Proceedings

of the Marine Safety Council

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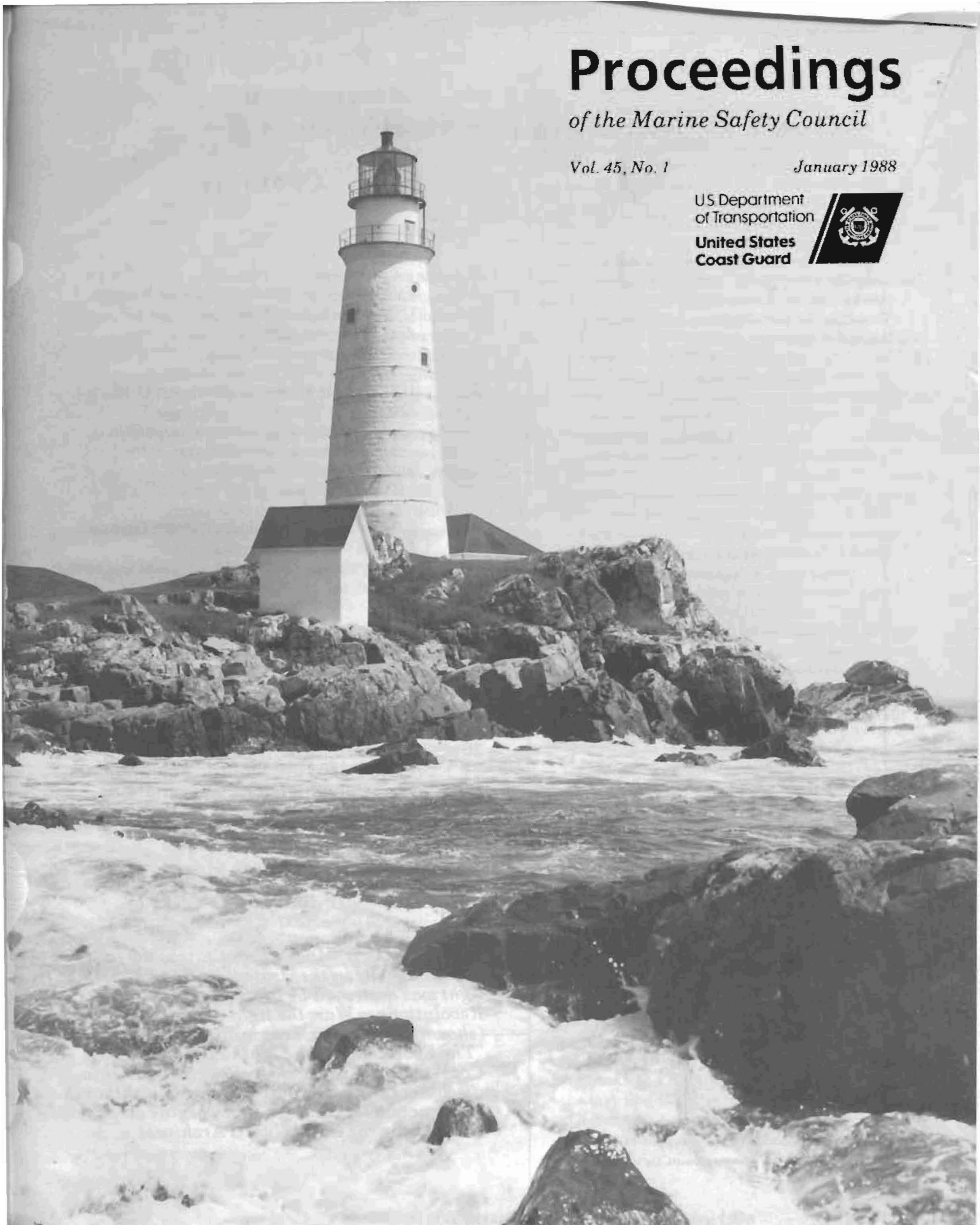

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Contents

Features

Departments

Cover

Boston Light, Massachusetts, was the first lighthouse site in the United States. The original light was destroyed by the British during the Revolutionary War; the light now standing (shown on our cover) was built following the war. "The Evolution of the Lighthouse Tower," by Coast Guard Historian Dr. Robert L. Scheina, discusses the history and progress of lighthouse construction techniques. Story begins on page 3. (Photo from the Coast Guard Archives)

Evolution of the Lighthouse Tower

Dr. Robert L. Scheina
U.S. Coast Guard Historian

Lighthouses come in many shapes and sizes. This evolution has taken centuries and is profoundly influenced by the development of technology. Twelve lighthouses were built in the United States before the Constitution became the law of the land and lighthouse control passed from the states to the federal government. No two were constructed from the same set of plans, and all were built from local materials. Therefore, it should come as no surprise that no two are alike. But, examining the one which remains, Sandy Hook in New Jersey, and the evidence of those which have not survived, reveals that these lighthouses shared some common features.

These early lighthouses were constructed of wood or stone. Those built of wood fell victim to fire sooner or later. The stone towers were built simply by piling one stone on top of another. These stones were held together by mortar. Since the walls apparently contained no additional support, such as reinforcing rods, they had to be tapered as they rose in order for the base to support the ever-increasing weight and to prevent the tower from becoming unstable. Therefore, the higher they wished to build the light, the thicker the tower had to become at the base.

Given the flat nature of East Coast geography, where all pre-federal lights were built, there was a need to build a lighthouse as tall as possible. Since colonial lights peaked at about 90 feet, we may assume that this was the maximum practical height for a tower built during this era. We have almost no construction details. We do have the Sandy Hook tower to study, but there are still many unanswered questions.

Dr. Robert L. Scheina has been the U.S. Coast Guard Historian for 10 years. All photos appearing in this article are from the Coast Guard Archives.

Lighthouses built between 1789 and 1820 deserve close attention. In 1789, the federal government took over responsibility from the states, and 1820 is when the Fifth Auditor of the Treasury became responsible for lighthouses. At first, President George Washington took an active interest in lighthouses. It wasn't too long before the President had to delegate this responsibility. First, the responsibility passed to the Commissioner of the Revenue, and then it went to the Secretary of the Treasury. For quite some time, Albert Gallatin, the Secretary from 1801 until 1814, personally played an active role in lighthouse administration. Hardly a year went by when one or or two new lighthouses were not appropriated.

During the later days of this era, cut stones were used for the first time. This permitted the construction of taller and stronger towers because the weight could be more evenly distributed. Of the first 40 towers constructed, only a few survive today. These include the old abandoned Cape Henry tower, Virginia; Portland Head, Maine; and Georgetown Harbor, South Carolina. Most of the remaining lighthouses built during the 1789-1820 era did not see the U.S. Civil War.

A villain has emerged from the Camelot-like history of the early days of lighthouse construction; it is the Fifth Auditor of the Treasury. From 1820 through 1852, he was responsible for the administration of the lighthouses. Lighthouse administration had become too large to remain a direct responsibility of the Secretary and was assigned to this subordinate. The Fifth Auditor of the Treasury was a bookkeeper and a financial zealot. The Fifth Auditor prided himself that for many years, he was able to return funds appropriated for the construction and repair of lighthouses to the Treasury unspent. The Fifth Auditor was a lighthouse novice when assigned the task and did little to improve his knowledge of lighthouse technology during this 32-year tenure. This period, which begins in 1820, 100 protected screw-pile lighthouses were built throughout the United States, principally in the Carolina sounds and Chesapeake Bay. But they could also be found in the Gulf of Mexico and one was even built in the Great Lakes at Maumee Bay, but survived only a short time. This type of structure was particularly suited to slow-moving, shallow water which was not subject to freezing. The principal enemies of this type of structure were fast-flowing water, ice, and fire. The screw-pile lighthouse design for exposed sites evolved 2 years after its less complex cousin, the type built for protected waters.

The exposed, screw-pile lighthouse was designed for and used in the Florida coral reefs. This structure varied in two important ways from the style designed for the protected bays and sounds. First the lighthouse structure was a tall, skeleton iron tower and not a squat wooden structure. The screw-pile lighthouse in the bays and sounds did not need to project its light more than a few miles, so the height of the lens was not a major concern. But this was not true for the Florida reef lights. These structures were to be major coastal lighthouses with first-order lenses weighing a number of tons. Therefore, they had to be tall structures. The second major difference was in the screw flange. Large, iron foot plates were added above the screw tip in order to diffuse the pressure caused by the weight of the tower. Six screw-pile lighthouses for exposed sites were constructed in the Florida reefs, three before the Civil War and three afterward. Also, one light was built in the Gulf of Mexico at Ship Shoal, Louisiana, in 1858. Those built before the war are much more simple in appearance than those built two decades later.

The new Lighthouse Board of 1852 began the construction of brick towers of increasing height. By 1859, nine brick towers over 160 feet tall had been built, and six more were constructed after the Civil War. These towers are conical in shape, except for Cape Romain, South Carolina, which is six-sided. None of the towers which they replaced topped 100 feet. One would suspect that some engineering or technological breakthrough had occurred in the 1850s which allowed this 60-foot-plus increase in the height of a coastal tower. This does not seem to be the case. Apparently, the walls of these towers are solid brick without reinforcements. This construction technique had existed long before the 1850s. There are a

Fowey Rocks in the Florida Keys is a post-Civil War, exposed-site, screw-pile lighthouse.

number of possible answers as to why the towers grew in the 1850s. The Fresnal lens was replacing the much less efficient reflector system; the Lighthouse Board was willing to spend more on the construction of towers than the Fifth Auditor; and advancements in the science of mathematics allowed engineers to more accurately calculate stress factors. All but one of the 15 towers remain standing, although due to erosion, the fate of a number is precarious. All 15 towers were built along the Atlantic Coast, as far north as Fire Island, New York, and as far south as Dry Tortugas, Florida. The tallest of these towers, Cape Hatteras (193 feet), is also the tallest lighthouse constructed in the United States.

The use of cast iron in lighthouse construction probably began in the early 1840s. In 1844, a cast iron tower was built on Long Island Head in Boston Harbor. The 1848 tower at Brandywine Shoals, the first screw-pile lighthouse in the United States, had a cast iron tower. Also, the three Florida reef lights and the first Minots Ledge lighthouse, all built in the early 1850s, incorporated much cast iron in their construction. The advantages of cast iron were that it was light when compared with stone and brick, it was inexpensive, it was strong, it was watertight, and it had a slow rate of deterioration. A number of cast iron towers were lined with brick for additional stability and insulation. By the close of the 19th century, cast iron towers proliferated throughout the United States. The tallest cast iron tower was the Cape Henry light built in 1881; it is 165 feet and is still standing.

Crib foundation construction was used extensively on the Great Lakes. Wooden cribs were constructed ashore, towed to the site, and filled with stone. Once the crib had settled to the bottom, it was capped with concrete or other masonry. Frequently, it was necessary to level the structure by adding weight to one side or another. From an engineering viewpoint, the two most significant crib lighthouses in the Great Lakes are Spectacle Reef and Standard Rocks. The first was completed in 1874 and the second 8 years later. Spectacle Reef is 10 miles from the nearest land, and Standard Rocks is 23. Each required a number of years to complete.

Cofferdam construction was used where it was desired to build the foundation on a dry site and where it was not necessary to penetrate the seabed to any great depth. This method could be used only in very shallow water. The wooden walls of the cofferdam were constructed ashore, taken to the site, assembled into a box in the water, bolted together and sealed, and the water pumped. Workmen then entered this open-

Saint George Reef Lighthouse off the northern California coast is one of a few wave-swept towers built in this country, all at great expense.

This view of Cape Henry, Virginia, shows the old and the new. To the right is the current Coast Guard station. The tower in the foreground is the tallest cast-iron tower built in the United States. The more distant tower was one of the first built by the federal government.

topped structure and prepared the foundation for the lighthouse.

Three lighthouses were constructed upon man-made foundations built upon underwater ledges, stone by stone, without the use of a crib. They were Stratford Shoal, New York; Race Rock, New York; and New London Ledge, Connecticut. These sites were exposed to strong currents which these foundations had to absorb. These lighthouses are characterized by a typical light tower, which might be found at any shore site, placed on top of a massive stone foundation designed to absorb the fury of the waves. However, the tower itself was not designed to sustain the force of waves crashing against it, as is the case for the wave-swept structure. Each of these foundations was very expensive to build. This fact, coupled with the development of the submarine lighthouse, probably accounts for the fact that only three of this type were built.

Cast iron revolutionized the construction of lighthouses in northern bays and sounds because it significantly reduced the cost of building a lighthouse foundation in the water to a fraction of what it had been. The screw-pile structure had revolutionized lighthouses in the bays and sounds of southern waters; however, this technology was not applicable in northern waters due to its vulnerability to swift currents and ice. The traditional method of preparing a foundation on an underwater site in northern waters was by laying and interlocking a bed of large stones weighing from 3 to 5 tons each. But this method was time-consuming and expensive. The 10,000-ton foundation at Race Rock, New York, took 5 years to prepare and cost a quarter of a million dollars in 1875. And the lighthouse still needed to be built. By comparison, a hollow, cast-iron shell could be sunk to the seabed in water up to 30 feet and filled with sand, rock, or concrete. Cast iron was selected because of its ability to resist corrosion in salt water. A lighthouse, typically of cast iron, was then placed on top of the caisson although other materials were also used for the tower. By the 1870s, these caisson lighthouses had proliferated through the northern waters of the nation. Approximately 50 caisson lighthouses were built.

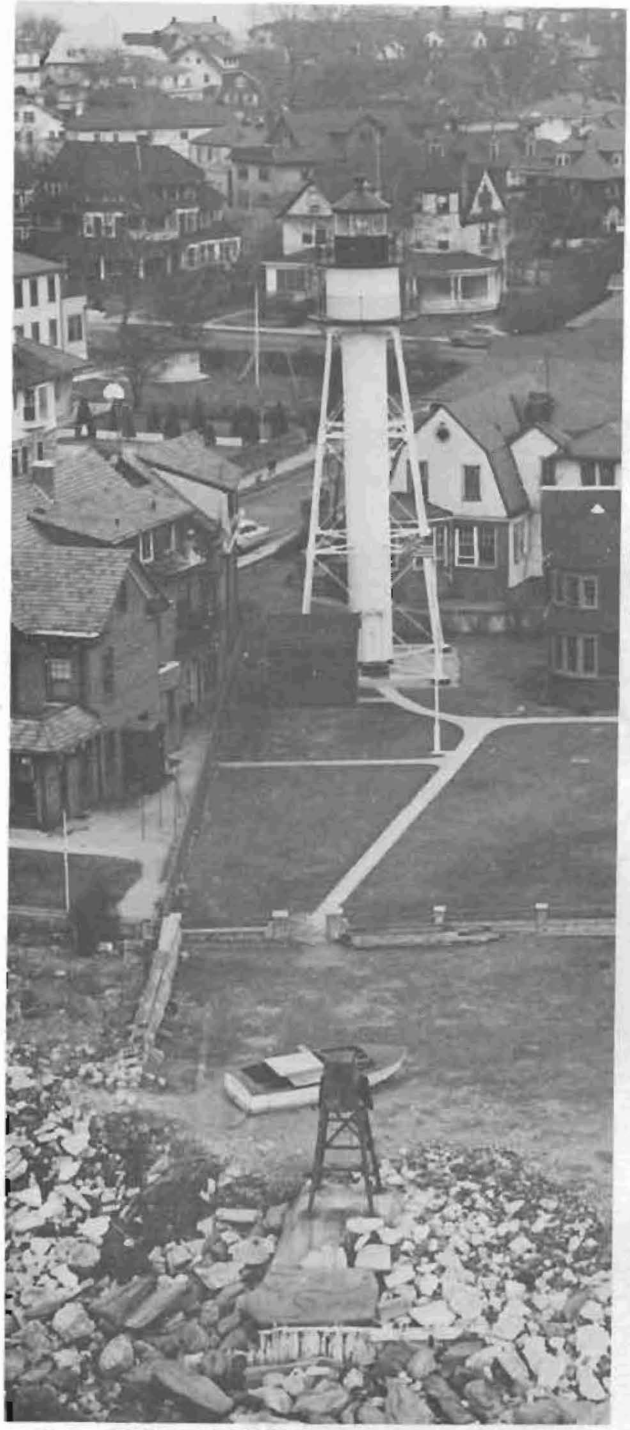
Most cast-iron caisson bases were simply lowered to the seabed and filled with concrete. However, sites where the seabed was uneven, unusually soft, or exposed to strong currents and waves required special preparation. For these lights, known as submarine site lighthouses, a caisson containing a double bottom was sunk in position. Once stood upright, air was pumped into the caisson, forcing the sea water out through the bottom. Workmen then entered the top of the caisson through an air-lock system and prepared the foundation. The bottom rim of the caisson acted as a cutting edge which settled into the seabed as workmen excavated sand and mud from inside the caisson. Water was kept from seeping under the edge and into the work chamber by air pressure. The excavated soil was hauled out or sucked out through an airtight shaft. The workmen might sink the cast-iron caisson structure as much as 33 feet below the seabed.

The first submarine, or pneumatic site lighthouse, was constructed at Fourteen Foot Bank, Delaware, in 1887. Eleven submarine site lighthouses were built. The most exposed is Sabine Bank, Louisiana, which is 15 miles off the shore in the Gulf of Mexico.

The breakwater lighthouse presented some unique challenges that were not solved until iron was introduced as a building material. The breakwater lighthouse had to be relatively

The Pensacola, Florida, lighthouse is one of 15 tall brick towers built along the East Coast. They were built before and after the Civil War.

Thimble Shoal, Virginia, is a typical cast-iron tower on a cast-iron base.



Coney Island, New York, lighthouse is a typical skeleton tower. These towers were built throughout the United States during the late decades of the 19th century and early 20th century.

light in order to avoid stress on the foundation; the structure had to be strong to withstand the impact of the waves and vibrations; and the lighthouse had to be compact because of the limited space available for the structure. Frequently, the keeper's quarters were in town because breakwaters were generally too small to attach the keeper's quarters to the tower. The majority of breakwater lighthouses were constructed in the Great Lakes.

The introduction of reinforced concrete once again changed the direction of lighthouse construction. This material was in many ways superior to iron and steel. It was cheaper and required much less maintenance. Also, it was extremely strong. Many lighthouses built in places susceptible to earthquakes were made of reinforced concrete. Therefore, most major concrete towers are found on the West Coast.

The first reinforced concrete tower was built at Point Arena, California, in 1910. It is 115 feet, one of the two tallest towers on the West Coast. The tallest reinforced concrete tower is Navassa in the West Indies. This tower is 150 feet. The Brandywine Shoal lighthouse, Delaware (1914), was the first combination of a reinforced concrete tower on a caisson base. A series of reinforced concrete towers of art-deco design were constructed in Alaska during the 1920s and 1930s. One of these, Scotch Cap, was

The Point Arena tower in California was the first lighthouse built of reinforced concrete.

The Ambrose lightship leaves station after the completion of the Ambrose light tower, New York.

destroyed by a tidal wave in 1946; five lives were lost. The newest reinforced concrete tower is Oak Island, North Carolina. This 169-foot tower was completed in 1958.. This silo-style tower was erected by using a Swedish-developed, moving slip-form method. Concrete was poured, and once that section dried, the form was moved up, and another section was poured. The color is integrated into the concrete. The lantern room is aluminum.

Aluminum had been introduced into lighthouse construction following World War II, primarily in the lantern room area. The Charleston tower completed in 1960 was the first structure where aluminum was extensively used in the construction of the tower. The skeleton of this 140-foot tower is made of high-strength steel, and the panels are aluminum. The tower is designed to withstand winds up to 160 miles per hour, and it is the only lighthouse with an elevator.

World War II technology permitted lighthouses to be built at locations previously served by lightships. These offshore light structures are based upon technology developed in the oil industry. Their legs are driven 170 feet into the seabed. The towers are designed to withstand 65-foot seas and 125-mph winds. Seven towers have been built.

These are the major evolutions in lighthouse towers. ▮

This article originally appeared in a booklet entitled, Lighthouses: Then and Now, *published by the Coast Guard's Office of Boating, Public, and Consumer Affairs. Chapter titles include "200 Years of Lighting the Way," "The Evolution of the Lighthouse Tower," "Ambrose: Last of the Lightkeepers," as well as other information and photographs.*

If you would like a copy of the booklet Lighthouses: Then and Now, *please contact Dr. Robert L. Scheina, U.S. Coast Guard Historian (G-BPA), 2100 Second Street, SW, Washington, DC 20593-0001.*

Hazardous Cargo Basics: An Updated Quiz

Ron Bohn

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Scoring: 3 points for each correct answer, except for the last question, which rates 4 points. Check "true" if the statement is true in all respects, "false" if it's in any way false or incorrect.

For convenience and brevity, the abbreviation "HM/DG" is used to mean hazardous materials/dangerous goods, i.e., DOT-regulated and/or IMO-covered materials and articles.

Basic Regulations

1. U.S. transportation regulations for packaged hazardous materials (including portable tanks, tank cars, and cargo tanks) are published in Title 49, Code of Federal Regulations (49 CFR), Parts 100-199.

Those regulations cover all modes of transport including air, highway, rail, and water.

True _______ False _______

Ron Bohn, the Hazardous Materials Administrator at the National Cargo Bureau's New York office, is also co-chairman of hte National Safety Council's Marine Section Training Committee. (LCDR Phillip Olenik, Chief of the Coast Guard's Packaged Cargo Section, reviewed this questionnaire to ensure that statements and references are current as of November 1987.)

2. 49 CFR contains a hazardous materials table of DOT-regulated commodities and also an "Optional" one of IMO shipping descriptions, IMO classes, UN numbers, and associated entries.

True _______ False _______

3. The Optional Table in the latest 49 CFR edition does not yet incorporate the changes of IMDG Code amendments 21 and 22, which became effective July 1, 1986.

True _______ False _______

4. The International Maritime Dangerous Goods (IMDG) Code is a four-volume set at present.

True _______ False _______

5. The International Maritime Organization (IMO), based in London, is the only source for the IMDG Code and its annual amendments.

True _______ False _______

Hazardous Commodity Description

6. The "proper shipping names," i.e., authorized shipping descriptions for DOT-regulated "hazardous materials" and IMO-covered "dangerous goods," are often the same as the applicable tariff descriptions.

True _______ False _______

7. If a material or article isn't listed by name in the 49 CFR or IMDG Code, then it may be considered a non-hazardous commodity, for transportation purposes.

True _______ False _______

8. The list of named HM/DG's in the 49 CFR tables and IMDG Code's General Index includes some specifically shown as "forbidden" or "carriage prohibited."

True _______ False _______

9. 49 CFR and the IMDG Code both provide the means to determine the proper shipping names when only a UN number is known.

True _______ False _______

10. When "NOS" shipping descriptions are used, both 49 CFR and the IMDG Code require an additional "technical name(s)" be added to it in parentheses for ocean shipments.

True _______ False _______

Hazard Classifications

11. The DOT hazardous class names correspond exactly to the IMO class numbers.

True _______ False _______

12. Any liquid that has a flash point under 200°F is regulated by DOT and included in class 3 (flammable liquids) by the IMDG Code.

True _______ False _______

13. Aerosols can now only be in class 2 or 9 in the IMDG Code.

True _______ False _______

14. The DOT criteria for corrosive materials are not the same as IMO's.

True _______ False _______

15. Both 49 CFR and the IMDG Code provide a "pecking order" table or list to determine classifications of HM/DG that meet the criteria of more than one hazard class.

True _______ False _______

Packaging and Marking

16. As of January 1, 1990, DOT-approved packaging will no longer be acceptable internationally. On that date, only packaging that meets UN performance standards, and is so marked, will be acceptable in "IMO countries."

True _______ False _______

17. A liquid commodity that qualifies as HM/DG and is acceptable in approved metal drums is automatically acceptable in portable tanks, including intermodal tank containers.

True _______ False _______

18. Imports of hazardous materials may move to U.S. inland ports in IMDG Code recommended packages even if the packages do not have DOT approval.

True _______ False _______

19. DOT-approved packaging units must show the DOT specification number or exemption number on the unit, with the manufacturer's name and address or approved symbol.

True _______ False _______

20. Empty packaging units containing a residue of a regulated commodity are still regulated in all respects as if they were full.

True _______ False _______

Labeling and Placarding

21. Hazard labels are applied to packages of HM/DGs; placards are applied to freight containers and tank containers.

True _______ False _______

22. It is possible for packaged hazardous materials or dangerous goods, in some instances, to be shipped without labels indicating the hazard class of the contents.

True _______ False _______

23. The UN number of HM/DGs must also be shown on their packaging units near the respective proper shipping name and hazard label. On portable tanks/tank containers of HM/DGs, the UN number may be displayed

either in the placard (replacing the text) or in an orange, rectangular panel near the placard.
True _______ False _______

24. If a label or placard comes off while the package, tank, or container is in the custody of a carrier then that carrier has to replace it.

True _______ False _______

25. The IMDG Code has provision for placarding to also indicate the subsidiary risks associated with the dangerous good concerned. DOT has no such provision.to replace it.

True _______ False _______

Documentation

26. 49 CFR contains fully detailed documentation requirements for intermodal moves of HM/DGs.

True _______ False _______

27. A carrier may not accept for carriage any hazardous materials unless presented with complete, correct, and certified shipping papers at the time offered.

True _______ False _______

28. Only IMO shipping description, classifications, and associated information need be used on shipping papers of U.S. exports, imports, or domestic transportation (a portion of which includes transportation by vessel) of HM/DG. Exceptions are DOT class A and B explosives and all radioactives.

True _______ False _______

29. Documentation requirements include the proper shipping name, hazard class, and four-digit ID (UN) number for each HM/DG item. The number and type of packaging units need not be given if it is palletized cargo.

True _______ False _______

30. The shipper's certification reference to the commodity being "in proper condition for transportation according to the applicable regulations of the Department of Transportation" means that, if containerized, the cargo also meets 49 CFR securing and segregation requirements of 176.76.

True _______ False _______

General

31. The "Bhopal Docket" HM 196 recently added new DOT requirements for documentation, packaging, marking, and labeling of commodities with a "poison inhalation hazard." IMO has similar provisions in the IMDG Code.

True _______ False _______

32. If the shipper/exporter of HM/DGs is unfamiliar with DOT and/or IMO requirements, then his freight forwarder may decided shipping descriptions, hazard classes, UN numbers, etc., for him.

True _______ False _______

33. The new 1987 edition of the NCITD booklet, "Hazardous Materials / Dangerous Goods Shipments by Water," covers all the question categories of this information quiz, and then some.

True _______ False _______

Answers and Comments

1. **True.** There are, however, additional requirements for air shipments in the form of ICAO Technical Instructions. (For the water mode shipments of military explosives and bulk solids, 46 CFR, Parts 140 to 155, applies. IMO's bulk solids recommendations are in *Code of Safe Practice for Solid Bulk Cargoes.*) Other rules apply to bulk liquids and gases.

2. **True.**

3. **True.** You therefore need the IMDG Code, updated to include the amendments 21, 22, 23-86 (23-86 covering marine pollutants, effective April 6, 1987), and amendment 24-86 (effective July 1, 1988, for those who like to stay on top of things.) In order to make use of these changes not listed in the Optional Table, you must obtain approval of the Director, Office of Hazardous Materials Transportation, in accordance with 49

CFR 172.102 (a)(1). The 1986 consolidated edition of the five-volume IMDG Code is now available in the United States for about $295. Amendment 24-86 is also available at about $65.

4. **False.** It's a set of five volumes, looseleaf style, with blue plastic covers. Annual amendments must be purchased. They are not supplied free or automatically. (Pre-1981 four-volume sets are still around and useable if maintained with annual amendments.)

5. **False.** The IMDG Code is available from such U.S. dealers as Labelmaster (Chicago), (800) 621-5808, and N.Y. Nautical Instrument and Sales, (212) 962-4522, and Southwest Instrument Corp., San Pedro, CA, (213) 519-7800, among others.

6. **False.** There's no connection -- and, to my knowledge, no one is making any effort to include such proper shipping names into any ocean cargo tariff.

7. **False.** It would be impossible to list the thousands of names concerned. Entries that are not "by name" are covered by the "N.O.S." shipping descriptions provided for, e.g., "Flammable liquids, NOS," "Poisonous Solids, NOS," "Compressed Gases, NOS," etc.

8. **True.** There are many more of them in the 49 CFR HM table 172.101 than in the IMDG Code General Index, you'll find.

9. **True.** See Appendix A following the Optional HM Table 172.102 in 49 CFR (but remind yourself that its reference to "102" table entries of IMO proper shipping names is outdated). In the IMDG Code, the UN Numerical Index follows the General Index. It gives the page numbers that the item(s) with a given UN number appear on.

10. **True.** See section 7.1.8, page 0017-1 to -3 of the IMDG Code and 49 CFR, 172.203(i)(2).

11. **False.** The DOT/IMO Class Comparison Chart, centerfold in the NCITD documentation booklet referred to in question 33, illustrates that rather clearly.

12. **False.** Such liquids could be DOT "combustible liquids" if their flash point is also 100°F and over but would not be IMO "flammable" liquids unless their flash points were 141°F or less.

13. **True.** If your IMDG Code still also lists them in classes 3, 6.1, or 8, then your IMDG Code has not been updated.

14. **True.** IMO criteria are far broader than DOT's. (49 CFR, section 173.240 referring to human skin and steel, versus IMDG Code class 8, section 1 ("Properties") referring to "living tissue" and "materials such as metals and textiles.")

15. **True.** See 49 CFR, 173.2 and IMDG Code, section 5.2.8, page 0014-1. (If you can figure out that IMO precedent of hazards table, would you please explain it to me?)

16. **True.** A DOT Notice of Proposed Rulemaking (HM-181) was published May 5, 1987, in the Federal Register and republished November 6, 1987, with corrections. It describes DOT's proposed change from "spec" packaging to UN performance standards packaging (among other things) to address that 1990 situation. U.S. exporters of HM/DG will be unable to move their packaged regulated commodities into international markets after January 1, 1990, unless they use UN-approved packaging or make some other arrangement with the Competent Authority of the receiving Nation. Domestic only shipments in specification packagings will be phased out 5 years later as currently planned. HM 181 is a major rulemaking which will completely change Title 49 CFR.

17. **False.** Acceptability is determined by Part 173 reference, and DOT's IM Tank Table, plus poison inhalation criteria resulting from docket HM 196. (See answer to question 31.) IMO's tank commodity acceptability is indicated in the IMDG Code General Index by a "dagger" mark following the proper shipping name.

18. **False.** If the packaged imported commodity qualifies as a DOT hazardous material, then its packaging must comply with 49 CFR Part 173 packaging requirements. The only exception is if the imported commodity stays in the "port area." That term is undefined in 49 CFR, 171.8. You have to consult the Coast Guard's Captain

of the Port for the port area and contiguous harbor boundaries of the port in question.

19. **True,** although the regulations make some individual exceptions (consumer commodities, etc.)

20. **True.** See 173.29, 49 CFR covering empty packagings, including empty portable tanks that have not been "cleaned and purged of all residue."

21. **True.** If you're talking labels, then you're referring to packaging units. If placards, then freight and tank containers. (The one IMO mention of "enlarged labels" is a reference to such placards.)

22. **True.** IMO class 9 and DOT's ORM's and "limited quantity" materials, for example, require no labeling to indicate hazard class. Small arms ammunition (class C explosive) and baled dry cotton (class 4.1) are other examples of such "no label required" commodities.

23. **True** for Title 49 CFR although not presently required by IMO for non-bulk packagings. IMO does have, however, a further requirement for display of UN numbers with or in the respective placard for full containerloads of a single dangerous goods commodity. (See IMDG Code section 7.4.4, page 0017-6, Vol. I.)

24. **True.** See 49 CFR, 176.33 and note replacement based on information taken from shipping papers covering the shipment concerned.

25. **True.** IMO even provides for deleting the hazard class number in the placard (and label) applicable to the secondary hazard.

26. **False.** While DOT regulations offer some guidance for intermodal documentation of HM/DGs, there are certain situations when the shipping paper and shipper's certification may not be physically present with the cargo. This situation may cause problems, especially for emergency response personnel. DOT is presently working on solving this problem in the regulations.

27. **True.** Note, for example, 176.24 and 176.27 and especially 176.52, which states that a carrier may not accept for transport by vessel any hazardous materials unless offered with shipper-furnished "written information about the true nature of the material at the time of delivery."

28. **True.** See 49 CFR 171.12, 172.202, and 176.11.

29. **False.** Reference to "one pallet" or "two skids," for example, is inadequate. (172.202(a)(4) and (c)(2).)

30. **True.**

31. **False.** IMO has nothing comparable, at present. (See 172.203(k)(4), 172.301(a), 172.402(a)(10), 172.505 and 173.3a in 49 CFR for DOT's details.)

32. **False.** That responsibility remains with the party "offering hazardous materials for transport" even if others assist him. That situation may be confused with the provisions for the shipper's "agent" to sign the shippers certification per 172.204(d).

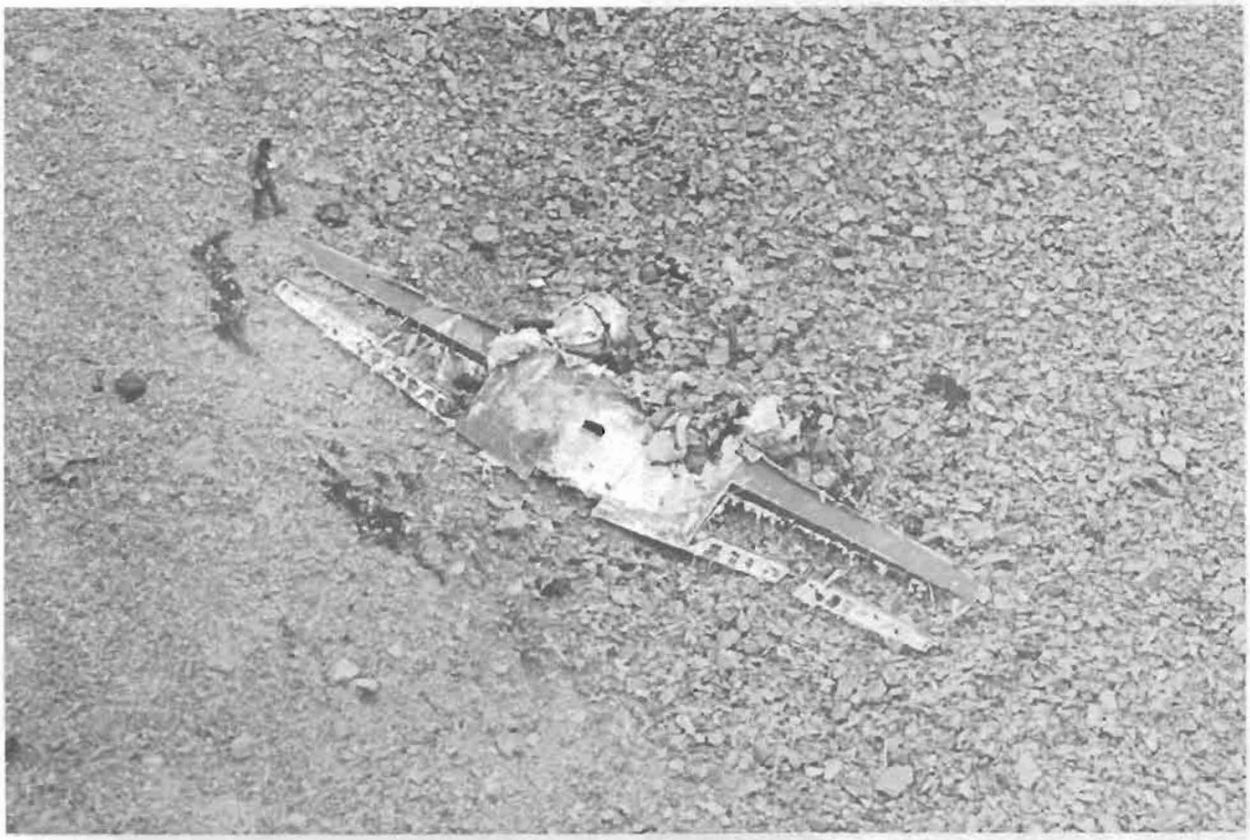
33. **True.** It's available at $13 per copy from the National Council on International Trade Documentation, 350 Broadway, Suite 1200, New York, NY 10013. For quantity discounts and NCITD member pricing information, call Paul Santella at (212) 925-1400.

How Did You Do?

Less than 66 points: You have your work cut out for you.

66 to 81 points: A comfortable level of knowledge -- but don't get complacent!

82 to 100 points: Very good indeed. Congratulations!



Coast Guard WWII Grumman Goose Found

On a rugged mountainside on the Alaskan Peninsula, members of the Army, Air Force, and Coast Guard spent 4 days examining the wreckage of a Coast Guard World War II aircraft lost in 1943. Members of the Army Central Identification Laboratory in Honolulu and Elmendorf Air Force Base's Mortuary Response Team were sent to the crash site 150 miles west of Kodiak on September 4, 1987, to recover the remains of an ill-fated Grumman Goose crew that had crashed into a mountain 44 years ago.

Chief Petty Officer Ed Moreth is a public affairs specialist with the Seventeenth Coast Guard District, Juneau, Alaska.

The identification lab is responsible for recovering U.S. military remains from World War II, Korea, and Vietnam.

Coast Guard helicopters from Kodiak transported the teams and equipment back and forth from the remote site. The Coast Guard pilots ad crew also lent a hand at sifting through the wreckage and surrounding loose rocks on the 3,000-foot cliff.

The wreckage had been found in 1949, but poor weather conditions and the location of the crash made the evacuation of any remains impractical. The aircraft was spotted again on August 26, 1987, by a U.S. Fish and Wildlife pilot on a routine bear patrol.

"It's like being an archaeologist," said Army Staff Sgt. Roy K. Torix, recovery team member. The team found bones, watches, coins,

For 4 days, teams searched 160,000 square feet of Kodiak mountainside. *(Photo by PAC Ed Moreth)*

uniforms, identification cards, a driver's license, and a photograph of a little girl.

The remains will be sent to forensic anthropologists at the Central Identification Laboratory in Hawaii. According to Capt. Benny E. Woodard, the Army's team leader, personal effects provide the anthropologists circumstantial evidence and give the lab a starting point of who was on board the aircraft.

"A lot of data and remains were collected from the crash site that will help the lab identify the crew," Woodard said. "But positive ID depends on whether the military records are still available."

Coast Guard records indicate who was on an aircraft of this type which was lost in 1943, but names are being withheld until positive identification can be made.

It is unknown how or why the Goose crashed.

"It's unbelievable how things were preserved," Torix said. Names were still legible on uniforms, identification cards, and a driver's license. Torix found a 1941 half-dollar in mint condition.

"I was pleased with what we found," said Mark Blair, the mortuary officer from Elmendorf Air Force Base. Blair, who was in charge of the recovery operation, said he had been on dozens of such missions.

Elmendorf's Mortuary Response Team is part of the Alaskan Air Command and is tasked with recovering any military remains in Alaska.

Blair said that he couldn't tell how many people were on board, judging by the amount of remains that were found. But he said there were indications of at least two.

"I have a certain respect for the people who were on these missions," Woodard said. "You become closely tied sometimes to the people, especially when you find personal effects such as the photo of that little girl in the wallet."

'It's really satisfying to finally bring them back home," Air Force Staff Sgt. Douglas E. Patch of the Mortuary Response Team said. "It's like the last chapter of a book."∎

Air Force Senior Airman James Rogers holds an officer's cap insignia found at the crash site. *(Photo by PAC Ed Moreth)*

Maritime Notes

DOT Sends Congress Legislation To Reform Ship Subsidy Program

The U.S. Department of Transportation has submitted to the Congress legislation to implement the Administration's proposed reform of the ship operating differential subsidy (ODS) program. The reforms would enable U.S.-flag operators to compete more effectively against their foreign-flag counterparts.

Both the House and the Senate are considering bills which would reform the ODS program. The Department previously notified the chairmen and ranking minority members of the appropriate congressional committees of its policy objectives for reform of the ODS program in a July 6, 1987, letter. The legislation implements the objectives in that letter.

The Department's bill recognizes the need to create an environment in which our merchant fleet can compete effectively by lessening federal regulatory constraints on maritime operations. The bill provides a 1-year window for presently subsidized and unsubsidized operators to enter into a revised ODS program. It would expand their operating flexibility, improve their cash flow by expediting subsidy payments, and permit worldwide acquisition of vessels.

The reform measure would result in amended ODS contracts for existing operators, while presently unsubsidized operators would be eligible for ODS under terms of grant agreements. Both would be limited to 10 years and a maximum of 20 ship-years of operation per year. The bill would limit ODS to wage subsidy only, as determined by the most economical collective bargaining or other wage agreement negotiated.

The bill would eliminate existing trade route restrictions, enabling carriers to operate in any sector of U.S. foreign trade. To improve the operator's cash flow, ODS would be paid semi-monthly, instead of at the end of a voyage. No subsidy would be paid for the carriage of military and civilian preference cargoes which are reserved for U.S.-flag vessels and not subject to foreign competition.

The bill would permit ODS operators to acquire their ships abroad at competitive world prices, provided that military features are included and specifications are approved by the Department of Transportation and the U.S. Navy. The current 3-year prohibition against reflagged vessels' eligibility to carry preference cargoes would be lifted. The bill would also allow subsidized operators to own and operate foreign-flag feeder vessels.

Modification to Federal Flood Insurance Law Is Possible

Homeowners who have lost the "front" from in front of their oceanfront dwellings know too well that the sea's awesome power can be both beautiful and devastating.

Because of a quirk in the existing Federal Flood Insurance law, many homeowners must literally watch helplessly as their houses are swept into the sea; houses that, except for their threatened location, are sound structures. This will all be changed under modifications authored by the chairman of the House Merchant Marine and Fisheries Committee, Walter B. Jones (D-NC) and contained in the Conference Report on the Housing and Community Development Act of 1987 passed by the U.S. House of Representatives on November 9, 1987. (Offered as an amendment to this bill during House consideration in June, the language was retained during the House-Senate Conference on the bill.)

The plan is grounded in the belief that it is far better to recede that to give in. It provides participants in the Federal Flood Insurance program whose structures have been certified as being "in imminent danger of collapse" with two choices: first, they can demolish and collect up to 110 percent of the value of the house; or second, they can move the structure out of harm's way and collect up to 40 percent of the value to assist with the move. The 40-percent and 110-percent payments are based on the value of the structure, which can be insured under the program for up to $185,000.

Under this plan the appropriate state or local agency, using Federal Emergency Management Agency guidelines, would certify the structure as being in imminent danger of collapse. If the homeowner then decides to relocate, it must be landward of the 30-year erosion setback (landward of the 60-year setback for structures with over four units.)

The Conference Report on the housing bill, S. 825, is expected to be approved by the Senate in the near future, and then the bill will be sent to the President for signature.

New Publications

Advanced First Aid Afloat, Third Edition

This is a completely revised and updated edition of the book that more than 25,000 bluewater sailors have looked to when injury or illness befell them at sea. Virtually every accident or ailment that might materialize when professional medical care is unavailable is squarely faced and dealt with, using layman's language and step-by-step instructions that allay panic and calmly conduct the reader from diagnosis, through treatment, to follow-up care.

The inside front and back covers contain diagrams that quickly point the way to the section of the book that should be consulted. But, for those life-or-death functions -- breath and heartbeat -- the reader should prepare well ahead of the cruise by studying Chapter 1, "First Things First."

There are separate chapters devoted to preparing your crew and your boat's medical chest for lengthy cruising -- from taking note of such potential causes of disaster as alcohol and drugs to reminders about seemingly minor matters of diet and sanitation -- to lists of drugs for which you will need prescriptions, to how many antacid tablets you should take. A number of chapters have been added to provide information on treating the newest members of the cruising set: children.

Author Peter F. Eastman, M.D., is a retired surgeon who sails the South Pacific and Australian waters aboard Con Tina.

Advanced First Aid Afloat, 3rd ed., *by Peter F. Eastman, M.D. Available from Cornell Maritime Press, P.O. Box 456, Centreville, MD 21617. Price $11.95.*

Chapman Piloting, Seamanship, and Small Boat Handling, 58th Edition

The 58th edition of Chapman's contains the latest information on the technological advances and new government regulations that have changed the face of recreational boating and affected our nation's waterways. In keeping with its noted ease of use, this edition includes a new glossary and a list of the most commonly used nautical acronyms and abbreviations. Special two-color instructional drawings, as well as dramatic full-page photographs and hundreds of illustrations, make the 58th edition at once more informative and more visually striking than ever.

As always, the heart of the book is safety. Reflecting the original author's prime concern for proper boat-operating procedures, Chapman's continues to include all the latest information on the rules of navigation and new safety equipment. Recent changes in regulations dealing with marine electronics, communication systems, government publications, aids to navigation, and the U.S. Coast Guard are also included.

The result is that the 58th edition is one of the most comprehensive and useful boating books available anywhere. Whether it is used as an on-board reference, for home study, or in conjunction with the courses offered by the U.S. Power Squadrons or U.S. Coast Guard Auxiliary, Chapman's is an important text for anyone interested in boating.

Chapman Piloting, Seamanship, and Small Boat Handling, 58th ed., *Elbert S. Maloney, editor. Available from Hearst Marine Books, 105 Madison Avenue, New York, NY 10016. Price $24.95.*

Chemical of the Month

Richard W. Sanders

Polymethylene Polyphenylene Isocyanate

Polymethylene polyphenylene isocyanate (PAPI) is a chemical with the formula $C_{23}H_{15}O_3N_3$. It is a dark brown liquid at room temperature and has a weak odor. PAPI belongs to the class of chemical compounds known as isocyanates. Isocyanates contain a nitrogen/carbon/oxygen group with the structure N=C=O. This three-atom combination serves as the active site on the isocyanate molecule for chemical reactions. Products are formed by bonding this group to other compounds.

Isocyanates are used primarily to make polyurethanes. Polyurethanes are important constituents of coatings, found in certain paints and lacquers, and in synthetic foams. Urethane foams may be rigid or flexible. Rigid foams are used as insulators and as molded structural parts for furniture and other products. Semirigid and semiflexible foams are used in automotive crash pads and armrests. Flexible urethane forams produce energy-absorbing articles and foam rubber used in mattresses and pillows.

Additionally, isocyanates are used to synthesize pesticides. Their high toxicity makes them effective agents against pests. This toxicity has also given the isocyanate family an infamous reputation. Methyl isocyanate (MIC) leaked from a Union Carbide pesticide plant in 1984, causing the tragedy in Bhopal, India.

Polymethylene polyphenylene isocyanate boils at approximately 230°C (450°F). It presents a minor-to-moderate fire hazard and has a high flash point. It releases CO_2 upon burning; therefore, it is self-extinguishing. PAPI will also react to evolve CO_2 when contaminated with water or acids.

Although less dangerous than other chemicals in the family, PAPI does present a health hazard. It will stain skin to a brown color, reacting slowly and painlessly if not removed. Temporary eye distress and labored breathing are also experienced. A major concern is not for the toxicity of the chemical itself, but for the poisonous additives found in conjunction with it. A threshold limit value has been established at 0.01 parts per million for polymethylene polyphenylene isocyanate. The LD_{50} for rats (dose at which 50 percent of the sample died) was found to be 10,000 mg/kg.

A person exposed to PAPI should be removed to fresh air, and oxygen should be administered if labored breathing occurs. Skin should be flushed with water after contaminated clothing is removed. Eyes should be washed with water for at least 15 minutes following contact with the chemical. If polymethylene polyphenylene isocyanate is ingested, vomiting should be induced three times, followed with a quart of milk and a mild cathartic (purgative). In all cases, medical help should be sought immediately.

If polymethylene polyphenylene isocyanate is spilled or leaks from a containment vessel, the chemical should be covered with a water spray. Cleanup should be initiated after all ignition sources have been secured. Personnel involved in the cleanup should wear protective clothing and respiratory devices if necessary. Additionally, the National Response Center should be notified.

PAPI is not corrosive to mild steel. However, aluminum cannot be used for containment. This isocyanate is unsafe when stored with many groups of materials. It is imperative that PAPI is stored under a dry, inert atmosphere at slight positive pressure to

Richard W. Sanders was a First-Class Cadet at the U.S. Coast Guard Academy at the time this article was written. It was written under the direction of LCDR J. J. Kichner for a hazardous materials transportation class.

eliminate traces of moisture contamination and prevent polymerization.

Polymethylene polyphenylene isocyanate is shipped as a liquid in hermetically sealed containers. The containers should be constructed of glass, plastic, or metal packed with inert cushioning and absorbent material. Cans, strong metal receptacles, and metal drums may be used also. PAPI is transported in a maximum gross package size of 250 kg.

Applicable Coast Guard bulk regulations are found in Subchapter O of 46 CFR. The U.S. Environmental Protection Agency regulations are contained in Title 40, Subchapter D. Polymethylene polyphenylene isocyanate is further regulated under Subchapter C, Title 49 of the CFR by the Department of Transportation. A poison label must be affixed to all containers storing or transporting this chemical.

Chemical Name
Polymethylene polyphenylene isocyanate

Formula
$C_{23}H_{15}O_3N_3$

Synonyms
PAPI, Thanate P 210

Physical Properties
boiling point: 230oC (450oF)
flash point: 425oC
density: 1.2 g/mm^3
vapor pressure at 46oC: very low
solubility in water: reacts

Threshold Limit Value
0.01 ppm

Odor Threshold
0.4 ppm

Flammability Limits
unavailable

U.N. Number: Unassigned

CHRIS Code: PPI

Cargo Compatibility Group: 12 (Isocyanates)

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. Before charging a refrigeration unit, the refrigerant charging lines should be ______.

A. flushed with clean refrigerant gas
B. purged with refrigerant gas
C. washed with an ammonia and alcohol solution
D. grounded to the compressor

Reference: Shulters, *Marine Air Conditioning and Refrigeration*

2. Etched or burned bands on the contact faces of brushes in a direct current generator could be caused by ______.

A. high mica segments
B. copper drag on the commutator
C. brushes improperly positioned
D. copper embedded in the brushes

Reference: NAVSHIPS Bureau of Ships Technical Manual

3. Testing the viscosity of an engine's lube oil may indicate

A. fuel oil dilution
B. oxidation of the lube oil
C. both A and B
D. neither A nor B

Reference: Henshall, *Medium and High Speed Diesel Engines for Marine Use*

4. According to Coast Guard regulations, which of the following is a requirement of a lube oil cooler installation?

A. Each cooler must be served by its own lube oil service pump.
B. There must be two means of circulating cooling water through the cooler.
C. All drains from the cooler must be led directly to the bilge.
D. All of the above.

Reference: Harrington, *Marine Engineering*

5. Waterside scale in a firetube boiler may cause

A. increased heat transfer
B. fireside erosion
C. high steam demand
D. overheated tubes

Reference: Elonka and Kohan, *Standard Boiler Operator Questions and Answers*

Deck

1. Peck and Hale gear is used most commonly for storing ______.

A. automobiles
B. baled cargo
C. large wooden crates
D. palletted cargo

Reference: Sauerbier, *Marine Cargo Operations*

2. The safe working load (SWL) for assembled cargo gear and the minimum angle to the horizontal for which the gear is designed shall be marked on the ______.

A. deck
B. head of the boom
C. heel of the boom
D. mast or kingpost

Reference: Sauerbier, *Marine Cargo Operations*

3. Using a safety factor of 5, determine what is the safe working load for 3-1/2-inch manila line with a breaking stress of 8 tons.

A. 0.94 tons
B. 1.60 tons
C. 4.90 tons
D. 12.25 tons

Reference: Sauerbier, *Marine Cargo Operations*

4. Static electricity may be built up by ______.

A. the spraying or splashing of petroleum
B. settlings of solids or water in petroleum
C. the flow of petroleum through pipes
D. any of the above

Reference: *Petroleum Tankship Safety*

5. You are planning to use the crude oil washing system on your tankship. Which of the following is required to prevent electrostatic buildup in the tanks?

A. The portable machines should be set at the proper drop for the first wash before the fixed machines are used.
B. The tank used as the source for the tank cleaning machines should be debottomed for at least one meter.
C. The inert gas systems must reduce the oxygen content in the tank to at least 18 percent.
D. The fixed machines must be operated simultaneously with the portable machines to equalize the electrostatic potential.

Reference: Marton, *Tanker Operations*

Answers

Engineer
1-B; 2-C; 3-C; 4-B; 5-D
Deck
1-A; 2-C; 3-B; 4-D; 5-B

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

Keynotes

Request for Applications

CGD 87-085, Rules of the Road Advisory Council; Membership Applications (November 26)

The U.S. Coast Guard is seeking applications for appointment to membership on the Rules of the Road Advisory Council. This Council was established under the Inland Navigational Rules Act of 1980 (33 U.S.C. 2073) to advise, consult with, and make recommendations to the Secretary of Transportation on matters relating to the Inland Navigation Rules and the International Regulations for Preventing Collisions at Sea (72 COLREGS).

Requests for applications should be received by the Coast Guard no later than January 15, 1988. Applications must be completed and returned to the Coast Guard no later than February 15, 1988.

Persons interested in applying should write to Commandant (G-NSS-2), U.S. Coast Guard Headquarters, Washington, DC 20593-0001. For further information, contact CDR Charles K. Bell, Executive Director, Rules of the Road Advisory Council, at the address above, or call (202) 267-0414.

Final Rule

CGD 86-031, United States Aids to Navigation System (November 6)

The final rule publishes regulations which make the United States Aids to Navigation System consistent with the International Association of Lighthouse Authorities (IALA) Maritime Buoyage System. It increases maritime safety and promotes a uniform international aids to navigation system by assuring United States participation in the IALA System. The final rule is required to inform U.S. mariners of the ongoing changes, and to eliminate unnecessary information from the present regulations. Minor changes are made to regulations concerning regattas and marine parades to reflect changes to the U.S. Aids to Navigation System. The effective date of this final rule is December 7, 1987.

For further information, contact LTJG G. R. Wulfkuhle, U.S. Coast Guard (G-NSR-10), 2100 Second Street, SW, Washington, DC 20593; telephone (202) 267-0349.

CGD 87-044, Security Measures; CFR Part Removed (November 6)

This rule removes the regulations requiring merchant vessels to post, when provided by the Coast Guard, CG Form 3526, entitled "Atomic Attack Instructions for Merchant Vessels in Port," in five designated areas of the vessel. This action is taken because the information on the placard is either outdated or provided in other publications required on merchant vessels. This eliminates the burden on the public of maintaining an unnecessary document and reduces Coast Guard operating costs for printing, stocking, distributing, and inspecting the document. The effective date of this final rule is November 6, 1987.

For further information, contact LCDR Joel R. Whitehead, telephone (202) 267-0491.

Notice

CGD 87-053, Coast Guard Recreational Boating Survey (November 23)

Notice is hereby given that Office of Management and Budget (OMB) approval, under the Paperwork Reduction Act, is being sought for the collection of information on use of alcohol by recreational boaters. The information will be collected through voluntary participation in surveys at selected sites. The request for OMB approval was submitted on November 18, 1987, and completion of the survey is tentatively scheduled for January 1989.

Copies of the Request for OMB Review (Standard Form 83) and supporting documentation are available for inspection and copying at Commandant (G-BP), U.S. Coast Guard Headquarters, Room 4224, 2100 Second Street, SW, Washington, DC 20593-0001. Persons desiring to comment on this information collection should send their comments to Office of Information and Regulatory Affairs, Office of Management and Budget, 726 Jackson Place, NW, Washington, DC 20503, Attn: Desk Officer, U.S. Coast Guard. Persons submitting comments to OMB are also requested to submit a copy of their comments to the Coast Guard Headquarters address given above.

For further information, contact Dr. Jerry Boden, (202) 267-0956 between 8:00 a.m. and 3:30 p.m., Monday through Friday, except holidays.

Proposed Rule

CGD 87-009, Boating Safety; Electrical System Standard (November 23)

The Coast Guard proposes to amend its regulations on electrical systems for new recreational boats by incorporating Underwriters Laboratories (UL) Standard 1426 -- Cables for Boats -- in lieu of a general reference to independent testing laboratories that is no longer considered useful, and by deleting UL Standard 83 -- Thermoplastic-Insulated Wires and Cables. The intended effect of the proposed amendments is to add the UL listed boat cable standard which is now widely used for marine cable installed in recreational boats.

Comments must be received on or before February 22, 1988, and should be submitted to Commandant (G-CMC/21) (CGD 87-009), U.S. Coast Guard, 2100 Second Street, SW, Washington, DC 20593-0001, between 8:00 a.m. and 3:00 p.m. Monday through Friday, except holidays.

For further information, contact Mr. Alston Colihan, telephone (202) 267-0981.

Proceed