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of the Marine Safety Council

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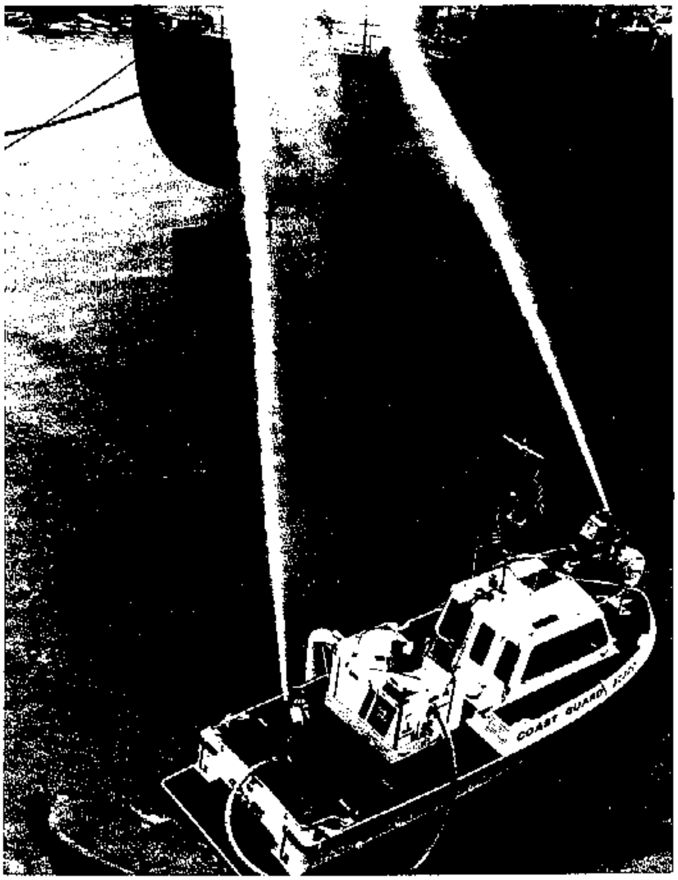
Personal flotation devices have come a long way from the vintage cork model worn by mariners around the turn of the century. Today's PFDs are so designed that anyone can find a comfortable one well-suited to his chosen activity. This month's issue has two articles on PFDs: an overview of the types available, starting on page 116, and a report on PFD performance in rough water, starting on page 120.

Coast Guard Evaluates Lightweight Firefighting Module

When the Coast Guard saw the need for a highly portable, high-performance firefighting pump, it asked the National Aeronautics and Space Administration for assistance. NASA engineers had acquired considerable technical experience in designing efficient, lightweight pumps for rocket engines. The result of this Coast Guard and NASA R&D project was a prototype firefighting module.

The pump design was modeled from the giant first-stage rocket engines of the Apollo/Saturn V, which pumped three tons of fuel per second to take U.S. astronauts to the moon. The self-contained unit developed for the Coast Guard was designed to pump 2,000 gallons per minute. The pump was intended to be suitable for long-term, unattended, unprotected storage, yet be ready for immediate deployment by trailer, helicopter, or boat. The uses foreseen included firefighting in and around the waterfront, shipboard firefighting, and firefighting on offshore structures.



The firefighting pump, seen here on a 32-foot boat, helps extinguish a fire aboard a test ship.

An HH3 helicopter lifts the firefighting module from its trailer.

The Fire and Safety Test Detachment of the Coast Guard's Research and Development Center tested a prototype firefighting pump to determine its potential for Coast Guard use. The unit was subjected to performance, endurance, and shock tests. These were followed by at-sea tests on a 32-foot port-and-waterways boat and an 82-foot patrol boat. In addition, air transportability was evaluated with an HH-3 helicopter.

The tests disclosed that the unit was not sufficiently weathertight, air-transportable, or rugged for Coast Guard use without major redesign. Nevertheless, NASA and the Maritime Administration have since evaluated the pump for port firefighting applications in St. Louis, and the U.S. Navy has acquired it for evaluation in Navy applications. In addition, the Miami Fire Department has acquired a second-generation, 3,000-gallons-per-minute pump for its new amphibious fireboat.

A final report entitled "Lightweight Fire Fighting Module Evaluation" is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161. Report No. CG-D-77-79, Accession No. AD A071-486, should be specified. ⚓

PFDs

Once again this year, the theme of National Safe Boating Week (June 5-11) is the importance of wearing personal flotation devices. It is a very simple, basic message with some hard facts to back it up.

The trim, well-fitting PFDs in use today stand in sharp contrast to those of days gone by. The device shown here is specially designed to keep the infant's head above water.

Every year millions of people enjoy our nation's waters in activities ranging from fishing to speedboating.

Unfortunately, accidents do happen, and every year hundreds of people lose their lives in boating accidents.

Of those who died in 1982, 70 percent did so because they unexpectedly found themselves in the water as a result of a capsizing, sinking, or fall overboard. The tragedy is

Where did the name "personal flotation devices" come from? According to a reliable source, the moniker can be traced to the growing drug problems of the early 1970s. The Coast Guard by then already had a variety of devices that could be used to meet the Federal carriage requirements. There were life preservers (Type Is), buoyant vests (Type IIs), special-purpose water safety devices (Type IIIs), buoyant cushions and life rings (Type IVs). Some generic term was needed so that people could discuss the subject easily. The first choice was "lifesaving device." This had to be rejected, as it would have looked bad for the Coast Guard to be promoting LSD. The Coast Guard finally settled on "personal flotation device," with the emphasis on "personal."

A Type I device, or life preserver (left), provides its wearer the greatest amount of flotation. A Type II, or buoyant vest (center), has less flotation but is more wearable. Type IIIs, marine buoyant devices, come in many different styles. One designed especially for water skiers (right) has deep cuts under the arms for freedom of movement.

that as many as 75 percent of the victims might have lived, had they worn their personal flotation devices, their PFDs.

In the past, PFDs were often bulky, uncomfortable, and unsightly. Some were even dangerous. It was easy to understand why people avoided wearing them. But that is no longer the case.

In the last several years, the Coast Guard and PFD manufacturers have worked to develop and produce new and attractive PFDs that are comfortable, well-fitting, and available in a variety of styles. Equally important, PFDs have been developed to meet the unique requirements of specific water sports and activities. Today's PFDs not only provide the needed protection and convenience but identify the wearer as a participant in a particular sport.

The law requires every boat to carry one personal flotation device for each person on board, including water skiers being towed. This PFD must be the proper size for the intended wearer. If the boat is 16 feet or longer, there must also be a throwable device aboard for man overboard protection. All PFDs must be Coast Guard-approved. At Coast Guard-certified facilities such as Underwriters Laboratories, PFDs undergo a variety of tests to ensure that they meet Coast Guard standards.

A special-purpose Type V device is designed with a hook for sailboarding.

PFDs come in a wide variety of styles, colors, and shapes. There are only five "Types," however.

Type I, the life preserver, has the greatest amount of flotation and is designed to turn most unconscious people face up in the water.

Type II, the buoyant vest, is more wearable than Type 1 but provides less flotation. Its turning action is not as pronounced as that of a Type I, and the device will not turn as many persons over under the same conditions as a Type I.

Type III, the marine buoyant device, is available in a wide variety of designs, colors, and sizes. This Type enables a wearer to place and keep himself in an upright position. Some Type III PFDs provide considerable protection against hypothermia. Many PFDs in this category have been designed to meet the specific requirements of such water sports as skiing, sailing, and hunting. Because they are so wearable, they are rapidly becoming the choice of many of today's boaters.

Type IV is the throwable device. This category includes buoyant cushions, ring buoys, and horseshoe buoys, all of which are designed to be thrown to a person in the water and grasped and held by him until he is rescued.

Type V PFDs are special-purpose devices designed to meet specific needs. Some, with hooks, are used for sail-

USCG Backs PFDs

(Reprinted with permission of BOAT/U.S. ©1982)

The Consumer Union (CU) made national headlines last year by condemning USCG-approved life jackets, proclaiming, "Don't Bet Your Life on the Life Jackets We Tested." However, the Coast Guard has objected strongly to CU's judging criteria and testing methods, maintaining that the USCG's deliberate compromise of performance and comfort is the best prescription for boating safety.

In the August 1982 issue of *Consumer Reports*, CU panned 29 of 31 USCG-approved Type III Personal Flotation Devices (PFDs), rating them "Not Acceptable." According to stated USCG standards, Type III devices are supposed to allow a conscious person to adopt and maintain a vertical, slightly backward position, without any tendency to turn face down. CU claims that in its tests only 2 of the 31 tested life jackets passed this criterion, allowing the wearers to "wait for a rescue without having to fight a tendency to turn face down."

However, CU's stringent testing standards appear to totally disregard the Coast Guard's policy of broadening the range of life jackets considered wearable by the general public. Encouraging the wearing of PFDs is held vital, since three-fourths of those who died in boating accidents last year were not wearing life jackets, despite the fact that boats are required to carry one for each passenger.

In creating the different classifications of PFDs, the Coast Guard purposely gave up the maximum performance of the Type I device for the increased wearability of the less bulky Types II and III so that more boaters would wear them.

In its rebuttal, the Coast Guard, whose initial Type III tests are performed by Underwriters Laboratories, cited problems with CU's test procedures: "The article stated that the test subjects were instructed to 'let their arms and legs go limp and keep their heads up.' If this is done, a Type III device may allow the wearer to turn face down due to muscle tone pulling the arms and legs forward and the high percentage of body weight in a person's head as compared to his immersed body weight . . . Therefore, the devices didn't turn the wearers face down, the wearers turned themselves face down by not allowing their heads to fall back."

The performance criteria also varied between the two organizations in defining what was acceptable for the amount of effort required for a wearer to get from a face-down to a face-up position and stay that way. Consumers Union down-rated Type III PFDs as requiring "a deliberate effort to get up and maintain an upright position."

The Coast Guard compares this righting effort to "rolling over in bed or lifting one's head." The Coast Guard further asserts that "anyone can find a stable face-up flotation attitude in a Type III which requires no effort to maintain, although it may be more horizontal than some people would like."

The Coast Guard also maintains that the consumer group's expectations of more stringent Type II PFDs also are too high: "CU apparently expected Type II devices to turn most wearers to a vertical and slightly backward position. This is in fact a requirement for a Type I device."

The most practical advice seems to be for boaters to test their own life jackets in the water to check out their flotation capabilities. Based on factors like weight, body buoyance, swimming ability, and type of boating, the individual can decide what best meets his performance needs.

boarding and "hiking out" (leaning off the side of a sailboat to act as a counterbalance). Another style, designed for white-water paddling, has a slit-and-hinged bottom so the wearer can get into a kayak. It also has a padded hood to protect the head. Remember: these PFDs are acceptable only when used in the sport for which they were designed.

Since PFDs are personal flotation devices, they must meet the wearer's personal flotation requirements.

People, like PFDs, come in many sizes. What fits one person may not fit another. Make sure you select the one that's right for you.

Individuals also vary in buoyancy. A 200-pound man with a high percentage of body fat may weigh only 7 pounds in the water, while a muscular 110-pound woman may weigh 11 pounds in the water. The same PFD may therefore float different people differently.

Some people, particularly infants and the handicapped, have special problems. In the case of small children, for example, most of the body's weight is in the head. The PFD must be constructed to compensate for this. PFDs for handicapped individuals also concentrate flotation at the top of the body, in the collar, to make sure the head remains above water.

For a PFD to function properly, it must also be correctly adjusted and worn. For example, if a skier falls, a loose PFD may ride up and pin his arms to his head. A second possibility is that the skier will float just fine, but his head will probably be underwater.

Select your PFD carefully. Make sure it fits you properly, and follow the manufacturer's instructions for taking care of it. If something should happen to you and you suddenly find yourself in the water, your PFD will take care of you. It can save your life—but only if you're wearing it.

Copies of "Your Friend for Life," the slide presentation from which this article was adapted, can be obtained by writing to Commandant (G-BBS-4), U.S. Coast Guard, Washington, DC 20593. ⚓

Since individuals vary in buoyancy, the same PFD may float different people differently. Water test your PFD to make sure it has the proper amount of flotation.

Today's PFDs can identify their wearers as participants in certain sports. This Type V has a slit-and-hinged bottom so its wearer can paddle from a kayak comfortably.

Rough Water

Weather and sea conditions often play a major role in survival at sea. We know that wearing a personal flotation device will increase a person's chances of survival in almost any weather conditions. Yet little is known about the performance of personal flotation devices in the wave conditions found in open water.

by LTjg Timothy R. Girton
Survival Systems Branch
Merchant Vessel Inspection Division

The pictures you see above aren't of a storm at sea. They were taken during a rough-water test of life jackets conducted by the Coast Guard in a model test tank. This tank is able to generate "seas" of 3.5 to 4 feet with a period of about 2.5 seconds--rather steep waves which subjects without adequate flotation quickly found to be quite debilitating.

The rough-water test was associated with several Coast Guard projects and therefore had several objectives. Life jackets, or personal flotation devices (PFDs), are not being worn as often as they should be. The reason usually given for this is that PFDs are too bulky and uncomfortable to wear. Accordingly, the main objective of the study was to determine how much of the material which gives a PFD its "inherent" buoyancy could be safely eliminated. The Coast Guard hoped that such a streamlining would induce people to wear PFDs regularly.

Among the other objectives of the testing was to evaluate the suitability of "hybrid" PFDs for commercial and recreational use (a hybrid PFD has a combination of inherent and inflatable buoyancy). The hybrid is a relatively new idea in this country. The Coast Guard's basic concept of an acceptable hybrid is a device which has enough inherent buoyancy to bring a person to the surface so he can inflate the device. The test done in the model basin was intended to determine if some prototype hybrids would achieve this result.

The tests were also intended to provide information on the performance of several approved types of PFDs in rough water. PFDs are currently tested only in calm water in order to ensure uniformity of testing conditions. The Coast Guard hoped that its tests in the wave basin would help it develop performance requirements for PFDs that would ensure that the devices functioned properly in rough water.

The tests described in the article were conducted by the Survival Systems Branch of the Coast Guard's Office of Merchant Marine Safety. The testing took place over a two-day period in February 1983 at the David Taylor Naval Ship R&D Center in Carderock, Maryland.

The waves in the basin are created by air pressure along the bank in the foreground of this photo and the bank to the right.

Expanding the Coast Guard's knowledge in the areas of training and rescue procedures was another objective of the project. The tests were videotaped, and the tape will be used to train rescue personnel for the conditions unique to rough water (how victims with different devices or victims of different sizes, weights, or body densities might be expected to drift, for example).

Finally, the Coast Guard hoped that the testing would lead to advances in techniques for rough-water survival. A recent debate on questions such as which position is best relative to the waves has led to conflicting advice from experts in the field. The Coast Guard hoped that the controlled conditions of the experiment might afford some new insight.

Photos by Charles S. Powell, Photojournalist

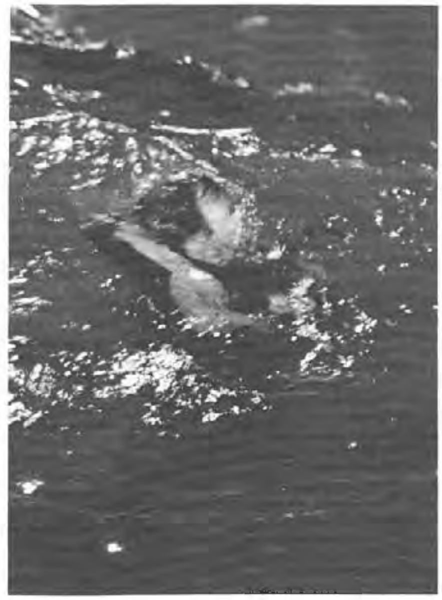
The "hybrid" PFD brings its wearer to the surface, where he inflates the device.

Findings

Of the PFDs tested, Type I devices turned in the best performance. This was not surprising, since Type I devices are designed to offer the wearer the most flotation. In the wave conditions created for the tests, Type I devices generally kept the wearer floating higher in the water and turned him from a face-down to a face-up position very quickly. This short turning time seemed to be the result of the waves' "helping" the PFD turn the wearer.

Other Coast Guard-approved PFDs were able to handle the waves reasonably well, even though they are not necessarily designed for such





"As is evident from the photos, a person wearing a PFD with insufficient buoyancy will be hard put to avoid swallowing a great deal of water."

rough conditions. The less bulky Type IIs and IIIs have less inherent buoyancy than a Type I. Even so, many of the test subjects wearing approved Type IIs and IIIs were able to relax and still keep their heads above water. The PFDs' degree of performance—how high and at what angle they floated their wearers—was similar to that recorded during calm-water tests.

A Coast Guard-approved Type I device with about 32 pounds of buoyancy floats its wearer relatively high in the water.

As is evident from the photos, a person wearing a PFD with insufficient buoyancy will be hard put to avoid swallowing a great deal of water. Everyone has a different buoyancy requirement in the water. (The test subjects all weighed between 7½ and 14½ pounds in the water. Most people weigh 7 to 12 pounds in the water.) The Coast Guard knows from experience that 15.5 pounds of buoyancy will adequately float about 99 percent of the U.S. population. Having tested varying amounts of buoyancy, the Coast Guard believes that about 10 pounds would be the right amount of inherent buoyancy to use in a hybrid PFD. It is still looking into this matter, however.

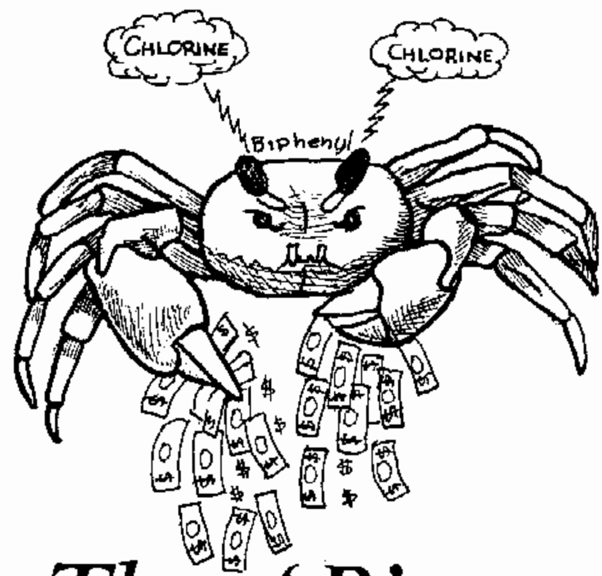
The Coast Guard also tested some survival suits. These proved to be the best devices for rough-water conditions. In the words of one of the test subjects, wearing a survival suit was "just like being in a raft."

The tests did provide some information about survival in rough water. However, the debate over which position is best relative to the waves was not resolved. Persons facing the oncoming waves could see them coming and therefore exercise breath control. On the other hand, some of the test subjects (usually those wearing devices with very large collars) found that by facing away from the waves they would not get as much water in their mouths. The larger collars seem to act as a breakwater, forcing the water away from the wearer's head. The best position to take thus appears to be a question of comfort and the type of PFD the victim is wearing.

A complete technical report of the tests is now being prepared. It should be available to the public sometime this fall. If you are interested in a copy of the report, contact

Commandant (G-MVI-3)
U.S. Coast Guard
Washington, DC 20593
Tel.: (202) 426-1444 ⚓

Illustration by Thomas H. Cannon



PCBs

by David Culver

and Thomas Hale

The 'P' and the 'C' in these chemicals' names could be read as 'persistent' 'contaminants.'

"PCBs"—the very word makes people wary these days. An article in the magazine *Environment* a few years ago called attention to the fact that PCBs were being found in all sorts of places they shouldn't be (in polar bears and seals north of the Arctic Circle, for instance). Why is this happening? More importantly, why is it a problem? After all, man-made chemicals are found throughout the world, many of them in unlikely places. Why are PCBs a threat to the environment? Where do PCBs come from? What, if anything, are they used for? In this article, we will discuss these issues and attempt to shed some light on a controversial subject.

The Chemistry and Production of PCBs

Polychlorinated biphenyls were first identified in 1881 but were not produced for commercial purposes until 1930. For a long time these widely used industrial chemicals were thought to be relatively nontoxic. Their potential threat to the environment was recognized in 1966. In that year, a Swedish scientist, Sõren Jensen, concerned about the declining seal population in the Baltic Sea, detected the presence of PCB compounds in fish and wildlife samples.

What exactly are PCBs? The word "biphenyl" refers to organic chemicals consisting of two benzene molecules fused together. "Polychlorinated" means that they have chlorine atoms attached to them. There are 60 or more different isomers in the PCB family (isomers have the same overall chemical formula, but the components are connected differently). The isomers vary according to how many chlorine atoms are attached to the biphenyl molecule and where the chlorine atoms are attached.

PCBs are known to be a widespread contaminant of the marine environment. Because they have little or no affinity for water (i.e., are "hydrophobic"), they are virtually insoluble in water. While this aids in clean up (the PCBs can be readily removed from water by adsorption onto activated charcoal/hay, for example), the compounds are not susceptible to breakdown by water, sunlight, and microbiological action. It is their resistance to being broken down and "neutralized" and the ever-present,

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David Culver and Thomas Hale are Cadets at the Coast Guard Academy in New London, Connecticut, where they wrote this article in connection with a course on hazardous materials in marine transportation. Also contributing to the article were Assistant Professor LCDR Pedro G. Filipowsky and Instructor LT Thomas J. Haas.

varying concentrations of chlorine that concern industrialists and scientists.

The Commercial Use of PCBs

Up until 1977, PCBs were produced in the U.S. by one company, Monsanto, under the trade name AROCLOR. Because of increasing public concern over the toxicity of PCBs, Monsanto in 1977 decided to stop production and let supplies run out. Production continues elsewhere in the world, however. Foreign manufacturers and their trade names include Prodelec (France), with PHENOCLOR, and I.G. Farben-Industrie A.G. (Federal Republic of Germany), with CLOPHEN. The Soviet Union also produces PCBs, under the trade name SOROL.

The key to the popularity of PCBs is their chlorine content. If four or more chlorine atoms are present per molecule, then the molecule is nonflammable. The big selling point for PCBs is that they will conduct heat without conducting electricity. This is of tremendous importance for insulating fluids in industrial capacitors and transformers. Another advantage is that PCBs are not readily broken down and may thus be used for a long time without losing their effectiveness. In addition to their use in electrical equipment, PCBs are used as softeners in plastics, paints, and rubber, as additives in inks and papers, and as oils in the preparation of laboratory slides. In view of their many and varied uses, it is easy to see how PCBs have entered our environment, especially the marine environment, through sewage and industrial effluents, atmospheric fallout of particles, rainwater, and runoff. Unfortunately, the very qualities that make PCBs so ideal for industrial use (stability, low flammability) make them one of the most abundant, persistent, and widely dispersed environmental contaminants.

The Impact of PCBs

The full impact of PCB pollution of the environment is extremely difficult to assess. How much of the chemical is being discharged into the waterways and at what level PCBs become hazardous are questions that have yet to be answered. Not enough time has elapsed since PCBs were first detected in the environment to allow us to gather the data necessary to determine the potential harm to the biosphere. We do know, however, that once PCBs get into the environment it is very difficult to get them out.

As stated earlier, the PCB molecule is very stable and does not biodegrade easily. Once introduced to the environment, either by accident or as waste, the chemical travels up the food chain. At each step, the PCBs become more concentrated (or, as scientists say, are "biomagnified"). In animals, the PCBs find their way into the fatty tissues, where they are stored. Because of this naturally occurring bioaccumulation process, levels of PCB contamination have been found in fish that were 40,000 times greater than that of the water in which the fish lived.

In many areas of the United States a steady increase has been recorded in the concentration of PCBs in fish. One major area of concern is the Great Lakes. Data collected by the Michigan Department of Natural Resources show a steadily increasing contamination of lake trout and Coho salmon, with contamination levels measuring 10 to 25 ppm (parts per million). The Food and Drug Administration has set the human tolerance level for PCB concentrations in fish and shellfish at 5 ppm. High levels of contamination could have a devastating effect on sportfishing and commercial industry in the Great Lakes area. In 1975, for example, 125,000 cans of Coho salmon were taken off the shelf because the level of PCB contamination was found to be too high.

An area where the level of contamination in fish is even higher than in the Great Lakes is the Hudson River. The extremely high concentrations in this area can be attributed to the two industrial plants there which use large quantities of PCBs in the production of such

The threat of PCB contamination today comes mostly from old equipment such as this electrical transformer.

electrical equipment as capacitors and transformers. Although no precise determination has been made of the quantities being discharged into the Hudson River, environmental groups put the amount at about ten pounds a day. Plant officials say that it would be impossible for them to completely halt the discharge of PCBs because the plants work with thousands of pounds of the chemical each day. In 1976 the plant owners agreed to pay the State of New York $3 million to help clean up some of the estimated 440,000 pounds of PCBs in the sediment of the Hudson River. To remove 75 percent of the PCBs in the sediment by dredging would cost about $25 million.

The worst incident of PCB contamination involving humans occurred in 1968 in Japan. It was this incident which alarmed people to the toxic effects of exposure to PCBs. One thousand people consumed rice oil contaminated with up to 2,000 ppm of PCBs. The contamination was traced to a leak in a heat exchanging pipe which allowed PCBs to be released into the rice oil during production. Victims of the poisoning suffered such varied effects as visual impairment, hearing loss, skin disease, neurological disorders, miscarriages, and stillbirths. Symptoms persisted in some patients for as long as three years. Children born to women who became pregnant after the PCB exposure had discolored skin and weighed less than other infants. This shows that PCBs can be passed from mother to offspring through the placenta. The effects of this tragedy have been studied so that we might have a better understanding of how PCBs affect humans.

Research

Many studies were performed on laboratory animals during the 1970s. One of the most important points brought out by these studies was that PCBs with a lower chlorine content may have a greater effect on reproduction than those with a higher chlorine content. (Producers switched to PCBs with a lower chlorine concentration because it was believed that they would be more biodegradable and therefore less of a danger to the environment.)

Experiments done by the University of Wisconsin School of Medicine on rhesus monkeys showed a definite correlation between the ingestion of PCB-contaminated food and the symptoms of human PCB poisoning. In the test group of monkeys being given food contaminated with 5 ppm of PCBs, only 12.5 percent became pregnant over a 3-month period, as opposed to 90 percent of the control group. This shows that PCBs are toxic at levels below the one set by the FDA as safe for human beings. Other laboratory tests indicate that genetic defects may be passed to future generations. All of these experiments provide general statements about the possible effects of PCBs on humans. Still more tests are needed to determine the long-term effects of PCB poisoning.

Control of PCBs

The use of PCBs in this country is on the decline. Despite Monsanto's decision to stop production and let its supplies run out (its supplies were depleted in 1978), there are some 750 million pounds of PCBs still in use or in storage. The threat of PCB contamination will continue to exist for several decades as old equipment releases PCBs, either by accident or through improper disposal.

There are two ways to dispose of PCBs. One way, developed by Monsanto to destroy PCB waste for its customers, is in a large, high-temperature incinerator. The temperature required to do the job is over 2,400°F (1,315°C). The capacity of the Monsanto incinerator is 1 million pounds a year. The other method of disposal was developed by the Sunohio Co. to clean contaminated transformer oil. This process, called "PCBX," strips the chlorine atoms from the compound and changes the biphenyl into a polyphenylene, which can then be precipitated from oil. This method is 40 percent cheaper than incineration. The only other method that has been used to get rid of PCBs is burial in special sites. Although this method is the least expensive and can take care of large amounts of waste at once, worries about leakage have yet to be settled.

The hazardous nature of PCBs has been well publicized. One way of ensuring that no further PCBs are released into the environment is to replace equipment containing PCBs. If this avenue proves too expensive, at least the PCBs could be removed and another material substituted. While these measures would do nothing to eliminate PCBs already in the environment, they would prevent the problem from growing--and that would benefit all inhabitants of our biosphere, from the American consumer buying a can of Coho salmon to the polar bear north of the Arctic circle. ⚓

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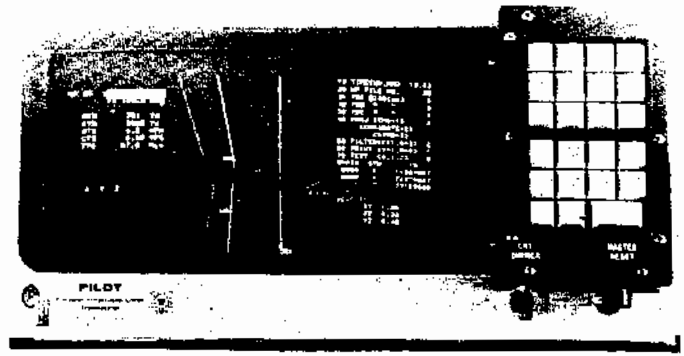
PILOT: Precision navigation in restricted waterways

The Loran-C radionavigation system has an advertised accuracy of one-quarter nautical mile. But as many experienced sailors know, the accuracy in the Loran-C signal is much better, even to the point of assisting navigation in restricted waterways.

For the past several years, the Coast Guard's Office of Research and Development has conducted a series of projects applying Loran-C to navigation in such restricted areas as harbors and harbor entrances. The objective has been to develop low-cost equipment for restricted-waterway navigation. The development and evaluation of PILOT, the Precision Intracoastal Loran Translocator, by the Office of R&D and Johns Hopkins University Applied Physics Lab marks the successful accomplishment of that goal.

PILOT has a standard graphics terminal and a microprocessor-based program which converts Loran-C receiver output into useful piloting information for transits in restricted waterways. The operator is given both digital and graphic displays, selected via an accompanying keypad.

Deployment of several PILOT systems in the St. Marys River resulted in greater than anticipated user acceptance and enthusiasm. Although the evaluation in the St. Marys River was intended to complete the Coast Guard's role in user equipment development, the Coast Guard has continued to study PILOT's applications in other environments. Recent examples include demonstrations on the St. Lawrence Seaway and in the Strait of Juan de Fuca (State of Washington). The latter resulted in a decision by the U.S. Navy to procure Loran-C-based PILOT-type equipment for its submarines.



PILOT gives the operator both digital and graphic displays.

The Office of R&D has published a report describing operation of the PILOT equipment and its software. The report is entitled "PILOT—A Precision Intracoastal Loran Translocator." Volume 1 (Users Manual) and Volume 3 (Software) are available from the National Technical Information Service (NTIS), Springfield, Virginia 22161, with the following ordering information: Report No. CG-D-21-81, I and III, Accession Nos. AD A123-764 and AD A121-759, respectively.

Identifying mid-ocean sand hazards

Ever since the spectacular collapse of several mid-ocean oil drilling rigs in recent years, engineers have been trying to learn how to avoid unstable areas of the ocean floor where rigs might collapse. Pedro DeAlba of the University of New Hampshire believes he has found a way of identifying unsafe ocean bottom sediments. Rigs sometimes collapse because the unconsolidated sands of the ocean floor liquefy during an earthquake or intense wave action. The energy of the quake forces sand grains closer together, causing the pressure of water between sand grains to rise. At the same time, the pressure the grains exert on each other falls, the grains are forced apart, and anything on top of them collapses.

DeAlba is trying to determine which sands are more prone to liquefaction by measuring the velocities of acoustic waves traveling through the sand. By studying laboratory-prepared samples, DeAlba has learned that the velocities, or acoustic signatures, depend on the composition and packing (whether they were tamped or poured into a sample tube) of the sand. He subjected the samples to forces simulating an earthquake to determine at what point the sample liquefied. DeAlba is now modifying a device that samples ocean bottom sediments to measure sand velocities in the field. Eventually, he hopes to determine liquefaction potential by direct measurement.

A Letter from the Editor

It's time for the *Proceedings* to get a new look. The consensus of a design review group was that the cover of the *Proceedings* was old-fashioned and stodgy-looking. Starting next month, you'll see some changes—primarily a switch to a more contemporary typeface. Look for the new nameplate, shown below.

Our December 1982 issue contained an article on "Safety Films from England." LCDR T. H. Jenkins, Officer in Charge, Marine Inspection, Los Angeles-Long Beach, wrote to inform me that one of the films described, "Fire Below," was no longer available. More importantly, a Canadian distributor serves the U.S. Anyone interested in the films should contact Captain B. F. McKay, ICHCA Canada, P.O. Box 2366, Station D, Ottawa, Ontario, K1P 5W9; tel.: (613) 737-2910. The Canadian distributor has a list of over 150 safety and technical training films on both 16mm and videocassette. Also available are three films on the offshore industry. Ask for the films distributed by Videotel Marine International Ltd.

I hope the *Proceedings'* new look meets with your approval.

Julie Strickler

Proceedings
of the Marine Safety Council

Keynotes

The Coast Guard published the following items of general interest in the Federal Register between March 21, 1983, and April 14, 1983:

Final rules: CGD 12-83-01 Marine Parade; Pacific Inter-Club Yacht Association Opening Day Parade on San Francisco Bay, March 24, 1983. CGD 83-05 COTP Hampton Roads, Safety Zone Regulations, Buck River, Chesapeake Bay, Virginia, March 24, 1983. CGD 03-83-03 Safety Zone Regulations, New Jersey, New York Harbor, Newark Bay, March 24, 1983. CGD 09-83-03 Drawbridge Operation Regulations; Sandusky Bay, Ohio, March 31, 1983. CGD 08-82-02 Drawbridge Operation Regulations; Gulf Intracoastal Waterway, Harvey Canal Route, Louisiana, March 31, 1983. CGD 03-80-03A Anchorage Grounds, Delaware Bay and River, March 31, 1983. CGD 11-17-83 Establishment of Special Local Regulations for the National Jet Boat Association Regatta, March 31, 1983. CGD 11-12-83 Establishment of Special Local Regulations for the "Newport to Ensenada Yacht Race," April 7, 1983. CGD 81-051 Charges for Coast Guard Aids to Navigation Work, April 11, 1983. CGD 82-100(a) Compatibility of Cargoes, Consolidation of Requirements, April 14, 1983. CGD 78-079(a) St. Marys River Vessel Traffic Service, April 14, 1983.

Notices of proposed rulemaking (NPRMs): CGD 05-83-02 Norfolk Harborfest, March 24, 1983. CGD 13-83-05 Drawbridge Operation Regulations; N. Fork, Willapa River, Washington, March 24, 1983. CGD 03-82-010 Drawbridge Operation Regulations; Beaver Dam Creek, New Jersey, March 31, 1983. CGD 03-82-032 Drawbridge Operation Regulations; Schuylkill River, Pennsylvania, March 31, 1983. CGD 09-83-04 Drawbridge Operation Regulations, Manitowoc River, Wisconsin, April 7, 1983. CGD 13-83-07 Regatta, Seattle Seafair Sea Galley Emerald Cup Race, April 7, 1983. CGD 13-83-08 Drawbridge Operation Regulations; Swinomish Channel at Padilla Bay, Whitemarsh, Washington, April 7, 1983. CGD 08-83-01 Anchorage Regulations; Lower Mississippi River, April 11, 1983. CGD 82-096 Unmanned Barges Carrying Certain Bulk Dangerous Cargoes, April 14, 1983.

Notices: CGD 83-008 Guide Clearances for Bridges Across Navigable Waters of the U.S., March 24, 1983. CGD 79-081b Manning Levels of Foreign Tank Vessels, Notice of Withdrawal, March 31, 1983. CGD 83-014 Coast Guard Academy Advisory

Committee, Notice of Meeting, March 31, 1983. CGD 83-015 Ship Structure Committee, Notice of Meeting, March 31, 1983. CGD 83-016 National Boating Safety Advisory Committee, Notice of Meeting, April 7, 1983. CGD 83-017 National Boating Safety Advisory Committee, Request for Applications, April 7, 1983. CGD 83-018 Houston/Galveston Navigation Safety Advisory Committee, Notice of Meeting, April 7, 1983. CGD 83-020 Chemical Transportation Advisory Committee, Subcommittee on Chemical Vessels, Notice of Public Hearing, April 11, 1983. CGD 83-021 Chemical Transportation Advisory Committee, Notice of Meeting, April 11, 1983. CGD 83-022 Lower Mississippi River Waterway Safety Advisory Committee, Notice of Establishment, April 14, 1983. CGD 83-024 Acceptance of Plan Review, Inspection and Examination by the American Bureau of Shipping (ABS) on behalf of the U.S. Coast Guard, Notice of Public Comment Period, April 14, 1983.

Questions concerning regulatory dockets or comments on any of the proposals described below should be directed to the Marine Safety Council at the following address:

Commandant (G-CMC)
U.S. Coast Guard
Washington, DC 20593
Tel.: (202) 426-1477

* * *

Coast Guard and OSHA Sign Memorandum of Understanding

The Coast Guard and the Occupational Safety and Health Administration (OSHA) have signed a memorandum of understanding (MOU) concerning jurisdiction in regard to the occupational safety and health of seamen aboard U.S. inspected and certificated vessels.

In the MOU, the Coast Guard is recognized as the dominant Federal agency with authority to prescribe and enforce regulations and standards governing seamen's working conditions. OSHA has agreed to refer any complaints (except discrimination complaints) from seamen aboard inspected vessels to the Coast Guard. OSHA will continue to enforce laws guaranteeing that anyone reporting substandard conditions will be free from retaliatory discrimination. The Coast Guard has the sole discretion to determine whether the reported conditions are hazardous.

The MOU, which does not affect uninspected vessels, was published in the Federal Register on March 17, 1983.

Confined or Congested Waters (CGD 77-196)

In keeping with the Administration's goal of reducing Federal regulations, the Coast Guard is proposing that requirements for vessels operating in confined or congested waters be deleted from the Code of Federal Regulations. No list of confined or congested waters has been published; therefore, the requirements have never gone into effect. Since different congested areas have different characteristics, the Coast Guard feels that prescribing one set of instructions would not provide enough flexibility for the various situations that might arise. Maintaining a list of confined and congested waters would be burdensome to the public and the Coast Guard.

The Coast Guard feels that prudent seamanship, the use of regulated navigation areas, and dissemination of information on particular situations will be adequate to ensure safety in congested waters.

The NPRM on this matter was published in the Federal Register on April 14, 1983.

Reception Waste Facilities (CGD 78-035)

The Coast Guard is soliciting public comment on all aspects of a suggested regulatory scheme for implementing the waste reception facility requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78). The Convention and its annexes require that facilities be provided to receive the operational wastes discharged from seagoing ships at ports and terminals serving them and at shipyards.

The advance notice of proposed rulemaking describing the regulatory scheme envisioned by the Coast Guard was published in the Federal Register on March 24, 1983. Comments on the proposed scheme should be received by the Marine Safety Council by June 22, 1983.

Ocean Thermal Energy Conversion Facility and Plantship Requirements (CGD 80-161)

On April 11, 1983, the Coast Guard published in the Federal Register a rule dealing with marine environmental protection and safety of life and property at sea as related to Ocean Thermal Energy Conversion (OTEC) technology.

The Coast Guard recognizes that OTEC technology is not yet sufficiently developed to permit a determination at this time of all safety or environmental hazards that may be posed by OTEC construction and operations. The rulemaking is intended to provide the OTEC industry with a clear definition of the initial general regulatory requirements the Coast Guard is establishing under the Ocean Thermal Energy Conversion Act of 1980. This should provide guidance to the emerging industry as it develops plans for commercialization of this alternate energy source.

The regulations resulting from this rulemaking will primarily affect prospective OTEC licensees and related private-industry support interests. General navigation interests may be affected by OTEC facility and plantship navigation movement, marking, and general aids-to-navigation requirements.

Casualty Reporting Requirements (CGD 82-069)

In a rule published in the Federal Register on April 7, 1983, the Coast Guard amended the reporting requirements for vessels involved in marine casualties. The costs of salvage, cleaning, gas freeing, and drydocking will no longer be considered in estimating damage costs. The current reporting threshold of $25,000 remains in effect.

Actions of the Marine Safety Council

At its April meeting, the Marine Safety Council approved further action on the following items:

CGD 83-012 Miscellaneous Amendments to Certifications, Safe Loading and Flotation Regulations for Recreational Boats

Recently the National Boating Safety Advisory Council (NBSAC), a congressionally-mandated advisory body to the Coast Guard, reviewed all the regulations issued by the Coast Guard's Office of Boating, Public, and Consumer Affairs. It recommended the elimination of some sections which were no longer necessary or did nothing to promote boating safety. As a result of the NBSAC recommendations, the Coast Guard will propose that:

1) two tables that applied to boats constructed between July 1973 and August 1978 be eliminated. Since the applicable dates have passed, there is no longer any need for the tables.

2) a Coast Guard-generated flotation table be eliminated and replaced with one that has been approved by the American Boat and Yacht Council.

3) references to a label which no longer exists be eliminated.

4) costly requirements for stability tests for larger boats (with a person capacity of over 550 pounds) be deleted.

An NPRM with the proposed changes should be issued this summer.

CGD 82-013 Use of LPG on Vessels Carrying Passengers for Hire

This proposal would allow the use of LPG stoves on vessels which carry passengers for hire. Up until now the use of LPG has been prohibited because LPG is heavier than air and would pose a safety hazard if a leak were to develop. However, the Coast Guard believes that the fuel is safe if used properly. Indeed, there is some evidence that LPG may be as safe as or safer than some of the presently approved fuels.

An NPRM should be issued this summer. ‡

TSAC Meeting Scheduled

The next meeting of the Towing Safety Advisory Committee (TSAC) is scheduled for July 20, 1983, in Room 3201 at U.S. Coast Guard Headquarters. The meeting will last from 9 a.m. to 4 p.m. It is open to the public, and oral or written statements may be presented to the committee. For further information, write Executive Secretary, Towing Safety Advisory Committee (G-CMC/44), U.S. Coast Guard Headquarters, 2100 Second St. SW, Washington, DC 20593, or call (202) 426-1477. The agenda for the meeting will be published in the Federal Register in mid-June.

Next Volume of Light List Released

Volume IV of the Coast Guard's 1983 Light List, Great Lakes (CG-159), is now available.

Volume IV covers lights, fog signals, buoys, daybeacons, radiobeacons, racons, and Loran stations on the Great Lakes and the St. Lawrence River above St. Regis. Also listed are certain lighted aids, fog signals, and radiobeacons maintained by Canada.

Volume IV of the Light List can be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, or obtained from GPO branch bookstores in cities across the country or GPO sales agents located in principal seaports. The cost is $9; the stock no. is 050-012-00182-1.

Two New NVICs Issued

The Coast Guard has issued two new Navigation and Vessel Inspection Circulars, Nos. 1-83 and 2-83.

NVIC 1-83 is entitled "Painters for Life Floats and Buoyant Apparatus." Vessel owners/operators must comply with requirements for a new painter arrangement by September 20, 1983. This NVIC is intended to provide them with the information they need. Covered in the NVIC are construction and performance standards for the painter, instructions for attaching it to a vessel by a float-free link, and stowing guidelines for the life floats and buoyant apparatus. Illustrations are provided.

NVIC 2-83 is entitled "Smith & Wesson Line Thrower Rockets." The Coast Guard has terminated its approval for these rockets because of incidents of malfunctioning. The NVIC tells what procedures should be followed for replacement.

NVIC orders should be directed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. A check or money order payable to "Superintendent of Documents, Government Printing Office," should be enclosed with each order. The cost of NVIC 1-83 is $2.50 per copy; NVIC 2-83 is $1.75 per copy.

NVIC subscribers will receive Nos. 1-83 and 2-83 automatically. Coast Guard personnel can obtain copies from Commandant (G-MP-4).

Next Bulk Chemicals Conference Scheduled

MariChem 83, the fifth conference in the industry's series for those involved in the marine transportation, handling, and storage of bulk chemicals, will be held October 18 - 20 at the Congress Centrum Hamburg.

MARPOL 73/78, the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978, will go into effect October 2, 1983. Most of the opening session of MariChem 83 will be devoted to MARPOL, in particular the mandatory provisions of Annex II, Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk, which will enter into force October 2, 1986. MariChem 83 will examine this Annex as it affects the design, construction, and operation of chemical tankers. Emphasis will be placed on practical effects and what operators need to do to prepare for the Annex's implementation.

The second session will be devoted to Operations and Safety, with papers covering important aspects of the hazards and necessary emergency procedures associated with chemical carrier operations. Session three will deal with Tank Containers in the Chemical Trades, and session four will cover such Technical Developments as the inert gas issue and developments in tank cleaning, level gauging, and materials selection.

Also planned for MariChem 83 are a technology exhibition and technical and sightseeing tours.

Details on the conference and registration forms are available from:

MariChem Secretariat
2 Station Road
Rickmansworth
Herts WD3 1QP
England

The "Proceedings" of two previous conferences are available from the same address: MariChem 82 (£ 40 or equivalent in other currencies) and Gastech 82, the Ninth International LNG/LPG Conference (£ 50 or the equivalent in other currencies).

Report on Accuracy in Ship Construction Available

The Maritime Administration has released a technical report entitled "Accuracy Control: A Guide to Its Application in U.S. Shipyards." This publication provides the basis for any American shipyard to initiate and operate an accuracy control system during ship construction.

The study was prepared by the University of Washington at the Tacoma Boatbuilding Co. in Tacoma, Washington. It provides a detailed case study of accuracy control planning, execution, and evaluation. The results are based on actual on-site planning, measuring, and analysis of the stern section of two U.S. Navy T-AGOS vessels under construction. Specific emphasis was placed on the steering gear compartment.

Copies of the 160-page report are available from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The order no. is PB83-183087; the price is $16.

Tanker Safety Conference Scheduled

The Fifth International Tanker Safety Conference (INTASAFCON 5), the largest tanker safety conference ever organized by the international shipping industry, will be held October 4 - 7, 1983, at the Athens Hilton in Athens, Greece.

INTASAFCON will feature papers by international experts on various aspects of tanker operations, including ship structure, training and manning, and the relative responsibilities of governments and industry. The conference is being sponsored by the International Chamber of Shipping (ICS), an organization of national shipowners associations in 30 countries, and will be chaired by Andreas K. L. Ugland, Chairman of the ICS Tanker Committee.

Full details and registration forms are available from:

Conference Secretary
INTASAFCON 5
International Chamber
of Shipping
30/32 St. Mary Axe
London EC3A 8ET
England

Barge Fleeting Being Studied in Louisiana

Federal, state, and local officials in New Orleans have announced a new study of problems associated with river barge fleeting facilities and services on the Lower Mississippi River.

Barge fleeting, as a maritime term, pertains to the storage and shifting of barges in a port or terminal area.

Says John Pisani, Director of the Maritime Administration's Office of Port and Intermodal Development: "The fleeting of barges is both a growth and a growing problem on the inland waterways. Environmental issues and other mooring problems related to land use along the waterways are already serious concerns. As our economy improves and barge traffic increases—as it is projected to do—, fleeting could become critical—unless preventive action is taken now."

The Louisiana study will describe and assess the projected volume of commodities and barge traffic based on these volumes to the year 2000 in the Lower Mississippi River/Louisiana area. Existing fleeting practices will be reviewed. This review will cover present sites, current fleeting patterns, capacity and throughput limitations, traffic congestion, navigational safety, environmental concerns, and new intermodal technologies.

The end product of the study will be an integrated, region-wide management plan for barge fleeting in the Lower Mississippi River/Louisiana area. If used as anticipated by the shipping community, the plan is expected to decrease congestion, improve safety and navigation, decrease barge delays, reduce operating costs, and improve efficiency and barging productivity.

The management plan will serve as a prototype for other regions of the national inland waterways system. The results of the study will be shared with any U.S. port and terminal operator having use for such information. ⚓

Hazardous Materials

by Ron Bohn

A Quiz on Basics

Some of you may have wondered if you were sufficiently informed about regulated cargoes to be responsibly involved with such shipments. If that question has come to mind, then compliment yourself. Such personal concern is the very core of a conscientious and professional approach to the subject of hazardous materials (as DOT calls them) and dangerous goods (the term used internationally by IMO and ICAO).

The following informal quiz may help you gauge the extent of your present knowledge of the rather basic aspects. These true-or-false statements apply to containerized ocean shipments of packaged regulated commodities. Check "T" if the statement is entirely true and "F" it is in any way incorrect.

Q 1. The two basic references applicable to hazardous materials/dangerous goods are 49 CFR (Title 49, Code of Federal Regulations, Parts 100 - 199 two volumes) and the IMDG Code (International Maritime Dangerous Goods Code of the IMO, London, in five volumes).

☐ T ☐ F

Q 2. The DOT and IMO definitions and criteria are similar. It is possible, however, for a material or article to qualify as a regulated commodity by one but not the other.

☐ T ☐ F

Q 3. A carrier may not accept any hazardous material without the shipper furnishing *written* information (in the form of properly prepared shipping papers) *at the time of delivery* to the carrier.

☐ T ☐ F

Q 4. The three basic, *required* elements of hazardous materials descriptive information, and their prescribed sequence on the shipping papers, are: (1) the commodity's "proper shipping name," (2) the hazard class applicable to that name, (3) the identification number ("UN," for export) for that material.

☐ T ☐ F

Q 5. If the commodity does *not* require the 4" x 4" diamond-shaped hazard label to be applied to the package, then that indicates the commodity is *not* regulated by DOT or covered in the IMDG Code.

☐ T ☐ F

Q 6. Any generally acceptable type of packaging is permitted for hazardous materials/dangerous goods if it bears the appropriate hazard label and proper shipping name concerned.

☐ T ☐ F

Q 7. 49 CFR permits use of IMO shipping descriptions, hazard classifications, and labeling *in place of* the DOT descriptions, classes, and labeling for ocean export or import shipments *unless* radioactive materials or explosives class A or B are involved.

☐ T ☐ F

Q 8. The shipper of a freight container in which there is any quantity of regulated materials must apply the correct hazard placards (both sides, both ends) *and* must secure the container contents to prevent movement in any direction before offering the container to a carrier.

☐ T ☐ F

Q 9. *Both* the 49 CFR Hazardous Materials Tables, 172.101 and 172.102, contain specific segregation requirements applicable to many of the listed materials.

☐ T ☐ F

Q 10. The IMDG Code also has direct equivalent classifications for what DOT calls hazardous wastes, hazardous substances, Other Regulated Materials (ORMs), and Consumer Commodities.

☐ T ☐ F

Q 11. If a commodity is *not listed by its tariff description* in 49 CFR or the IMDG Code, then that indicates the commodity does *not* qualify as either hazardous material or dangerous goods.

☐ T ☐ F

Q 12. Civil penalties for violation of hazardous materials regulations can be $10,000 per violation, per day of violation continuance. Criminal penalties are also provided for, with $25,000 fines and/or five-year prison terms for willful violations.

☐ T ☐ F

Answers (Section numbers referenced are from 49 CFR):

1. True. See sections 171.2 plus 171.12, 176.11, and 176.27. 49 CFR refers to "IMCO," the former acronym for what is now IMO. (Name changed May 1982)

2. True. DOT and IMO criteria differ, especially for flammable liquids, poisons, and corrosives. Commodities that do not qualify as DOT-regulated hazardous materials *could* therefore qualify as IMO dangerous goods.

3. True. Note 176.52(a) plus 176.3(a), 176.24.

4. True. See 172.201 and 172.202. Note, however, the additional descriptive information requirements of 172.203 when documenting radioactives, limited quantities, and hazardous substances.

5. False. There are *regulated* materials and articles that do *not* require hazard class labeling. Examples: small arms ammunition, limited quantities (other than poisons), ORMs, and IMDG class 9s.

6. False. Although "strong outside packaging" applies to several ORMs, it is normally required that DOT specification packaging be used. Note section numbers, given in column 5(b) of the "101" Table, that should be checked to see the range of packaging choices permitted by DOT. Details of the various package specifications are given in 49 CFR, Part 178.

7. True. See 171.12(b) and (d) plus 176.11(2)(i). Note, however, that the IMO info may be shown *after* the required DOT info, according to 172.201(a)(4).

8. True. See 172.504 and 176.76(a)(2). Note that the shipper's certification (172.204) commits the shipper's compliance with *all* "the applicable regulations of the Dep't. of Transportation." That *includes* securing requirements of 176.76.

9. True. Note the column 7(c) requirements in *both* tables. Regulated materials often must be kept away from *non*regulated commodities such as foodstuffs, powdered metals, and organic materials, as well as dissimilar hazard classes. Basic segregation of the classes, as shown in table II of section 176.83, applies to container contents as well as aboard a vessel.

10. False, but that does not mean they do not qualify as IMO dangerous goods. The shipper has to determine the nearest IMDG Code equivalents according to the characteristics and properties of the material concerned. CAUTION: hazardous wastes may *not* be offered for transportation unless the shipper *and* carrier(s) have gotten an EPA identification number and shippers use the prescribed EPA Hazardous Waste Manifest in addition to their other normal shipping papers. See 172.203, 172.205.

11. False. There is *no* connection between tariff descriptions and DOT proper shipping names or IMO's correct technical names.

12. True. See 107.343 and 107.371. Those penalties are as applicable to *individuals* as they are to firms.

Ron Bohn is hazardous materials manager for Hapag-Lloyd Agencies, New York. His column on Hazardous Materials appears every four weeks in Brandon's Shipper & Forwarder, *from which this article is reprinted.*

by Kenneth M. Theurer

This is the second in a series of five Chemicals of the Month written by guest authors—chemistry students at the Coast Guard Academy in New London, Connecticut.

Vinyl Acetate: $CH_3COOCH{=}CH_2$

Synonyms:	VAM acetic acid vinyl ester vinyl a monomer
Physical Properties	
boiling point:	73°C (163°F)
freezing point:	-93°C (-135°F)
vapor pressure at	
20°C (68°F):	90 mm Hg
46°C (115°F):	300 mm Hg
Threshold Limit Values (TLV)	
time weighted average:	10 ppm; 30 mg/m^3
short term exposure limit:	20 ppm; 60 mg/m^3
Flammability Limits in Air	
lower flammability limit:	2.6% by vol.
upper flammability limit:	13.4% by vol.
Combustion Properties	
flash point (c.c.):	-8°C (18°F)
flash point (o.c.):	-1°C (30°F)
autoignition temperature:	427°C (801°F)
Densities	
liquid (water = 1.0):	0.94
vapor (air = 1.0):	2.97
Identifiers	
U.N. Number:	1301
CHRIS Code:	VAM
Cargo Compatibility Group:	13 (Vinyl Acetate)

If you've ever seen a broken windshield, you've seen this issue's Chemical of the Month at work providing an important health benefit. Vinyl acetate is one of the materials used to make the plastic that goes between the two sheets of glass in safety glass. When the windshield is shattered, the plastic remains intact and holds the broken pieces together.

Vinyl acetate is also used in making latex paints and in textile finishing. It becomes even more useful when it is paired with other chemicals to form the long chains of molecules known as polymers. As a "copolymer," it forms a tough, flexible product with good chemical resistance. It is often mixed with vinyl chloride, the first widely manufactured vinyl resin and one which lacks the properties of toughness and flexibility. The resulting copolymers are used in the manufacture of luggage, molded plastic products, electrical insulation, and foam. Open-cell foam (foam that "breathes"), used for upholstery, is made by bubbling air through the chemical mixture. Closed-cell foam is made by heating the polymer with a chemical additive so that tiny bubbles are formed. This type of foam is used in making flotation devices—an appropriate product for this month's issue, with its two articles on PFDs—and for insulation.

If the copolymers contain a high ratio of vinyl acetate, they lend themselves to use in such products as adhesives and emulsion paints. If acrylonitrile is added to the vinyl acetate-vinyl chloride copolymer, the resulting molecule becomes a "terpolymer." Those of you who have bought boat covers made of Dynel® have held this polymer in your hands. Dynel® is also used to make, among other things, athletic field covers, awnings, (those at the White House, for instance), wigs, and doll hair.

In its unpolymerized state, vinyl acetate is a sweet-smelling, colorless liquid. While it is not especially dangerous to transport (if handled properly), it should be borne in mind that vinyl acetate is 1) reactive, 2) mildly toxic, and 3) flammable. Heat or moist air may cause it to begin self-polymerizing, or reacting with itself. Chemicals designed to inhibit this tendency are often added for safe transportation and handling. One frequently used inhibitor is hydroquinone (HQ), 14 to 17 parts per million of which is usually sufficient to prevent unwanted polymerization.

Because vinyl acetate is mildly toxic, certain precautions should be taken with it. Those handling the chemical or cleaning a spill should wear a breathing apparatus and protective clothing. Exposure to high-concentration vapors is known to have a narcotic effect and may result in temporary incapacitation. Exposed skin or eyes may be irritated by the "defatting" action of the chemical. As is the case with any chemical, exposed skin areas should be washed well and the eyes, if affected, promptly flushed with plenty of water.

Since vinyl acetate is flammable, common sense dictates that it never be exposed to an open flame. If a vinyl acetate fire should break out, it can be extinguished with foam, carbon dioxide, or dry chemical. Firefighters should make sure they have respiratory protection.

Vinyl acetate is transported in bulk by tank truck, railroad, barge, and tank ship. It is advisable to keep the chemical dry during transport and to ensure that ventilation is adequate. Care must also be taken to keep it separated from cargoes that might induce oxidation (such as chlorine bleach or fertilizer).

The U.S. Coast Guard regulates vinyl acetate for shipment in tank ships and tank barges in Subchapter O of Title 46 of the Code of Federal Regulations. The U.S. Department of Transportation regulates it as a flammable liquid. Vinyl acetate is also regulated by IMO, the International Maritime Organization, which puts it in Chapter 6 of its Chemical Code (chemicals to which the Code applies). It can be found on page 3111 of the IMDG (International Maritime Dangerous Goods) Code, and it is assigned a Hazard Class of 3.2.

Kenneth M. Theurer is a second-class Cadet at the Coast Guard Academy. He wrote this article in connection with a class on hazardous materials transportation taught by LT Thomas J. Haas. Technical assistance was provided by personnel in the Cargo and Hazards Branch at Coast Guard Headquarters.

Man Overboard!

The subject of February's Lessons from Casualties section was a fatality that resulted when a man fell overboard from a fishing vessel in the winter. The man perished because the men on the boat were not able to bring him back on board quickly enough. Even though he was being held next to the boat, he died of exposure (hypothermia).

A reader wrote to us and commented that the case was "depressingly familiar." He asked for suggestions for ways to retrieve a seaman from the water, particularly if the man were heavily clad, as he would be in winter. It's a good question and one not easily answered, especially in the context of fishing vessels with small numbers of people on board.

Given the variety of vessel designs and rigs for different fisheries and the many other types of vessels at sea, it is difficult to make any generalizations. The basic answer is that the crew should plan for such an occurrence. Going overboard is not a pleasant prospect for anyone, but if thought is devoted to this subject in advance, lives can be saved--maybe yours.

The first thing to look for is the hazard that will send someone over the side. The article in February described a trawl rig that seemed to be carefully designed. When stowed, however, it had a tendency to snag in such a way that a crew member would have to reach outboard of a trawl door secured at the edge of the work deck to release it. This appears to have cost a life. Tripping hazards, slippery decks, narrow walkways at the side of the vessel, low or nonexistent rails and safety lines, machinery and rigging that might knock someone over the side, sources of oil or grease on deck--look at the design and cleanliness of the vessel and think about the people who must use it. A change in design or perhaps in operating rules or training may be needed.

These steps are absolutely necessary, but they will probably never be completely effective. Seamen are going to fall overboard because of the forces of the sea even if a vessel is properly designed. So--

The next step is emergency planning. Look at your particular vessel--generalizations are of no use here. Is there emergency equipment available? Life rings (one with a line attached), personal flotation devices (life jackets or work vests), life rafts, lifeboats, exposure suits? When conditions are bad, seamen should wear appropriate safety devices. The other devices should be readily available for emergencies.

So far we have tried to keep anyone from falling overboard and then tried to keep him from drowning if he does fall overboard. How can the victim be brought back aboard?

In the case described in February, the master of the fishing vessel, after vainly trying other methods, launched an inflatable raft, dragged the victim into the raft, and then hauled him aboard the vessel, using a cargo boom. This is the kind of procedure you can expect to see in many cases. Begin by planning for it. Look at your particular vessel, how it is configured and how it is equipped. How high are the sides and gunwhales? Is there a stern ramp? Is a skiff normally carried? Is there a cargo boom? Assume that someone (maybe you . . .) is going to go over the side in cold weather. Assume that that someone cannot help in his own rescue because he is suffering from exposure. Assume that the rescuer will also be affected by the cold. Rescue must be quick, or the person will die. This is a matter of life and death, which is the assumption that should always be made when someone falls overboard, even in moderate temperatures. In moderate temperatures (water above 60°F), a life ring with a line attached and a ladder over the side may work if used quickly. Below moderate temperatures or after some time has passed, the person in the water will not be able to climb a ladder and may not be able to hold on to the life ring.

DO SOMETHING—or watch him die. First, prevent drowning—support his head, keeping it out of the water. Second, get him out of the water. If only one person is left on board, that person should try to pull the victim aboard. Often, this is not possible. It may be necessary to tie the victim to the side of the vessel in order to get the equipment needed to bring him aboard. Don't strangle him. The life raft and hoisting boom technique used by the master in the incident described in February is possibly the best one. A skiff may also be useful, depending on its design and capabilities. Don't agonize over the cost of the life raft or the hassle of having it repacked—get it into the water quickly and tie it securely to the vessel. Some life raft painters purposely have a weak spot in them so the raft will break free if a vessel sinks; if this is true of yours (check ahead of time in a review of emergency plans), use a different line to secure the raft. Pull the victim into the raft.

Now a winch and boom are needed. A winch alone would probably pin the victim to the gunwhale or side of the vessel and kill him. If there is a cargo boom free, use it. Tie the line to the victim's life preserver if it is properly secured. If he is not wearing one, tie the line around the victim's chest under his arms. Do not use a slip knot—this is not an execution. If the victim is not able to keep his arms down, there is a danger that the sling will slip up and off. Tie a piece of line to the sling and run it down one side, between the legs, and back up the other side; tie it to the sling on that side. Have a knife ready to cut these lines off if necessary when the victim is hoisted onto the deck.

But what if there is no cargo boom available? What other booms are on board? There are working booms for the fishing gear—use one. This is a matter of life and death. If you plan for such occurrences, you can make a decision in advance as to the quickest (and most economical) way to have access to a working boom. Cutting a large net loose could be expensive, particularly if no plans are made to provide for the salvage of the net, but what is a human life worth? Decide ahead of time and be prepared to act quickly, because there will not be time to agonize over it or think about alternatives when an accident happens. Make plans right now.

Hoisting a heavily clad seaman back on board a vessel has shown up as a serious problem in several death cases. It is a challenge, but by thinking ahead, noting the particulars of your vessel, and having a few pieces of equipment available, you can be successful.

This article was written by John A. Crawford, an analyst in the Office of Merchant Marine Safety. ⚓

Ample Clearance

Dutifully following standard procedures and getting all your calculations right won't help you pass under a bridge safely if you overlook the obvious.

by LT Gerald Jenkins

On the afternoon of June 8, 1982, a cargo boom on the bulk cargo carrier NOVA GORICA struck New Orleans' Huey P. Long Bridge as the vessel was passing underneath traveling upbound on the Mississippi River. The only damage to the vessel was a bent cargo boom. The bridge suffered approximately $200,000 damage to its vehicular lanes and understructure, requiring that those lanes be closed for 16 days while repairs were made. The cost to commuters and transporters of goods cannot be calculated.

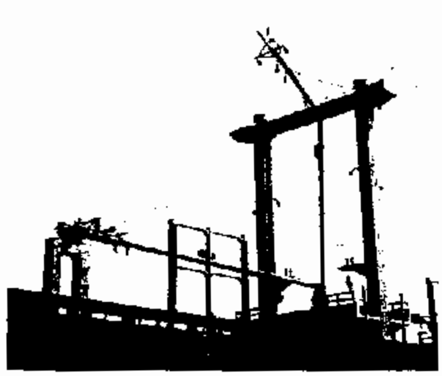
The pilot on board had correctly computed the clearance under the bridge and conveyed this information to the ship's officers. The watch officer, in turn, had computed the height above water (air draft) of the ship's radar mast and assured the pilot of an ample clearance. The radar mast was the highest point on the vessel in the ship's general plans, which depicted the mast as towering over the cargo booms. In the depiction, the latter were placed at about a 40° elevation.

When raised to maximum elevation, the vessel's cargo booms exceed the radar mast in height. As the NOVA GORICA passed under the bridge, the No. 2 cargo boom, which was being used to move hatch covers, was near its maximum elevation. The height of that boom was further increased by a shallow draft forward, as the vessel had deballasted for cargo loading. As a result, the ample clearance which existed over the radar mast did not exist for the cargo boom.

At maximum elevation, the NOVA GORICA's cargo booms exceed the vessel's radar mast in height.

Unfortunately, accidents caused by incorrect determination of vessel height are not that uncommon. This type of error resulted in three collisions with the Huey P. Long Bridge during the month of June 1982 alone.

Incidents like this point out the need for careful consideration of such factors as:

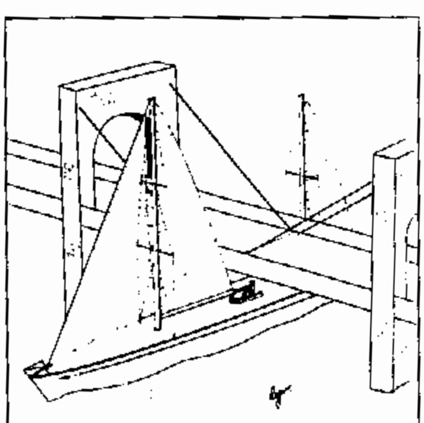


Slender as this (now bent) cargo boom is, it caused $200,000 damage to the Huey P. Long Bridge.

- What is the highest point on the vessel?
- Where is it located and how was its height determined?
- Was vessel trim considered? Is the trim expected to change during the transit?
- Will any tall structures on the vessel (booms, etc.) be moved during the transit? If so, what effect will this have on the vessel's air draft?

Unless there is absolutely no question that a vessel will clear, a thorough discussion by the master and the pilot of these factors and others that affect a vessel's air draft is necessary to ensure safe passage under a bridge. ⚓

LT Jenkins is currently attached to the Inspection Department of the Marine Inspection Office in New Orleans. When he wrote this article, he was serving as an Investigating Officer in MIO New Orleans' Investigations Department.



"Say Rod, would you come on deck a minute?"

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:

DECK

1. Which statement is true concerning combustible gas indicators?

A. One sample of air is adequate to test a tank.
B. They do not work properly where there is a lack of oxygen.
C. They will detect a lack of oxygen.
D. They are calibrated to read the lower explosive limits (LELs) of all poisonous gases.

REFERENCE: Tanker Operations, G. S. Marton

2. The mechanical advantage of a two-fold purchase rove to advantage is

A. three.
B. four.
C. five.
D. six.

REFERENCE: MMOH - Merchant Marine Officers Handbook, 4th Edition

3. In restricted visibility, when "man overboard" is heard, the ship would make a(n)

A. Anderson turn.
B. 180° turn.
C. half turn.
D. Williamson turn.

REFERENCE: Knights Modern Seamanship, 16th Edition

4. A shot of anchor chain consists of

A. 6 fathoms.
B. 12 fathoms.
C. 15 fathoms.
D. 45 fathoms.

REFERENCE: International Maritime Dictionary, 2nd Edition

5. In the construction of tank vessels, which bulkheads need not be of class A construction?

A. Bulkheads in stair towers
B. Corridor bulkheads in accommodation areas
C. emergency-generator-room bulkheads
D. galley bulkheads

REFERENCE: 46 CFR 32.57-10

ENGINEER

1. An excessive power loss in a straight reaction turbine is commonly caused by

A. improper nozzle angle.
B. excessive fluid friction.
C. leaking diaphragm packing.
D. excessive tip leakage.

REFERENCE: Osbourne

2. In a single-acting, two-stroke-cycle diesel generator engine, the power impulse in an individual cylinder occurs

A. once every crankshaft revolution.
B. once every two crankshaft revolutions.
C. once every piston stroke.
D. twice every piston stroke.

REFERENCE: Stinson

3. Turbulence in the combustion chambers of a diesel engine may be traceable to

A. delayed ignition.
B. increased clearance volume.
C. directional intake ports.
D. multi-orificed fuel nozzles.

REFERENCE: Stinson

4. Which type of A.C. single-phase motor will also operate on direct current?

A. Split-phase
B. Series
C. Shaded-pole
D. Repulsion-start

REFERENCE: Nav Pers

5. Insufficient air for combustion in a boiler furnace could result in

A. a white incandescent flame.
B. a high flame temperature.
C. black stack smoke.
D. 0% carbon monoxide.

REFERENCE: Latham

ANSWERS

DECK
1.B;2.C;3.D;4.C;5.B
ENGINEER
1.D;2.A;3.C;4.B;5.C

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

Correction

The answer given for question No. 4 in the DECK section of March's Nautical Queries was incorrect. The question began, "If magnetic north is to the right of compass north . . ." The correct completion is B, "deviation is east."

Clarification

Deck Question No. 4 of January's Nautical Queries dealt with the meaning of the numeral appearing above the small green arrows used on Pilot Charts to indicate expected currents. Captain Lawrence E. Worters, Director of Training for the United New York and United New Jersey Sandy Hook Pilots' Benevolent Associations, took issue with the answer given, "The mean speed in nautical miles per day." The Coast Guard Institute's response to Captain Worters reads as follows: "The problem with the question resulted from the fact that the legends mean different things on different charts. On the North Pacific Pilot Charts, the numerals by the arrows did indicate nautical miles per day. On the North Atlantic Charts they indicate, as you point out, the speed in knots. Please rest assured that this question will be revised."

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