." Chief officer's office should house the stress/stability calculator and all deck department records. The cargo office, for use by all deck officers, stevedores, and cargo supervisors, should be a reasonably large room with several chairs and ample desk space, and should include a large general arrangement plan of the ship. The engineer's office should be for general everyday use, with or without direct access to engine room. The catering officer's office should have access to storerooms/galley. All offices ought to be fitted with some form of communication system. A single door to the accommodation would be fitted with a self-locking device, spring-loaded, and not fitted with a hook-back.

4. Design

The experience of seafarers is that the quality of design is worse on newer/modern ships. All equipment and instruments require thorough testing for use in the marine environment before being fitted/sent to a vessel.

5. Free-surface effect

Problem: The increasing size of ships has brought new problems with double bottoms — the free-surface effect from double bottoms divided in the middle only.

Remedy. There should be more thought given to LFSE and the consequent effect on stability at the design stage.

6. Galley

With reduced manning, galley equipment needs updating with dishwashers, microwaves, and other labor-saving devices.

7. Incinerator room

Problem: When this is sited in the accommodation with no direct access to engine room, all dirty sludge is required to be carried through the accommodation and frequently past the galley.

Remedy. Design the incinerator room with direct and easy access to and from the engine room and away from accommodation area.

8. Master's accommodation

Problem: The master's study/office is frequently too small to accommodate shoreside/ Customs personnel. It is often combined with the day cabin.

Remedy. The master's office should be separate from the day cabin and large enough to accommodate all required personnel comfortably. The filing cabinet and desk should be designed for the office.

9. Manning

Problem: Ships are designed with equipment that requires several men to rig and operate.

Remedy. With today's reduced crews, all equipment should be designed for operation by few persons.

10. Recreation

Problem: Few recreation facilities are provided. Often there are only films or videos.

Remedy. With faster turnarounds and slow steaming, the time spent at sea is greater. More automation with reduced manning results in less physical activity. There should be a mini-gym with a variety of equipment for use by all on board, together with a games room, outdoor games for tropics (deck quoits/golf), libraries from the Marine Society, films, videos, and various board games. Physical health equates directly to mental health and general efficiency, not to mention longevity.

11. Spindle valves

Problem: Spindle valves are frequently difficult to operate due to heavy cargoes causing hogging/wracking/sagging stresses. They are easily damaged.

Remedy. Existing design of spindle valves should be improved; a less delicate system is required.

12. Supply vessels

Problem: Cargo work aboard supply vessels is always dangerous. Crash barriers are provided but obstructed by engine room escape hatches, tank lids, hoses, etc. Protection in a hurry is not always possible. Casing is difficult to lash down on deck and results in rolling across deck. The wood sheathing on deck to prevent sliding of cargo can be hazardous when loading and dragging cargo into place. It interferes with anchoring operations.

Remedy. Consult IMO Resolution A4695 (XII) No. 807, December 1982.

13. Tanks

Problem: An increase in temperature of water and air can cause an overflowing of tanks onto the deck when tanks have been pressed up.

Remedy. Conditions resulting from the various changes in temperature likely to be experienced and the effect on pressed-up tanks indicate that better design is needed.

This concludes our 10-part series from London's Nautical Institute.

The Tall Ship DANMARK

About 5,000 young Americans from all over the nation were trained on the Danish schoolship DANMARK from January 1942 until the end of World War II. Approximately 60 percent of those young men were commissioned as officiers in the U.S. Coast Guard and Navy.

The ship DANMARK, owned by the Danish government, was designed by AAge Larsen and built in Nakskov Shipyard in 1933. It is a three-masted, full-rigged, steel-hulled ship with an auxiliary diesel engine. The length from the yardarm of the flying jib boom to the yardarm of the spanker boom is 250 feet. The width is 33 feet, and the top of the main mast in 130 feet above the water. It is indeed a true sailing ship.

The story of how the DANMARK became a training ship for American Coast Guard and Navy officers is partly the story of an indomitable Danish captain, his crew, and 120 Danish cadets ranging in age from 14 to 18.

In 1939, Captain Knud Hansen, his First Mate Knud Lengeved, his crew, and the 120 cadets set sail from Denmark bound for the New York World's Fair as a representative to the festival for their country. Captain Hansen left behind his wife and 9-year old daughter. He and his men would not see Denmark again for 6 years, and some of them would never see their homeland again. Fourteen would die serving the Allied Forces in World War II.

In 1940, after appearing at the New York World's Fair, the DANMARK was in Jacksonville, Florida, preparing to return to Denmark. The day before his planned departure, Captain Hansen received word that his country had been occupied by Germany. There was no going back. The DANMARK was given refuge by the U.S. Coast Guard Station in Jacksonville, where she remained until the Japanese attack on Pearl Harbor. Immediately thereafter, Captain Hansen offered the services of his ship, his men, and himself to the U.S. government. The ship was ordered to proceed to the Coast Guard Academy at New London, Connecticut. Seven of the original crew were transferred to the schooner ATLANTIC as teachers and instructors. The rest stayed aboard the DANMARK to train young Americans from all over the country.

Thus began an association that would see thousands of Coast Guard and Navy officers trained in the classic nuances of the sea; trained before the mast; learning to respect and understand the awesome power and vagaries of weather, wind, and water. The DANMARK continued to be used as a schoolship at the Coast Guard Academy until the end of World War II, when she returned to Denmark.

On April 19, 1985, the DANMARK sailed up the Potomac River and arrived in Washington, DC, under the command of only her second captain in 53 years, Vilhelm Hansen. (Captain Hansen served as a cadet under the first Captain Hansen, but they are not related.) The visit to Washington, at the invitation of the District of Columbia government, commemorated the World War II years when the DANMARK helped train so many young officers. Still in use as a training vessel for Danish naval cadets, the DANMARK docked at the Harbor Police Wharf in the Washington Channel and was the focus of ceremonies until April 25th. A special guest was Captain Knud Langeved, the First Mate to Captain Hansen during the World War training years. Captain Langved flew in from Copenhagen to participate in the event. Admiral J. S. Gracey, Commandant of the Coast Guard, and Admiral O. W. Siler (Ret.), former Commandant, also visited the ship on which they trained as cadets.

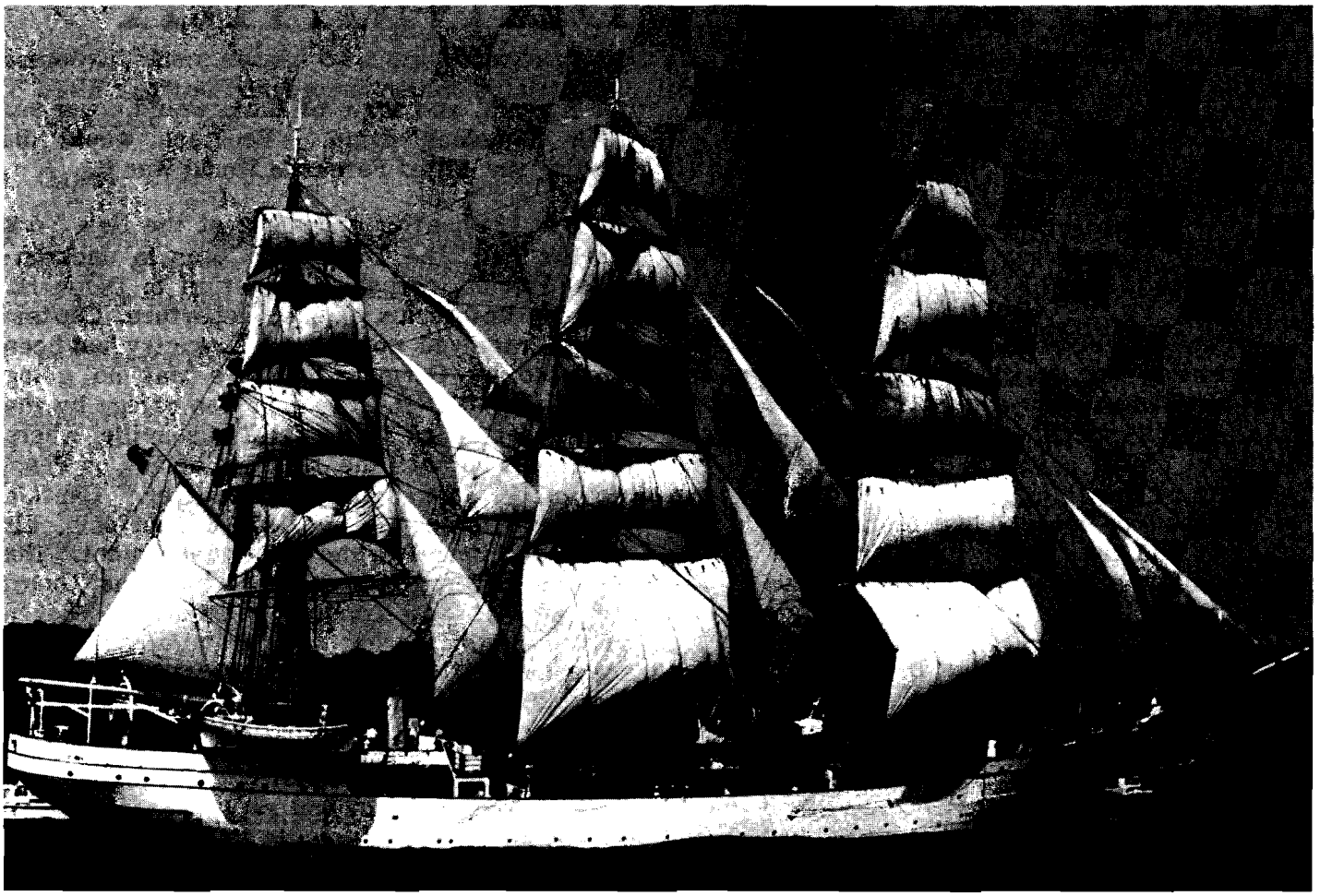


Photo of the DANMARK by PA3 Lee Bryant, U.S. Coast Guard.

New Publications

Bulk Carriers of the World Fleet

The Maritime Administration has released its annual update of **Bulk Carriers of the World Fleet.** The publication lists oceangoing, merchant-type bulk ships of 1,000 gross tons and over as of January 1, 1984.

The statistical compilation covers the vessels' age, gross and deadweight tonnage, speed, draft, and total number of ships by country of registry.

Limited copiies of the report are available from MARAD's Office of External Affairs, Room 7219, Nassif Building, 400 Seventh Street, SW, Washington, DC 20590.

Nautical Charts

A new edition has been issued of a publication that explains symbols and abbreviations used on nautical charts produced by the federal government. The 58-page publication, **Chart No. 1, Nautical Chart Symbols and Abbreviations,** was prepared by the Commerce Department's National Oceanic and Atmospheric Administration (NOAA) and the Defense Department's Defense Mapping Agency.

The National Ocean Service (NOS), the issuing organization for NOAA, said that for the first time this edition (the eighth) includes many internationally accepted charting symbols and an extensive glossary of terms used on foreign charts. Descriptions of the U.S. Coast Guard aids to navigation system and an explanation of the International Association of Lighthouse Authorities Buoyage System are also included.

Completely redesigned, **Chart No. 1** is available through authorized NOS chart sales agents and the NOS Distribution Branch (N/CG33), National Ocean Service, Riverdale, Maryland 20737, for $2.50. (This material is reprinted with permission from the magazine **Pacific Shipper.)**

Strandings and Their Causes

Fairplay Publications, Ltd., has recently released **Strandings and Their Causes.** This book, a companion volume to **Collisions and Their Causes,** carefully spotlights the lessons that must be learned from stranding casualties which chiefly fall under the category of "human error." Mistakes in judgment, the neglect of fundamentals, bad watchkeeping, poor passage planning, and the failure to recognize risk are all illustrated by actual incidents of strandings which took place over a 20-year period.

The author, Captain Richard Cahill, looks at the consequences of poor training and slipshod management, and he is not afraid to point a finger at the shoreside attitudes which actively discourage the pursuit of excellence in ship operation.

Strandings and Their Causes is available from Fairplay Publications, Ltd., 52/54 Southwark Street, London SE1 1UJ. Price 12.00; other countries 13.00 or U.S. $18.00.

The Radar Book

A new book about radar has been prepared by a pair of experienced mariners and published by Cornell Maritime Press.

The Radar Book, by Samuel M. Van Wyck and Max H. Carpenter, addresses topics such as collision avoidance, plotting, navigation, and piloting. Several self-testing quizzes and many radar plot diagrams are included. One section focuses on preparing the professional for passing the U.S. Coast Guard's licensing examinations.

continued on page 148

Keynotes

Request for Comment; Notice of Meeting

CGD 85-021	Standards for Small Passenger Vessels	(April 8)

The Coast Guard is prepared to reevaluate its position and consider relaxing more onerous requirements of 46 CFR Subchapter T - Small Passenger Vessels (Under 100 Gross Tons) - and is seeking public comment on this matter. The comment period closes June 7, 1985.

Final Rule

CGD 82-069a	Casualty Reporting Requirements	(April 11)

This rule eliminates the costs of salvage, cleaning, gas freeing, and drydocking from the marine casualty reporting requirements contained in Title 33, Code of Federal Regulations (CFR). Effective date: May 13, 1985.

Extension of Comment Period

CGD 83-030	Lifesaving Equipment	(April 25)

This notice extends the comment period on the notice of proposed rulemaking published September 27, 1984 (49 FR 38151) until June 4, 1985.

Notice of Meeting

CGD 85-031	Rules of the Road Advisory Council; Meeting	(April 25)

The Rules of the Road Advisory Council will meet on June 6 and 7, 1985, at the Marriott Copley Hotel, Copely Place, 110 Huntington Avenue, Boston, Massachusetts. The meetings will begin at 8:30 a.m. and end at 4:30 p.m. (50 FR 16318).

Requests for copies of NPRMs should be directed to the Marine Safety Council. The address is Commandant (G-CMC), U.S. Coast Guard, 2100 Second Street, SW, Washington, DC 20593; telephone (202) 426-1477. The office, Room 2110, is open between the hours of 9:00 a.m. and 4:00 p.m. Monday through Friday. Comments are available for inspection or copying during those hours.

Nautical Queries

The following items are examples of questions included in the Third Mate through Master examinations and the Third Assistant Engineer through Chief Engineer examinations:

ENGINEER

1. An open field rheostat in any AC generator could be detected by short circuiting its terminals and observing a

A. negative deflection of the wattmeter pointer.
B. positive deflection of the wattmeter pointer.
C. buildup of alternator voltage.
D. low, but constant, alternator voltage.

Reference: Hubert, Preventive Maintenance of Electrical Equipment

2. Poor quality fuel being used in a turbo-charged, medium-speed diesel engine could result in

A. hard starting.
B. excessive fuel consumption.
C. loss of power.
D. any of the above.

Reference: Stinson, Diesel Engineering Handbook

3. Downcomers installed on auxiliary package boilers are protected from direct contact with hot gases by

A. refractory and insulation.
B. several rows of screen tubes.
C. steel baffles.
D water wall tubes.

Reference: Osbourne, Modern Marine Engineering Manual, Vol. I

4. The source of power for the CO_2 alarm is

A. the emergency power and lighting bus.
B. the general alarm, 24-volt DC bus.
C. CO_2 pressure.
D. any of the above.

Reference: MARAD, Marine Fire Prevention, Fire Fighting and Fire Safety

5. Coast Guard regulations state that the final emergency power source on cargo vessels of 1600 GT or more and certificated for oceans must be capable of continuous operation under emergency load for a minimum period of

A. 6 hours.
B. 8 hours.
C. 18 hours.
D. 36 hours.

Reference: 46 CFR 112.05-5(a)

DECK

1. The Master of a cargo or tank vessel shall be responsible that each lifeboat is lowered to the water at least once in each

A. week.
B. month.
C. 3 months.
D. year.

Reference: 46 CFR 35-10-5-(e)(5); 46 CFR 97.15-35(b)(6)

2. Reserve buoyancy is

A. GM.
B. the void portion of the ship below the waterline which is enclosed and watertight.
C. transverse watertight bulkheads.
D. the part of the enclosed and watertight portion of a vessel above the waterline.

Reference: Ladage, Stability and Trim for the Ship's Officer

3. In order for a vessel to be "engaged in fishing," she must be

A. underway.
B. using gear which extends more than 50 meters outboard.
C. using a seine of some type.
D. using gear which restricts her maneuverability.

Reference: International Rules

4. A vessel "restricted in her ability to maneuver" is one which

A. from the nature of her work is unable to maneuver as required by the rules.
B. through some exceptional circumstance is unable to maneuver as required by the rules.
C. due to adverse weather conditions is unable to maneuver as required by the rules.
D. has lost steering and is unable to maneuver.

Reference: International Rules

5. What types of portable fire extinguishers are designed for putting out electrical fires?

A. Foam and soda-acid
B. Foam and carbon dioxide
C. Soda-acid and dry chemical
D. Dry chemical and carbon dioxide

Reference: CG 329

ANSWERS

1-C;2-D;3-D;4-A;5-D
DECK
1-C;2-D;3-A;4-C;5-C
ENGINEER

If you have any questions about "Nautical Queries," please contact Commanding Officer, U.S. Coast Guard Institute (mvp), P.O. Substation 18, Oklahoma City, Oklahoma 73169; telephone (405) 686-4417.

New Publications

(continued from page 145)

Messrs. Van Wyck and Carpenter teach at the Maritime Institute of Technology and Graduate Studies in Linthicum, Maryland.

The book, priced at $17.50, may be purchased through marine book outlets or from Cornell Maritime Press, Centreville, Maryland 21617. (Reprinted with permission from **Pacific Shipper,** March 18, 1985.)

Radioactive Wastes in the Ocean

The National Oceanic and Atmospheric Administration (NOAA) has published a comprehensive examination of the disposal of radioactive wastes in the ocean and its impact on the marine environment.

Dr. P. Kilho Park of NOAA's Office of Oceanic and Atmospheric Research said the publication, **Radioactive Wastes and the Ocean,** is an overview of "our knowledge of oceanic processes relevant to the solution of radioactive waste disposal." It contains a historical perspective, a series of case studies on the practices of radioactive waste disposal, and a discussion of the feasibility of placing radioactive wastes beneath the sea floor.

The third of six volumes on wastes in the ocean, the 522-page publication was supported in part by grants from NOAA. Copies of **Wastes in the Ocean, Vol. 3, Radioactive Wastes and the Ocean** can be obtained for $85 from John Wiley & Sons, 605 Third Avenue, New York, NY 10158. (Reprinted with permission from **Pacific Shipper,** April 8, 1985.)

Chemical of the Month

Aluminum Phosphide

Gastoxin, fumitoxin, and phostoxin are the commercial names for this issue's chemical of the month, aluminum phosphide. These names clearly indicate that the chemical is not something to handle casually. Aluminum phosphide is stable in inert atmospheres, but in moist air it can evolve phosphine (a penetrating gas highly toxic to pests but easily dissipated with no long-lasting deleterious effects). Aluminum phosphide is widely accepted as a fumigant for raw agricultural commodities, animal feed, and processed foods and as a space fumigant for flour mills, warehouses, and railcars.

In pure form, aluminum phosphide is a dark gray or dark yellow powder prepared by reacting aluminum and zinc phosphide (Zn_3P_2) at 900-950°C, obtaining the powder through sublimation, or by heating aluminum and phosphorus together at 1300°C for 2 hours, removing unreacted metal with hot 1,2-dibromoethane. The tablets and pellets prepared commercially also include ammonium bicarbonate or aluminum sulphide. These decompose into ammonia and hydrogen sulphide respectively, both of which have odors more easily detected than the poisonous phosphine gas. In addition, the ammonium bicarbonate releases carbon dioxide, a fire suppressant, which is important because phosphine is highly flammable.

Tom Meyers was a Second-Class Cadet at the Coast Guard Academy when this article was written. It was written under the direction of LCDR Thomas J. Haas, chemistry instructor at the U.S. Coast Guard Academy.

The safety and health hazards associated with aluminum phosphide are due almost exclusively to its decomposition into phosphine. Phosphine is spontaneously flammable in concentrations as low as 1.79% and at temperatures above -87.4°C. In an environment that allows a temperature of above 40°C, the gas may also self-ignite. Obviously, a good deal of caution must be utilized when handling or working with aluminum phosphide. It should never be allowed to come into direct contact with liquid or water as an explosive release of phosphine occurs. The chemical should not be used under conditions which would allow gas concentrations to reach the lower flammability limit. Strict adherence to the manufacturer's directions and to federal regulations should prevent fires or explosions, but in case of fire, water or water-based foam will only worsen the situation. Carbon dioxide and dry sand are the preferred extinguishing agents. Personnel involved in fighting such a fire must also be concerned with phosphine's high toxicity and wear appropriate protective gear to prevent inhalation or ingestion.

Should exposure to the chemical occur, symptoms of poisoning will result. Exposure to low concentrations (0-5 ppm) produces subacute poisoning, causing blood and lymph stasis (fluid stoppage); and symptoms of fatigue; nausea; pressure or pain in the chest; ringing in the ears; and uneasiness. Exposure to moderate concentrations (5-50 ppm) produces poisoning characterized by degeneration of ganglion cells (a mass of nerve cells external to the brain or spinal cord). Other symptoms include vomiting, stomachache, disturbance in equilibrium, and difficulty in breathing. Symptoms due to mild or moderate poisoning will readily disappear

with rest and fresh air, but exposure to high levels (50 ppm and up) can quickly cause cyanosis, subnormal blood oxygen, permanent damage to the central nervous system and liver, unconsciousness, and death. Death can occur very quickly or be delayed several days as a result of pulmonary edema.

First aid to a victim of phosphine poisoning is relatively simple: Remove the victim immediately from the gas atmosphere and notify a physician, treat for shock, and do not use fats, oil, butter, or milk as antidotes. Atropine should not be administered as it is contrindicative. If breathing stops, initiate artificial respiration. Even in cases of mild exposure, the victim should rest at least 24 hours and should not resume any work involving aluminum phosphide or phosphine.

Aluminum phosphide should be stored in dry, locked, and well-ventilated areas. Again, adherence to the manufacturer's directions and federal guidelines should remove the possibility of poisoning. Precautions include the mandatory availability of gas masks specifically for phosphine and gas detection devices for personnel involved in handling and applying aluminum phosphide.

The regulations concerning the transport of aluminum phosphide are necessarily restrictive and specific. Classifying it as a flammable solid, the U.S. Department of Transportation (DOT) requires both a "flammable solid" label and a "dangerous when wet" label and outlines stringent and detailed packaging requirements. These can be found in specification 173.154 of the DOT's shipping requirements. These requirements also specify that aluminum phosphide cannot be transported in any passenger aircraft or railcar, and limited amounts are allowed on cargo-only aircraft and passenger ships. The International Maritime Organization (IMO) places aluminum phosphide in Hazard Class 4.3 (chemicals which are dangerous when wet), and the specifications regarding the class (aluminum phosphide in particular) can be found on pages 4132 through 4144 of the International Maritime Dangerous Goods (IMDG) Code. Information other than regulations can be obtained from the commercial producers of aluminum phosphide preparations, standard chemical literature, the Registry of Toxic Effects, pesticide and agricultural references, and the Cargo and Hazards Branch at the U.S. Coast Guard Headquarters.

Aluminum Phosphide

Formula	*AlP*
Synonyms	*gastoxin* *phostoxin* *fumitoxin* *quickphos*
Physical Properties	
melting point	*2000°C (3632°F)*
liquid density (water=1)	*2.85*
Identifiers	
U.N. Number	*1397*

Phosphine

Physical Properties	
melting point	*-133°C (-208°F)*
boiling point	*-87.4°C (-125°F)*
vapor density (air=1)	*1.1829*
vapor pressure	*40 atmospheres*
Flammability	
lower flammability limit	*1.79% by volume*
flash point (cc)	*-87.8°C (-126°F)*
autoignition temperature	*40-50°C (104-122°F)*
Threshold Limit Values (TLV)	
time weighted average	*0.3 ppm; 0.4 mg/m^3*
short term exposure limit	*1.0 ppm; 1.0 mg/m^3*

The formula for last month's chemical, cyclohexane, was incorrectly listed as C_6H_6. The correct formula is C_6H_{12}. We apologize for the error.

Where To Find Coast Guard Regulations

In the past, the Coast Guard provided the public with reprints of selected subchapters of the Code of Federal Regulations (CFR) free of charge. This was done to keep interested parties up-to-date on Coast Guard regulations. Becvause of high printing costs and tight budgets, this policy has been discontinued. The Superintendent of Documents of the U.S. Government Printing Office publishes the CFR in yearly updated form; the CFRs are thus now the best source for current Coast Guard regulations.

To order copies of the CFR, call (202) 783-3238 or write Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Information on the price and availability of any volume can also be obtained from that source.

Title 46 of the CFR, covering shipping regulations, is divided into nine volumes. When ordering, refer to the volume and parts desired as shown in the chart below. For example, if marine engineering regulations are needed, then 46 CFR Parts 41 to 69 (Volume 3) should be ordered.

The chart also shows the old Coast Guard-numbered publications (no longr being printed) that are equivalent to the CFRs.

Current CFR Volume and Parts	Contains	Replaces
1. 46 CFR Parts 1 to 29	Subchapter A - Procedures Applicable to the Public (Parts 1 to 9)	No Coast Guard-numbered equivalent
	Subchapter B - Merchant Marine Officers and Seamen (Parts 10 to 16)	CG-191 Rules and Regulations for Licensing and Certificating of Merchant Marine Personnel
	Subchapter C - Uninspected Vessels (Parts 24 to 29)	CG-258 Rules and Regulations for Uninspected Vessels
2. 46 CFR Parts 30 to 40	Subchapter D - Tank Vessels (Parts 30 to 40)	CG-123 Rules and Regulations for Tank Vessels
3. 46 CFR Parts 41 to 69	Subchapter E - Load Lines (Parts 42 to 46)	CG-176 Load Line Regulation
	Subchapter F - Marine Engineering (Parts 50 to 64)	CG-115 Marine Engineering Regulations
	Subchapter G -Documentation and Measurement of Vessels (Parts 66 to 69)	CG-177 Yacht Admeasurement and Documentation

Current CFR Volume and Parts	Contains	Replaces
4. 46 CFR Parts 70 to 89	Subchapter H - Passenger Vessels (Parts 70 to 89)	CG-256 Rules and Regulations for Passenger Vessels
5. 46 CFR Parts 90 to 109	Subchapter I - Cargo and Miscellaneous Vessels (Parts 90 to 106)	CG-257 Rules and Regulations for Cargo and Miscellaneous Vessels
	Subchapter I-A - Mobile Offshore Drilling Units (Parts 107 to 109)	No Coast Guard-numbered equivalent
6. 46 CFR Parts 110 to 139	Subchapter J - Electrical Engineering (Parts 110 to 139)	CG-259 Electrical Engineering Regulations
7. 46 CFR Parts 140 to 155	Subchapter N - Dangerous Cargoes (Parts 146 to 149)	CG-108 Rules and Regulations for Military Explosives and Hazardous Munitions
	Subchapter O - Certain Dangerous Bulk Cargoes (Parts 150 to 154)	No Coast Guard-numbered equivalent
8. 46 CFR Parts 156 to 165	Subchapter P - Manning of Vessels (Part 157)	CG-268 Rules and Regulations for Manning of Vessels
	Subchapter Q - Specifications (Parts 160 to 165)	No Coast Guard-numbered equivalent
9. 46 CFR Parts 166 to 199	Subchapter R - Nautical Schools (Parts 166 to 168)	No Coast Guard-numbered equivalent
	Subchapter T - Small Passenger Vessels (Under 100 Gross Tons) (Parts 175 to 187)	CG-323 Rules and Regulations for Small Passenger Vessels
	Subchapter U - Oceanographic Vessels (Parts 188 to 196)	No Coast Guard-numbered equivalent
	Subchapter V - Marine Occupational Safety and Health Standards (Part 197)	No Coast Guard-numbered equivalent

Listed below are the Code of Federal Regulations (CFR) subchapters covering Coast Guard regulations on Navigation and Navigable Waters (Title 33, Chapter I of the CFR). Chapter I consists of a single volume containing 19 subchapters. Subchapters and/or parts of this chapter are not published individually; the entire volume must be ordered.

33 CFR Parts 1 to 199	**Contains**	**Replaces**
	Subchapter A - General (Parts 1 to 26)	No Coast Guard-numbered equivalent
	Subchapter B - Military Personnel (Parts 45 to 53)	No Coast Guard-numbered equivalent
	Subchapter C - Aids to Navigation (Parts 60 to 76)	CG-208 Aids to Navigation Regulations
	Subchapter D - International Navigation Rules (Parts 80 to 82)*	CG-169 Navigation Rules, International/Inland*
	Subchapter E - Inland Navigation Rules (reserved for future regulations)*	CG-169 Navigation Rules, International/Inland*
	Subchapter F - Interim Inland Navigation Rules (Parts 92 to 98)	CG-172 Rules of the Road—Great Lakes* CG-184 Rules of the Road—Western Rivers*
	Subchapter G - Regattas and Marine Parades (Part 100)	No Coast Guard-numbered equivalent
	Subchapter H - Routes for Passenger Vessels (Part 105)	No Coast Guard-numbered equivalent
	Subchapter I - Anchorages (Parts 109 and 110)	No Coast Guard-numbered equivalent
	Subchapter J - Bridges (Parts 114 to 118)	No Coast Guard-numbered equivalent
	Subchapter K - Security of Vessels (Part 122)	CG-239 Security of Vessels and Waterfront Facilities

33 CFR Parts 1 to 199	Contains	Replaces
	Subchapter L - Waterfront Facilities: Security Zones and Regulated Navigation Areas (Parts 125 to 128)	CG-239 Security of Vessels and waterfront facilities
	Subchapter M - Marine Oil Pollution Liability and Compensation (Parts 135 and 136)	No Coast Guard-numbered equivalent
	Subchapter N - Artificial Islands and Fixed Structures on the Outer Continental Shelf (Parts 140 to 147)	CG-320 Rules and Regulations for Artificial Island and Fixed Structures on the Outer Continental Shelf
	Subchapter NN - Deepwater Ports (Parts 148 to 150)	No Coast Guard-numbered equivalent
	Subchapter O - Pollution (Parts 151 to 159)	No Coast Guard-numbered equivalent
	Subchapter P - Ports and Waterways Safety (Parts 160 to 165)	No Coast Guard-numbered equivalent
	Subchapter S - Boating Safety (Parts 173 to 183)	M16752.2 (old CG-497) Rules and Regulations for Recreational Boats

* Sections of Title 33 of the CFR were altered to incorporate the new unified Inland Navigation Rules, which went into effect on December 24, 1981. The only publication now needed for a complete listing of Navigation Rules is CG-169, Navigation Rules, International/Inland, a new edition which is available from the Government Printing Office under the number COMDTINST M16672.2.