PROCEEDINGS
OF THE MARINE SAFETY COUNCIL

VOL. 36, No. 10

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HAPPY

HOLIDAYS

U.S. Department of Transportation
U.S. Coast Guard

CG-129

PROCEEDINGS
OF THE MARINE SAFETY COUNCIL

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Season's Greetings

There could be no more appropriate time than the joyous Christmas season for us in the Maritime Community to rededicate ourselves to the traditional concern for the safety of others which, since the beginning of time, seamen have extended to their fellow man in the often unforgiving marine environment. As the new year dawns, it is also a time to address ourselves to the challenges which the decade of the 1980's will present to marine safety. I wish each of you Godspeed and health as we begin the new year.

J. B. HAYES

Admiral, U.S. Coast Guard, Commandant

maritime sidelights

TANK OVERFILL CONTROL SYSTEMS POSSIBLY HAZARDOUS

The Coast Guard Office of Merchant Marine Safety's Chemical Engineering Branch has revealed potential hazards in tank overfill control systems using automatic quick closing shutoff valves and remotely actuated quick closing valves.

Under 46 CFR 153.408 (A)(2), a tank overfill control system must automatically close the filling line before the tank is filled to 98 percent of its capacity. Many systems have incorporated an automatic quick closing shutoff valve to fulfill the requirement.

There is increasing concern over the safety and reliability of the automatic valves. Many feel this type of valve can create surge pressure great enough to rupture a transfer hose or cargo line.

The remotely actuated quick closing valve required under 46 CFR 153.253, though not actuated automatically, operates in the same manner and could possibly created excessive surge pressures when closed. Section 153.253 is being reevaluated in conjunction with standards for automatic tank overfill control systems.

Until Part 56 CFR 153 is revised, Sections 153.253 and 153.408 (A)(2) will not be enforced.

Questions may be directed to the Chemical Engineering Branch, Coast Guard Headquarters, (202)426-1217.

(Reprinted from the *Port Safety Bulletin*)

Continued on next page.....

MARITIME SIDELIGHTS.....

HYPOTHERMIA CONFERENCE DATE CHANGE

The International Hypothermia Conference, noted in this column in our October issue, has been rescheduled for January 23-27, 1980. As far as we know, all other details remain unchanged. The conference and related workshop will be held at the University of Rhode Island, Kingston and will feature the world's leading experts in hypothermia research and treatment.

For further information write to: International Hypothermia Conference, University of Rhode Island Marine Advisory Service, Narragansett, RI 02882.

PROPELLER CLUB ANNOUNCES NATIONAL MARITIME ESSAY CONTESTS

Prize trips on American ships to the Mediterranean, South Africa, Europe, the Orient, the Caribbean and South America; coastal cruises on Atlantic, Gulf and Pacific Coasts; and Great Lakes, Mississippi and Ohio River trips are being offered to high school students throughout the United States as national prizes in the 45th Annual Harold Harding Memorial Maritime Essay Contest of The Propeller Club of the United States and its member local Propeller Club Ports.

Cash prizes of $500, $400, $300 and $200 are also being offered to college students as national prizes in the Fourth National Maritime Essay Contest. This contest is also sponsored by The Propeller Club and its local chapters throughout the country.

Captain William V. Figari, National President, in announcing these contests, stated "The contest for high school students has been held successfully for 44 years to broaden the education of teenage students in maritime matters of vital importance to our country, and acquaint our younger generation with the necessity of a strong Merchant Marine and maritime industry for our economic welfare and national security." He continued, "In addition to the high school contest, The Propeller Club and its local clubs will again conduct an essay contest for college students. This contest will offer a challenge and opportunity for young men and women to increase their awareness, and that of the public generally, as to the vital role that our Merchant Marine plays in the National interest by insuring the effective carriage of our commerce overseas and on our Inland Waterways and Great Lakes."

The theme of the 1979-1980 high school essay contest is "Our Merchant Marine, Ocean, Great Lakes and River Vessels--for Energy and Trade." Themes for the college essay contest are to be chosen by contestants but must be based on Merchant Marine and maritime-related objectives stipulated by The Propeller Club.

Both contests close March 1, 1980. National Prize Winners will be announced on National Maritime Day, May 22, 1980. Last year 19 high school students won National Prize voyages, 2 won cash prizes and 2 honorable mention. In the college student category four students won the cash prizes and six students received honorable mention.

For full details contact local Propeller Clubs or The Propeller Club of the United States, 1730 M St., NW, Washington, DC 20036.

MSC OFFERS SEAGOING JOBS

Jobs may be tight in certain areas of the maritime industry, but definitely not with the Navy's Military Sealift Command (MSC). Civilian positions paying up to $47,000 a year with overtime opportunities are available with MSC.

Although a Navy organization, MSC employs 4,000 civilian seamen who man dry cargo ships, tankers, replenishment ships that support Navy combat vessels, and other ships that are involved in ocean surveys, the space flight program and a variety of research efforts.

Seagoing mariners are Navy Civil Service employees and may transfer from one ship to the other. They receive normal Civil Service benefits but their pay and work rules are based on those in the maritime industry.

Civilian jobs for which MSC is recruiting include first and second mates, steam and diesel engineers, able-bodied seamen, oilers, firemen-watertenders, electricians, machinists, pumpmen, cooks and bakers. Particularly desired are former Navy men experienced in underway replenishment.

While many MSC seafaring positions require some maritime experience and Coast Guard licenses, MSC occasionally needs entry level people with training in carpentry, electrical work, diesel engines, or administration.

Detailed information is available via a new toll free number to MSC headquarters in Washington, DC, 800-424-2739. Additional commercial numbers (NOT toll free) are: East Coast area, (201)858-7602 or -5775; West Coast area, (415)466-5774 or -5775. Or write: Military Sealift Command, U.S. Navy, Washington, DC 20390.

The Tanker Safety and Pollution Prevention package which was discussed in our last issue has been published. The package comprises part V of the November 19, 1979 Federal Register (44 FR 66500). These rules make up Coast Guard dockets (CGD) 77-057 (final rules), 77-058(b)(c) and (d) (interim final rules) and 77-063 (final rules).

The comment period on the Tank Barge Construction Standards projects, CGD 75-083 and 75-083A, has been extended due to continuing public interest. Additional comments will be accepted by the Marine Safety Council (address listed below) until December 1,

Continued on next page.....

1979. Any comments received after that date will not be accepted. The Congressional hearings on these projects have been cancelled. They will not be rescheduled until all information is received from the Coast Guard, which will be after the comment period expires.

Of note to the people on the Lakes are the recently published amendments to the Great Lakes pilotage rules (CGD 78-144b). These amendments change the training and experience requirements for pilots, increase the length of time they may hold their certificates and add some clarification to terms used in the regulations. These amendments were published in the November 8, 1979 Federal Register.

Quite a few of these projects call for an NPRM or rule in December. With the move of Coast Guard Headquarters and the resultant administrative problems, there is a possibility that some deadlines may not be met. The Council would be happy to answer questions on the progress of any of these rules; please don't hesitate to call or write us (address listed at the end of this column).

Parts 1-199 of the 1979 volume of 33 CFR are available from the Superintendent of Documents at this time. Copies may be obtained for $8.50 by writing:

SupDocs
U.S. Government Printing Office
Washington, DC 20402

Titles 46 and 49 have not been received by our office but should be available shortly.

The *Proceedings* would like to receive comments/suggestions on any particular rules or areas of interest that should be included in this column.

Any questions regarding regulatory dockets or companies and individuals wishing to speak at public hearings should notify Captain P. J. Danahy **at our new address:** (G-CMC/TP24), U.S. Coast Guard Headquarters, 2100 Second St. SW, Washington, DC 20593; (202)426-1477.

* * *

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

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

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

As stated in the last issue, these projects have been withdrawn (44 FR 25243). New NPRM's which were anticipated in June have been delayed and are now scheduled for publication later this year under new Coast Guard docket numbers 79-116 and 79-116a.

REVISION OF ELECTRICAL REGULATIONS
CGD 74-125

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

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

An initial NPRM was published on June 27, 1977 (42 FR 32700). A supplemental NPRM will be issued late in 1979.

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

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

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

The new NPRM on tank barge construction, withdrawing the prior NPRM and the ANPRM for existing tank barges, was published as part VI of the June 14, 1979 Federal Register (44 FR 34440 and 44 FR 34443, respectively).

Public hearings were held on the dockets as follows: August 2, 1979, Washington, DC; August 15, 1979, Seattle, WA; August 23, 1979, New Orleans, LA; September 5, 1979, Washington, DC; and September 7, 1979, St. Louis, MO. The comments given at the hearings have been incorporated in the docket.

On Thursday, November 8, 1979 a Federal Register notice extended the comment period on the project. This extension was based on the continued public interest and will run to December 1, 1979.

Anyone wishing to make comments or obtain copies of the rulemaking may do so by contacting Capt. P. J. Danahy, Marine Safety Council **at our new address** (telephone number has not changed) which is given in the introduction to the Keynotes section.

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

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

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

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vention for the Prevention of Pollution from Ships.

The NPRM was published on June 27, 1977 (42 FR 32670). A supplemental NPRM was published October 27, 1977 (42 FR 56625). As stated in the August issue, the draft of the final rule is under legal review prior to publication. It is scheduled to appear in January 1980.

DESIGN AND APPROVAL REQUIREMENTS FOR OIL POLLUTION PREVENTION EQUIPMENT CGD 76-088a

These regulations set out specifications and procedures for approving oil-water separators, cargo monitors, bilge monitors and bilge alarms for use on merchant vessels. They are based upon international design and test specifications adopted by the International Maritime Consultative Organization (IMCO) as Resolution A-393X, and provide standards for equipment that is representative of the best technology presently available.

The final rule, published in the September 13, 1979 Federal Register (44 FR 53352), requires that performance testing of prospective equipment must be done by one of the independent testing laboratories designated by the Commandant (G-MMT). The following laboratories have received authorization to commence testing:

Underwriters Laboratories
Tampa, Florida, USA

National Sanitation Foundation
Ann Arbor, Michigan, USA

University of New Castle
New Castle Upon Tyne, UK

The following three regulations, CGD 77-057, CGD 77-058(b)(c)(d), and CGD 77-063, make up the Tanker Safety and Pollution Prevention (TSPP) Regulations. Public hearings have been held on the package, comments were requested and 541 have been received. A notice of delay in publishing the final regulations was published in the June 7, 1979 Federal Register (43 FR 32713). Final rules have been published and appeared in the November 19, 1979 Federal Register (44 FR 66500).

INERT GAS SYSTEM CGD 77-057

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

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

The Inflationary Impact Statement for this regulation was completed in May 1977. An NPRM was published February 12, 1979 (44 FR 8984). Hearings were held March 21, 1979 in Washington, DC and March 28, 1979 in San Francisco, CA; 136 comments were received and have been evaluated. The final rule is currently being reviewed by the Office of the Secretary of Transportation and should be published by the time this issue is published.

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

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

The NPRM was published May 16, 1977 (42 FR 24868). As a result of the IMCO Tanker and Pollution Prevention Conference of February 1978, a new NPRM was issued on February 12, 1979 (44 FR 8984). Public hearings were then held in March in Washington, DC and San Francisco, CA; 265 comments were received on the docket, and were analyzed and the final rules were formulated. These rules should appear in the Federal Register by the time this month's *Proceedings* is published.

STEERING GEAR DESIGN STANDARDS TO PROVIDE REDUNDANCY CGD 77-063

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

An NPRM was published May 16, 1977 (42 FR 24869). As a result of the IMCO Tanker Safety and Pollution Prevention Conference of February 1978, a new NPRM was issued on February 12, 1979 (44 FR 8984). Public hearings were held on the docket and 138 comments have been received and analyzed. The final rules are being reviewed by the Office of the Secretary of Transportation and should appear by the time this magazine is published.

CONSTRUCTION AND EQUIPMENT EXISTING SELF-PROPELLED VESSELS CARRYING BULK LIQUEFIED GASES CGD 77-069

These regulations would amend the current ones to include the substantive requirements of the "Code for Existing Ships Carrying Liquefied Gases in Bulk," adopted by the Intergovernmental Maritime Consultative Organization (IMCO). The use of liquefied gas has increased, as have the problems associated with it. Due to its unique properties and the dangers associated with them, new regulations are being drafted. The environmental impact statement and regulatory analysis were completed in February 1979 and an NPRM on these regulations is anticipated in November of this year.

Continued on next page.....

LICENSING OF PILOTS
CGD 77-084

This regulation takes into account the problems caused by increased ship size and unusual maneuvering characteristics. The proposal would require recency of service for each route upon which a pilot is authorized to serve, licensing with tonnage limitations commensurate with pilot experience, and consideration of ship-handling simulator training for pilots of very large vessels. A regulatory analysis and work plan were completed in October 1978. An NPRM is expected in December 1979.

REVISION OF 46 CFR 157.20-5 DIVISION INTO THREE WATCH REGULATION
CGD 78-037

This revision would require an adjustment in vessel manning requirements, to bring them in line with current legislation. It would change the requirements which identify personnel who must be used on the three watches and personnel who may be employed in a day working status. An NPRM is scheduled to be published on this docket in January 1980.

TANK VESSEL OPERATIONS REGULATIONS, PUGET SOUND
CGD 78-041

This regulation governs the operation of tank vessels in the Puget Sound area. It was initiated to reduce the possibility of environmental harm resulting from oil spills in Puget Sound. This is to be accomplished by governing the operation of tankers and reducing the risk of collision or grounding.

Former Secretary of Transportation Brock Adams signed a 180-day Interim Rule on March 14, 1978 prohibiting entry of oil tankers in excess of 125,000 deadweight tons in Puget Sound; this appeared in the Federal Register of March 23, 1978 (43 FR 12257). An ANPRM was published March 27, 1978 (43 FR 12840). An extension of the interim rule was published in the Federal Register in order to allow the Coast Guard adequate time to complete this rulemaking.

The public hearings scheduled June 11 and 12 in Seattle, Washington, June 13 in Mt. Vernon, Washington, and June 14 in Port Angeles, Washington have been completed and all the comments received have been entered in the docket files for consideration. The extension of the interim navigation rule was published June 21, 1979 (44 FR 36174). This extension was effective July 1 and will be in effect until the Coast Guard prints notice of its cancellation. Copies of documents or the transcripts of the hearings may be obtained by writing to the Marine Safety Council. A final rule on the docket is currently expected in August 1980.

EIGHT-HOUR DAY VOLUNTARY OVERTIME
CGD 78-146

This docket is a review of the Eight Hour Day, Voluntary Overtime regulation in 46 CFR 157.20-10, which states that no licensed officer should be required to be on duty more than eight hours per day except in extraordinary circumstances. Existing regulations, however, do not address overtime or consider any possible "fatigue factor." Recent Coast Guard studies have shown that this factor has a profound effect on reaction time and judgement, therefore the regulation is currently being reviewed. An ANPRM is expected in late December 1979.

PERSONNEL JOB SAFETY REQUIREMENTS FOR FIXED INSTALLATIONS ON THE OUTER CONTINENTAL SHELF
CGD 79-077

This regulation is concerned with the health and safety requirements for installations and vessels engaged in oil field exploration and development. This action was mandated by pending Outer Continental Shelf legislation. It will provide more comprehensive protection for personnel employed in vessels and installations in the oil trade. the work plan received by the Marine Safety Council (MSC) in early July calls for an NPRM in January 1980.

SHIPBOARD NOISE ABATEMENT STANDARDS
CGD 79-134

These standards will establish acceptable sound levels for each of the various vessel compartments based on the latest technology. The standards will differentiate acceptable sound levels for both existing vessels and new vessels, acceptable methods of compliance, and will establish a hearing conservation program.

During the development of these standards, the U.S. Naval Ocean Systems Center (NOSC), San Diego, California was contracted by the Coast Guard to evaluate sound levels aboard several U.S. merchant vessels, to study the data obtained, and then to define the extent of the noise problem. Based on this data and other information available, they were asked to recommend a set of noise levels to be used in the control and/or elimination of the shipboard noise problem for the proposed standards.

This study has been completed. Copies will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161 after January 1, 1980 or may be obtained by contacting Captain P. J. Danahy, Marine Safety Council (G-CMC/TP24), U.S. Coast Guard Headquarters, Washington, DC 20593.

PERSONNEL AND MANNING STANDARDS FOR FOREIGN VESSELS
CGD 79-081

This regulation, deemed necessary to reduce the probability of oil spills, would establish minimum manning levels for foreign tank vessels operating in U.S. navigable waters. It would also establish procedures for the verification of training, qualification and watchkeeping standards. An NPRM is expected on the docket in late December 1979.

Continued on next page.....

Lessons from Casualties

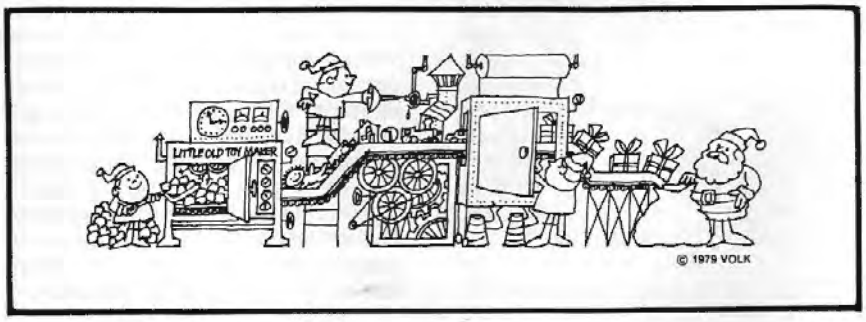
A boiler flashback on an uninspected, undocumented deck barge fatally injured the attending fireman. While attempting to relight a hot auxiliary boiler, the fireman inserted by hand a lit rag into the fire box. He had not purged the boiler of hot gases prior to the relight attempt. The resulting flashback ignited his clothing. Before fellow crewmen could put out the fire, the fireman suffered second-and third-degree burns which resulted in his death several weeks later. It was learned that the fireman routinely lit the boiler in this fashion without a reach rod. Additionally, there were no lighting or safety instructions posted to caution the fireman.

This case points out one of the most serious hazards of boiler operation. It most certainly was a preventable casualty. Responsible supervisors must be continuously on the alert for unsafe practices. Correct procedures and the posting of proper operating instructions may have prevented this death.

KEYNOTES.....

A complete listing of all Coast Guard regulations, both "significant" and "non-significant," appeared in the Monday, August 27, 1979 Federal Register (44 FR 50140).

THE COAST GUARD HAS NO PUBLIC HEARINGS SCHEDULED FOR DECEMBER.



Marine Safety Council Membership

Donald C. Thompson graduated from the U.S. Coast Guard Academy with a Bachelor of Science degree and a commission of Ensign in June 1952.

He was first assigned as Navigations and Communications Officer and later Navigator on USCGC BIBB, stationed at Boston, Massachusetts, followed by a tour as Engineering Officer aboard the USCGC ANDROSCOGGIN out of Miami, Florida.

In June 1954 he entered flight training at Pensacola, Florida, continued at Corpus Christi, Texas and upon completion served as search and rescue (SAR) aviator at Coast Guard Air Station San Diego, California. He was subsequently transferred to Chanute Air Force Base, Illinois, for Aero Maintenance Officer training until August 1958.

Next, then-Lieutenant Thompson received three consecutive air station engineering assignments, first, at Coast Guard Air Station Annette, Alaska; then to Air Station Miami, Florida; and was promoted to the rank of Lieutenant Commander while at Air Station Los Angeles, California.

He entered Krannert Graduate School at Purdue University in 1965, and received a Masters Degree in Industrial Administration the following year. He was then assigned to the Aircraft Repair and Supply Center at Elizabeth City, North Carolina as Chief, Management Information Services Division.

In August 1970, Rear Admiral Thompson was assigned to Headquarters, serving as Chief, Aeronautical Engineering Division and Manager, Aviation Study Plan. Four years later, he was transferred to become Commander, Coast Guard Group San Diego, serving as Captain of the Port and Air Station Commanding Officer through July 1976. His next duty station was the Eleventh Coast Guard District Office, where he served two years as Chief, Operations Division and one year as Chief of Staff. He was appointed Rear Admiral and assumed his present position as Chief, Office of Engineering in June 1979.

In addition to the Meritorious Service Medal, Rear Admiral Thompson has received the Coast Guard Commendation with three Gold Stars, Coast Guard Meritorious Unit Commendation with O, and the Navy Expeditionary medal.

Rear Admiral Thompson is a native of Hollis (Long Island), New York. Mrs. Thompson, the former Jeanne G. Kline of Tionesta, Pennsylvania, and Admiral Thompson have three sons and three daughters.

Admiral Thompson is a member of various civic and professional organizations, including member of Executive Committee and National Director of S.A.M.E., A.S.N.E., Propeller Club, Association of Port Authorities and M.T.S.

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ICEBREAKING PROCEDURES ON THE UPPER CHESAPEAKE BAY

By Henry W. Gamp
Tug DRUM POINT
Curtis Bay Towing Company
Baltimore, Maryland

Due to the heavy ice conditions in the Upper Chesapeake Bay during cold winters and the resultant stoppage or slowing down of oceangoing vessels and barge tows encountering this ice, a few observations on how ice jams vessels and how they are freed by icebreaking tugboats may be useful to anyone unfamiliar with icebreaking procedures.

ICE FORMATION IN THE BAY

Ice truly is a unique and interesting phenomenon. Several degrees in temperature determine whether ice will form at all, or if enough ice will freeze to stop oceangoing vessels. Ice may be very hard one day due to low temperatures, weaken and begin thawing with a warming temperature, and regain its strength or hardness with a falling thermometer. Ice which is broken and soft may be pressed and compacted together, becoming thicker and harder than it was originally.

Large fields of ice may slide underneath other fields of ice, becoming twice as thick as the original ice. The open water left will cover with skim ice and will be only fractionally as strong as the older ice now knitted together. The weight of clinging ice may lay buoys on their sides or sink them. Ice freezing around small piers, pilings, day beacons and radar ranges on low water can lift and destroy them with the rising tide. Small vessels which are grounded are at the mercy of the floes and run the risk of being capsized by the tremendous pressures exerted against their hulls.

Ice conditions are in no way uniform. They can remain constant or change quite rapidly. When there is slack water and no wind there is no motive force to affect the ice field and give it motion. Irregular shoreline, islands, jetties and lighthouses act to anchor the surrounding ice when the forces of nature would otherwise be shifting it. This stationary ice is referred to as *fast ice*. Without some external force holding the ice field it is free to follow the wind and tide. Free moving ice is known as *pack ice*. Pack ice being carried along by the wind and tide in open water can come in contact with fast ice and slide under this stationary field, forming ice twice as thick. Care must be used when following a path through pack ice made by another vessel or tow or when breaking a path for a vessel astern to follow, as the broken path may almost immediately be carried outside the channel limits.

VESSEL DESIGN AND ICEBREAKING

Many misconceptions are held by the inexperienced on how vessels are affected by ice. It would seem logical to say, for example, that if a vessel is jammed in the ice, breaking a path in front of her should free her. However, this usually is not the case because the sharp bow acts as a wedge being driven into the ice. This ice must have a place to move to or it will exert pressure on the hull. If the force thus developed on the hull is equal to or greater than the propelling force which is driving the vessel ahead, she will stop. If the

ice flows away from the ship and does not compress to the point of equalizing the propelling power of the ship, she will continue moving. The greatest resistance for an ice encircled vessel pushing her way through the ice is where she turns at the bow (the widest part of the wedge). The least resistance she has is aft of the mid-body where the ice will more easily follow the narrowing quarter. The thrust from the wake stream also acts to relieve pressure on the stern and carry away ice.

Sheer power, though important, is not the only factor in breaking through ice; good hull design is essential. For example: ships with more cutaway bows, shorter mid-sections and cutaway quarters will enter ice and clear it easier than wide beam blunt bulk carriers. Some foreign vessels are built with ice-breaking bows which allow the ship to ride up on the ice and break it. Ships designed for Scandinavian waters are often fitted in this manner.

Likewise, hull design of tugs will make a great deal of difference in the way they will perform in ice. Tugs which can be ballasted to keep the bow high and stern deep will do better than tugs trimmed down by the bow. This allows the tug to ride up on the ice in the manner of icebreakers; in addition, the weight of the tug helps break the ice and keeps the screw deeper in the water, affording it more protection from ice damage. Some tugs must be trimmed down at the bow to keep slush ice from following the hull down to the sea suctions and entering sea chests, thereby clogging them and making it necessary to shut down the main engine and remove the ice.

Tugs with keel coolers are superior to tugs not so equipped, provided the keel coolers are substantially constructed, because they have no sea suctions and strainers to clog up with slush ice. The necessity of shutting down the plant, often with the tug in a precarious position (i.e., when breaking a path in front of a vessel or tow when the assisted vessel is making way and is rapidly overtaking the stopped icebreaker) is eliminated. Tugs with elliptical sterns can turn better in heavy ice than tugs with square sterns because the fullness of the stern tends to jam the ice against it while turning, and a longer turning radius must be allowed for.

Weight is a factor in a vessel continuing to move through an ice field or slowing down and becoming jammed. Deep loaded vessels and tows of the same horsepower as light draft vessels and tows will continue moving in ice when the latter becomes bogged down and stopped. As it takes more power to move a heavier vessel through the water it also takes more resistance (ice) to stop her, and this is where weight and draft are advantageous to navigating in ice. Also, the deeper the draft the deeper the sea suctions and the less surface slush and chunk ice which will be drawn into the strainers.

AIDS TO NAVIGATION

The prudent navigator piloting his vessel in ice congested waters will have to be attentive to the many dangers and hazards that can beset him. Ice fields drift with the wind and tide and very often are moving at oblique angles in relation to the vessel's heading, and at much higher velocities than the navigator is anticipating. Such an area is the eastern extension of Brewertown Channel. The channel is roughly east-west while the tide sets in a generally north-south direction. The best aids to navigation in such an area are range lights, when visibility permits their use. The course made good and compass heading may be striking in their variance. When visibility is restricted, knowledge of which way the ice is setting and careful watching of the fathometer is the best method of keeping the vessel within the channel. Radar ranges to the shore or fixed aids such as lighthouses and also radar bearings to these objects are very useful. Where definite improved channels do not exist these radar ranges and bearings afford the navigator his best information, as the fathometer may not show a steep shoal until the vessel has grounded on it. Likewise, it goes without saying that anytime the water shoals up unexpectedly the vessel should be stopped and her position fixed and adequate adjustments made on her course to prevent grounding. Tugboats transiting ice congested areas cannot rely on making the course steered. The tug will sheer in the direction of least resistance which can be a crack in the ice, thinner ice next to a heavy ridge of ice, etc. Also, the tug is often handled in such a manner as to take advantage of these factors in avoiding the hardest ice. Add to this the added deviation introduced into the magnetic compass by the tug pounding in the ice and variations of as much as 10 degrees from the normal variation in the Upper Chesapeake Bay, and the compass becomes a questionable instrument to be continually checked against more reliable information. A gyrocompass unaffected by these factors is far superior to the magnetic compass and every icebreaking vessel should be equipped with one.

The warning "The prudent navigator will not rely on any one single aid to navigation particularly on floating aids" contained on all National Ocean Survey charts is especially appropriate when navigating in ice. Buoys are quite often missing, and even when they are observed they are just as apt to be off station as on. They need only be off station a few hundred feet to mislead a navigator enough to ground his vessel. One area where this could happen is Craighill Angle and Upper Craighill Channel, along the easterly edge of the channel, where the depth at places abruptly rises to 16 feet at the channel limits. Their positions should be verified by ranges and depth sounding.

Buoys can be unreliable and impossible to use at times. A buoy may show one minute and the next minute be dragged under the ice, or vice versa. Lights on buoys are often extinguished during ice season. Buoys constantly being dragged under the ice may have their light cages torn off, their bulbs may be burned out, and their batteries dead. Due to the increased workload placed on the Coast Guard at this time of year, buoy lights may remain extinguished for extended periods of time.

Chunks of ice often stick up high enough to be mistaken for buoys on the radar. At times these growlers appear to be ice covered buoys even to the naked eye.

Numbers on buoys may not agree with their location. Sometimes a new coat of paint will be worn off a buoy by its constant grating against the ice, exposing

Continued on next page.....

the number of a former station where the buoy was previously placed. Occasionally a lighted red buoy which was formerly black, or vice versa, has been weathered to the point that the mariner is in doubt as to whether the buoy he is observing is red, black or red and black. Buoys with two-digit numbers may have one number erased, e.g., *18* may show as *1* or perhaps *8* instead of *18*. In summary, be suspicious of floating aids, navigate by ranges, lighthouses and fixed objects whenever possible, take your time, and try to establish your position and course by as many independent methods as are available to you.

SHORT CUT HAZARDS

Navigating in ice is serious and involves real risks. Avoid short cuts and possible shoals which more often than not lie close to those short cuts. If smaller vessels have a choice of more than one channel, route or fairway to follow they should take the deepest and best marked of the alternatives. The ship channels are the best routes to follow because the volume of traffic using these routes helps keep them open. Often, channels are very passable but only a couple hundred feet outside the channel limits heavy unbroken ice is impassable, or at best navigable with much difficulty. Sometimes the constant ship traffic within a channel during a warm period will entirely free the channel of ice, but on either side heavy ice will remain, giving the appearance of navigating within a canal. A vessel may encounter heavy ice all along a channel, turn on a reciprocal heading, retrace her track, and find almost no ice or ice of completely different thickness and texture.

If you do become stuck, a ship running close abeam at full speed may be the added boost you need to start moving again. An even more important reason to stay in deep channels is that a rescue vessel may not be able to take a short cut and you may be without aid. A vessel drawing 10 feet bound for Baltimore from the C&D Canal may feel she can avoid heavy ice at Tolchester by taking Pools Island Flats, but if she misjudges and becomes ice bound she is in serious trouble. Not only is she stuck where other vessels may not be able to reach her, but if she is pushed over a shoal--and there are many shoals on each side of the flats--she is in peril of being capsized. Take into

The Tug ESTER K is maneuvering into position to put her hawser on the N.B.C. Line Barge Container Transport #5 (barge is a converted L.S.T.). When her hawser is up, the tug MARTHA M will come alongside her, passing her hawser over to the ESTER K's stem head and both tugs will pull the barge. The DRUM POINT will break a path for the tow to follow along Craighill Channel.

account your limitations as well as those of your vessel. These types of risks certainly do not justify any savings in time. Do not permit your enthusiasm to outweigh obvious danger; allow margin for error.

BREAKING OUT A STRANDED SHIP

As you approach an ice bound vessel try to get an idea on which side the ice is heaviest; how the ship lays in relation to the channel; the course to be made good once the vessel is freed; and prepare a general plan of action, as you will be quite busy once you begin breaking ice around the vessel and all your concentration will be needed for your boat handling. Approach the vessel on whichever side appears to have the weakest ice; this is something in which experience will help greatly. Different types of ice may be weakest at different times of the day or night.

If another vessel has successfully traversed the channel by your stranded vessel in the not too distant past, this would be the side on which to make your initial pass. However, if it has been quite some time, say an hour or more since a vessel has passed by, this may not be the side to begin with. The ice may have compacted more and if it has had enough time to refreeze may, in fact, be stronger than the unbroken ice next to it. Constant breaking and refreezing can make very heavy and strong ice. Ice quite passable in daylight hours, because of sunlight and warmer temperatures, becomes tremendously hard after the sun sets as it compacts and freezes solid. The virgin ice next to it which was the more difficult to break during the day is now the easier to maneuver through.

Having decided on which side you will make your first pass, call the pilot of the vessel on your radio. Tell him which side you propose to come down and instruct him to work the ship full ahead when you arrive abeam to take advantage of any pressure against his hull you might release. In the meantime, he can also help by shifting his rudder from hard right to hard left and so forth, allowing the ship to swing to the maximum arc the ice will permit each time. He can also have the master trim the vessel as deep aft as possible and as light forward as practical, and perhaps shift ballast side to side if it can be easily accomplished. Make passes up and down the side of the ship until the ice is broken.

A systematic routine of running a pattern up and down and ahead of the vessel is required. As you run circles around the vessel the tug will move easier the second, third, fourth pass, etc. Rather than make erratic passes, say 100 feet apart once you have initially broken the ice, move over 20 to 30 feet and expand the path you already have. this way you are not continually breaking hard ice but instead slicing off a small ledge and allowing the tug to run freer.

When running toward the ship's bow run out some distance ahead so that if the vessel begins moving she will have broken ice ahead of her to follow. When you reverse your course do a Williamson Turn; that way you will be heading more directly for the stranded vessel, as your tug will not make the sharp turn you are accustomed to her making in ice free water.

When making your passes down a ship's side it is not necessary to run as close as possible to her; in fact, it can be quite dangerous to do so. Fifty feet off is a good minimum distance. If the ice suddenly cracks toward the ship you will have enough time to throw your rudder away from her or stop your tug before she follows the crack to the ship and strikes her. As you run up and down along the vessel's hull you may be stopped where the mid-body ends and the bow begins to cut away. The force of the vessel working full ahead against the ice creates a greater pressure at this point than at the other parts of the ship's hull. When this occurs, throw your rudder side to side to rock the tug. If she remains stuck you must back up your tug (be sure to have rudder amidship), get a running start, and batter your way through the ice jam. When this fails, the ship must stop working ahead to release the pressure she is transmitting to the tug via the ice until the tug breaks out of the ice jam.

Generally, breaking ice in this manner around a ship will free her. One word of caution: if the vessel does begin to move do not break a path directly in front of her, since if the tug becomes stuck or your plant overheats you will have no place to go. Pilots who have been stuck in ice are anxious to get underway again, and are reluctant to stop when they are moving simply because you are out ahead of them. It is far safer to run out ahead but off to one side or the other. You will be relieving the pressure and if you should stop, the ship can sail by you without anyone having a heart attack, collision, or scare. If the vessel is making better time than you, once she is moving follow astern in her broken water--but not so close that if she stops you can't avoid hitting her.

In the event the above procedures do not free the vessel have the vessel stop her engines. Break up the ice in front of her, have the vessel back up some distance, then have the vessel come full ahead. Often, the momentum of the ship will be sufficient to keep her moving. The ice field may have been heavier at this point than the surrounding ice and once past it your ship will pick up some speed and keep moving. If she stops, repeat these maneuvers again and so on. More probably than not you will make some headway, be stopped by the ice, and have to start all over again.

Once you are moving again let the pilot know if the ice is weakest on his port or starboard side. He will have a tendency to stay on the centerline of the channel no matter what. However, this is the time to move side to side in the channel and take advantage of any open or thin spots, as long as you can keep adequate water under your keel and are not meeting, crossing or overtaking other vessels. If another vessel with more horsepower has recently passed by, fall into her track as long as it hasn't been carried outside the channel. Whenever possible, avoid that 4- or 5-foot-deep ridge where the pack ice has been hummocked and piled up against the fast ice.

BREAKING OUT STRANDED TOWS

Generally speaking, the methods employed to free ships locked in ice clogged waters apply equally well for extricating barge tows. A tow is comprised of one or two tugboats pushing or pulling one or more barges. Therefore, it is necessary to point out how this and other diversities will alter the plan of action when

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breaking out ice bound tows, as opposed to ships. For the purpose of this discussion a tow will be composed of one towing vessel and one barge.

Most tugboats operating in the Chesapeake Bay have a power range of 700 to 4,000 horsepower (hp). Ships, on the other hand, range from a low of around 4,000 hp to upwards of 60,000 hp. From this it is easy to see that the lower powered tugboat which, in addition to itself, is towing a barge perhaps 300 feet long and 40 to 60 feet wide, will jam in much less severe ice conditions than most ships.

The draft of most tugboats and their tows rarely exceeds 16 feet. Ships may draw from 15 feet upward to 40 feet. This enables tows to navigate outside the improved channels in many instances. Consequently, they can take advantage of thin ice coverage or perhaps clear water where a ship constrained by her deeper draft could not do so. However, this lighter draft is a hindrance in heavy ice as the deeper laden the vessel the more apt she is to continue moving.

A ship has a pointed bow which it drives into the ice, cutting it as a knife and allowing the ice to flow down along the vessel's hull. A barge, on the other hand, has a square blunt bow which does not enter ice well at all. The barge being pulled or driven into the ice field pushes another field of ice before her as it cannot escape down her sides.

Barges towed in ice should be either pulled on a hawser or pushed ahead using wire pushing cables.

Seven Foot Knoll Light House during February of last winter. Notice the ice build-up around the support structure of the light. The ice had begun to recede when this picture was taken. Several days previous the ice almost reached the floor of the building.

Towing with the barge alongside has numerous drawbacks and should be avoided. These include added drag, less rudder power, continual set on to whichever side the barge is made fast, and ice jamming between tug and tow.

Make passes around the tow, breaking up the ice in the same manner as to free ships. When you no longer are making acceptable progress begin breaking ice around the tow once more. Have the tugboat operator swing his unit from hard right to hard left to free the ice from the barge's sides. Have him back up and then come ahead full, repeating this over and over until he is making headway.

After the ice is broken and not offering your tug much resistance, position your tug ahead of and slightly off the port or starboard bow of the barge. Keep your tug in such a position that your wake just misses the barge's bow and flows down her side, washing with it some of the ice which the barge is carrying out ahead of her. If you begin to outdistance the barge you must slow down or stop until the tow catches up to you. As long as headway can be made in this manner continue to do so. Keep a constant check on the barge behind you so you are not run over. Another thing to keep in mind is that your boat will need some time to pick up headway after slowing or stopping and the tow already has headway. Therefore, any time you stop place your throttle back into idle. The ice will act as a brake and, importantly for you, it won't be necessary to wait precious seconds for your clutch to engage while the barge is overriding your stern.

The other method to use when towing in ice is to put a hawser on the tow and pull it. A wire bridle leading from both corners of the barge shackled to the tug's hawser would be the proper towing gear to use. The towing vessel will have an area of clear water from 20 to 100 feet astern, depending on the thickness of the ice. The hawser length should not exceed this area of free water, as this wash helps to disperse the ice forward of the barge. It must be borne in mind that if the tug stops the tow can override the tug, ramming her in the stern. Usually, when the ice is heavy enough to stop the tug it likewise stops the barge. Nevertheless, deep loaded barges have been known to come up on their tugs before. If you find yourself in this predicament work ahead full, throwing your rudder side to side to free yourself, and hope your wash hitting the barge will stop or deflect her.

The towing vessel can help herself by see-sawing from one side to the other, allowing the barge to pivot, and thus help free the ice from the barge's sides and allowing her wash to shove some of the ice out from the bow of the barge.

BREAKING ICE FOR BARGE CONVOYS

When ice conditions become severe it is desirable to form convoys for barge tows bound from Baltimore through the C&D Canal and from the canal to Baltimore and other Bay ports. This allows the Coast Guard and other privately operated icebreaking services to pool their men and equipment to effectively keep traffic moving, and not run helter-skelter around the Bay to free a dozen ice locked tows in a dozen different locations.

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DRUM POINT laying to in ice from one to two and one-half feet thick (last winter). The author was able to walk out on the ice without danger of falling through. At time, even with 2400 h.p., the DRUM POINT was stopped by such thick concentrations of ice.

The usual procedure is to have an eastbound convoy leave Baltimore on the first day. Convoys are formed up at North Point or Swan Point and escorted through the C&D Canal to Reedy Point. Here the convoy disperses and the escorting vessels lay over for the night. The following morning they organize a westbound convoy bound for Baltimore. This convoy usually will form off Pea Patch Island then enter the C&D Canal. When conditions permit, the convoy will disband upon reaching North Point. Sometimes, tows will be escorted to the Francis Scott Key Bridge. Convoys will transit in this manner one day east, next day west until the Captain of the Port feels the need no longer exists. The nightly layover in port is quite essential for the crews of all vessels involved in icebreaking, as they are afforded very little sleep during the day with the tug bouncing, crunching and ramming the ice.

The convoy is organized with the most powerful tugs and their tows placed first in line in order of horsepower down to the smallest tug and tow last. Tugs with less than 1,000 hp are barred from these convoys as they are too underpowered to run in ice. If the lower powered tows were to lead the convoy, every time they stopped all progress would be halted until they were freed. However, by being astern of higher powered tows, the ice is broken when they reach it. If they stop in spite of this, one or two icebreaking vessels can assist the jammed tows while the rest of the convoy sails on.

The escorting vessels essentially break ice and assist in the same ways previously stated for freeing individual tows.

Tows sailing in convoy usually are made up using pushing gear. They are lined up close together so the wash from the first tow helps clear the ice from the second barge's bow, etc. down to the last tow. By keeping the tows close together, often it will be necessary to break ice only for the lead tow. Under severe conditions tugs may put out intermediate hawsers to the barge astern of them and one or more icebreakers may put hawsers on the lead barge, adding their horsepower to the convoy. This last method is very useful if one or two tows must continually stop when the rest of the convoy is able to keep moving.

In cases where an icebreaker assists a towing vessel by putting out a hawser on the aided vessel's stemhead, stay out in front of her. If you work off to one side you have the leverage to lay her on her side, especially so if her tow astern sheers in your direction.

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Watch astern of your vessel as well as ahead; its not a comfortable position for the one caught in the middle when the lead tug meanders all over the Bay.

Do not divide the convoy if the lead vessels are doing well, or one of two things may happen. Either the lead vessels will continue doing well, and when they reach their destination the slower group will call you back to aid them--so you retrace your track and begin again, or both groups stop and the icebreaking capability is now divided in half. Don't divide your resources--have the tows put out hawsers between them.

Good radio communications are essential to coordinate everyone's efforts. Often it may not be apparent to other vessels what each icebreaker is attempting to accomplish or what ice conditions are on the perimeter of the convoy's track. Radios also allow you to tell everyone you are ice locked, need assistance, or shout "Watch out--I'm stuck, don't run me over!" If you see the convoy being set into shoal water you can alert the rest of the vessels. Therefore, keep your radio turned on and listen to it!

SUMMARY

In summary, let me stress three things above all others. Do not allow yourself to be rushed. Icebreaking is slow, methodical and tedious work. Allow yourself margin for error. It may save writing an accident report. Lastly, keep track of your position at all times! It is all too easy to become confused after making 20 or 30 circles around a stranded vessel.

I hope this information will be of assistance to anyone sent to break ice without having had previous experience. These are the procedures and principles that I have observed over the past several winters; they form the nucleus of knowledge from which I work. Quite possibly there are other methods just as good as these, perhaps better. Other captains or pilots may take exception to some points I have made. Nevertheless, this discussion should give the uninitiated some idea of what will be facing them and what should be done under various circumstances which they will encounter.

Readers wishing to comment on this article may write to the editor or to Mr. Gamp directly at 1152 Mainsail Drive, Annapolis, MD 21403.

About the Author

Henry W. Gamp

Henry W. Gamp is a member of the Association of Maryland Docking Masters (Baltimore Harbor) and is employed by Curtis Bay Towing Company of Baltimore, Maryland as a Tug Master and Ship Docking Pilot. Mr. Gamp holds a Masters License for Oceans, Unlimited Pilotage for Baltimore Harbor and extensive pilotage for the Chesapeake Bay. During severe winters he serves aboard Curtis Bay Towing's icebreaking tugboat chartered to the Maryland Port Administration, assisting the Coast Guard in the vital role of keeping the port open to shipping and barge traffic. It is from this extensive experience in icebreaking that Mr. Gamp has written this article.

SAFETY IS THE LITTLE THINGS

Too often when we think of safety, we visualize a formal accident prevention program staffed by so-called specialists who are employed to stuff "safety" down our throats. True, a formal program is necessary for many reasons, but it is not the program that makes us safe; only **ourselves**--each and every one of us--can in the final analysis by working together achieve real safety.

Our ships are designed and built by professionals, and every consideration--consistent with operational requirements--has been given to safe construction. To this end we have been more or less successful. Rarely is there an accident resulting from unsafe construction. Instead it is the little things that cause the vast majority of shipboard accidents.

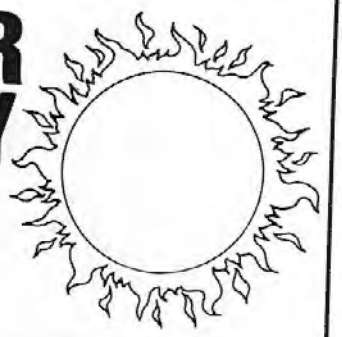
It is such things as not being alert--the small oil spill left on deck, nails protruding from hazardly stacked refuse, sharp tag ends of wire or strapping material left on lashings, failure to wear personal protective equipment--not using hand rails--and numerous other things, minor in themselves, that contribute to almost every shipboard accident.

Only if each of us consistently and alertly remains vigilant to avoid these little things, can such incidents be prevented.

If we resolve to look out for and correct, we can prevent the little things that could cause someone to be injured.

(Reprinted from the Lykes Lines *Safety Bulletin*)

WINTER ENERGY QUIZ #2



1. If your house has an electric furnace you should:
(a) not vary the thermostat setting,
(b) consider installing a heat pump,
(c) also have an electric water heater,
(d) avoid spending money on storm windows and insulation.

2. The most efficient gas furnaces have a:
(a) pilot light,
(b) electric ignition,
(c) gas-starter,
(d) solar-powered switch.

3. An automatic furnace flue damper:
(a) keeps the pilot light from going off when the residents are away on vacation,
(b) reduces heat loss when the furnace is off,
(c) helps prevent rust,
(d) will interfere with a fire in the fireplace.

4. If you use your fireplace when the furnace is on there is no need to:
(a) lower the thermostat to 50 or 55 degrees,
(b) close all doors and warm air ducts in the room with the fireplace,
(c) open a window near the fireplace one-half to one inch,
(d) consider installing a glass front or screen over a masonry fireplace to reduce loss of warm air,
(e) avoid burning hardwoods and softwoods in the same fire.

ANSWERS: (1)b, (2)b, (3)b, (4)e.
(Source: Dept of Energy)

THE HARRY LUNDEBERG SCHOOL OF SEAMANSHIP

The basic vocational education program offered at the Lundeberg School prepares young people to work as entry-rating seafarers and boatmen in the maritime industries.

The Marine Electrical Maintenance course helps students specialize in the field of electricity in addition to being an important asset to the crew of a vessel.

A tiny tip of land in southernmost Maryland--Piney Point--is the home of the largest school for boatmen and unlicensed seafarers in the United States. Each year, over 1,500 men and women enroll in the Harry Lundeberg School of Seamanship (HLS). One-third complete basic training and embark on a new career in inland waters or deep sea shipping. The rest return to their ships, tugs, towboats or barges with the additional training and knowledge necessary for advancement in their chosen line of work.

The Lundeberg School was established at Piney Point in 1967. This location, at the convergence of the Chesapeake and Potomac, was selected when rapid marine technological development necessitated centralized and intensified training. The school's facilities had been scattered among several U.S. port cities. Named after the founder and first president of the Seafarers International Union (SIU), HLS operates under the combined guidance and support of SIU and various shipping and towing companies.

The Harry Lundeberg School has a unique approach to training. Its basic courses follow a learn-by-doing philosophy--but vocational training is only one aspect of HLS instruction. The staff is concerned with each student's total development, believing that a well-rounded, enthusiastic individual will be more competent and more highly motivated on the job. Today's seafarers are, indeed, professionals. Complex marine technology and multi-million dollar fleets cannot be entrusted to ill-qualified workers. Therefore, academic, vocational and social skills are emphasized.

The training programs of HLS enable graduates to function within and contribute to society, as well as perform their jobs efficiently and effectively. Young trainees receive instruction in banking, political events, geography and foreign customs which they may encounter in their travels. These practical matters are as important to a successful maritime career as is vocational instruction.

In addition, The Lundeberg staff is convinced that academic instruction is fundamental to job success. All HLS trainees are given a reading comprehension test during their first week of school. Adequate reading skills are essential in modern marine industry. It's a dangerous business, particularly for an illiterate who cannot read a bill of lading or hazardous cargo warning! This is especially important when transporting mineral and oil products. The Lundeberg School offers assistance to all students who wish to improve their reading skills, regardless of their current reading level. In fact, individualized instruction is available for all academic courses. Students who have not completed their high school education are strongly encouraged to do so while attending HLS. Age is no barrier. The Lundeberg School offers a high school equivalency program (GED) which is approved by the Maryland State Department of Education. Hundreds of HLS students have taken and passed the Maryland State GED Examination.

This unique curriculum has proven dramatically effective. Students have improved overall performance, as success in one area tends to motivate success in another. Through practical application (the "learn-by-doing" philosophy) trainees realize that their academic and vocational goals complement each other.

The Harry Lundeberg school offers three vocational programs: entry-level, for beginners with no previous maritime experience; upgrading, for experienced seafarers or boatmen desiring career advancement; plus specialized and advanced courses for further job enrichment. All of these programs undergo constant evaluation and are redesigned, as appropriate, in response to feedback from industry and changes in Coast Guard regulations.

Entry-level (basic vocational education) students receive 12 weeks of broad, background training in seamanship. Classroom lectures and hands-on instruction are conducted aboard training vessels of the HLS fleet. Upon graduation, these young people are

Continued on next page.....

qualified to become entry-level seafarers on U.S.-flag merchant vessels or deckhands on tugs and towboats. Currently, jobs are more plentiful in the domestic shipping industry on the western rivers and the Gulf of Mexico. Since HLS trains its students to meet current industry needs and demands, the school is presently heavily oriented toward coastal and inland waterways shipping.

On-the-job safety is incorporated into every aspect of basic practical training. In addition, HLS has developed and included a number of courses which specifically address safety and survival. Trainees must spend over 30 hours in hands-on lifeboat training, plus classroom instruction, and pass the U.S. Coast Guard lifeboat exam before shipping out. After 90 days of seatime, these graduates may apply for Lifeboatman endorsement without further testing.

Firefighting is greatly emphasized at HLS; students receive classroom instruction in firefighting and fire prevention techniques, then attend a full day of practical training at the Fire Fighting School in Earle, New Jersey. Further emergency preparedness is gained through first aid and cardiopulmonary resuscitation (CPR) classes. Because statistics show that a disproportionate number of seafarers die from heart attacks--due to lack of immediate medical help--HLS requires all trainees to complete a 12-hour CPR course. Courses in accident prevention and emergency procedures affect overall job safety awareness. Lundeberg graduates have a commendable safety record, an important factor in holding down overall marine industry casualty figures.

The HLS upgrading program serves a double purpose. Through this additional training, experienced mariners can continue their career advancement. In turn, the marine industry is benefited by having workers who are familiar with and trained in the newest developments in marine technology. Deep sea upgrading training includes deck, engine and steward departments, and covers the most modern equipment, safety procedures, and the new skills required of seafarers. Upgrading boatmen may choose from deck or engineering programs. These programs are highly individualized, according to each boatman's working location: Great Lakes, inland waterways, western rivers, or oceans. All upgraders must pass required Coast Guard examinations to receive their licenses or endorsements. The Lundeberg instructors work with each upgrading candidate to pinpoint his strengths and weaknesses in both training and experience. This insures that the indvidual receives necessary training to "fill in" his weak areas and add to his current knowledge, so that by examination time he is fully qualified to advance and has the capability to accept increased responsibility.

The Lundeberg School offers a variety of special training programs, in addition to basic training and upgrading. Some of these, such as Seniority Upgrading and Bosun Recertification, are available only to SIU members or affiliates. Other special programs cover LNG, shipboard automation, and many more areas including electrical and refrigeration maintenance and steward department ratings. In addition to these established programs, HLS is presently investigating the possibility of offering an associate degree program in maritime studies.

The Academic Programs at HLS help students acquire their high school equivalency diploma.

Instruction in the Reading Lab is very individualized and helps the students learn their vocational materials in addition to learning reading skills.

Training for the Pumpman Course. This is an engine department course for upgraders.

Through commitment, dedication and hard work, the Harry Lundeberg School of Seamanship is making a considerable contribution to our modern marine industry. As stated in the Lundeberg catalog, "The school is committed to provide the nation's maritime industry with skilled and responsible deep sea seafarers and inland waterways boatmen." Two key words--"skilled" and "responsible"--are what job safety and efficiency are all about. Through training students properly and conveying to them the importance of accepting responsibility, HLS is helping to create the professionals who man the waterways of the world.

For more information about the Lundeberg School, contact:

Office of the President
Harry Lundeberg School
Piney Point, MD 20674
(301)994-0010

I would like to run a series of articles on marine-related schools and organizations to familiarize readers with existing institutions, explaining exactly what they are and what they do, and who is eligible to join/attend.

If you are interested in a particular school or organization or would like to submit information on one, please drop me a line: (G-CMC/TP24), U.S. Coast Guard Headquarters, Washington, DC 20593 or call (202)426-1477. -Ed.

PESTICIDE
it can be a problem at sea!

By Commander John E. Lindak and Lieutenant Thomas J. Haas
Cargo and Hazardous Materials Division
U.S. Coast Guard Headquarters, Washington, DC

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

This article is a condensed, simplified version of the complete technical report to be presented at the 1980 National Conference and Exhibition on the Control of Hazardous Material Spills, May 13-15, Louisville, Kentucky.

In recent years, the manufacture of agricultural pesticides (including insecticides, herbicides and fungicides) in the United States has increased steadily, averaging an approximate 5 percent overall annual growth rate. In 1975, over 800,000 tons of pesticides were produced, with over 20 percent of this volume subsequently shipped to foreign countries. In 1978, pesticide exports from the U.S. totaled over 327,000 tons, valued at close to a billion dollars. The manufacture, transportation and use of pesticides are closely regulated by a number of government agencies, such as the Environmental Protection Agency, Department of Labor, Food and Drug Administration and the Department of Transportation. This is because of the toxic properties of many of the ingredients/components of these complex chemical pesticides.

Maritime export shipments of chemical pesticides rarely pose an undue threat to human life or the environment. Occasionally, however, emergency situations will arise where the toxic hazards of pesticides must be assessed in terms of their threat to human health and marine wildlife. This article will describe a recent shipboard casualty which resulted in a unique involvement of a pesticides cargo.

MOCAP ON THE MARIA COSTA

On February 23, 1979 Costa Cargo Lines, Inc. contacted the Coast Guard Captain of the Port (COTP), Hampton Roads, Virginia and advised that the container ship MARIA COSTA (16,083 deadweight tons, 548 feet length overall) had sustained underwater hull damage in rough seas near the Azores and was steaming toward Newport News, Virginia for repairs. The Italian vessel had experienced flooding in No. 3 hold from an unlocated leak. The flooding was affecting her stability. In the hold were twenty-two 20-foot freight containers which held a wide variety of general cargo such as tobacco, carpets and machinery. Also, stowed on pallets in No. 3 hold were 65 tons of the pesticide Mocap 10G in 30-pound multiply kraft paper bags. The active ingredient of this Mobil product is an organophosphate insecticide, ethoprop (10 percent by weight).

Ethoprop in the pure state is a Class B poison* and is hazardous to humans through inhalation, ingestion and absorption through the skin. It is also toxic to marine life in concentrations as low as 50 parts per billion in water.

Approximately 2,000 tons (almost 500,000 gallons) of contaminated water were estimated to be in the 50x21x71-foot hold space. The flooding had disintegrated the bags, causing the ethoprop to be released from the clay backing material onto which it was adsorbed. (Subsequent analysis of the contaminated water in No. 3 hold revealed ethoprop concentrations in the 500 parts per million range.) Due to the possibility of releasing large amounts of pesticide into the water and endangering life and property in Chesapeake Bay, the Captain of the Port denied the vessel permission to enter the Bay until the flooding problem was resolved and the potential hazard posed by ethoprop in a water solution could be assessed. The

*The definition of a Class B poison is given in Section IV, "Requirements for Water Shipment."

Norfolk area is still recovering from a previous incident involving the pesticide kepone, which affected marine life such as shrimp and crab, and is therefore especially sensitive to any possible pesticide water pollution incident.

In order to check both the stability of the vessel and the health condition of the crew, the Coast Guard boarded the MARIA COSTA a few miles off Cape Henry. It was determined that 12 crew members had been exposed to the contaminated water in the flooded hold while they attempted to pump it out. Seven of these men developed red rashes which covered parts of their bodies. However, after several hours the symptoms disappeared. No other signs of possible poisoning were noted. It was also learned that in the flooded hold one of the free floating cargo freight containers had apparently punctured the forward bulkhead into the No. 4 starboard deep tank. This tank contained animal fat (tallow), some of which had flowed into the contaminated No. 3 hold. At this time, the Coast Guard COTP reconfirmed his denial of passage into the Bay until there was an acceptable plan to find and eliminate the cause of flooding of No. 3 hold.

A COOPERATIVE SOLUTION

Since neither the crew nor the vessel appeared to be in imminent danger, the Captain of the Port returned to the Marine Safety Office for a meeting with representatives from Costa Lines, Mobil Chemical Company, the Environmental Protection Agency, the State of Virginia and Coast Guard Headquarters Staff. At this initial meeting on February 26, 1979 the possible hazards to the ship's crew and the environment were discussed, and the vessel's stability and a basic plan of action to assess the hull condition were described. It was also agreed at this time that samples of the contaminated hold water be taken for subsequent analysis by a local laboratory. During this

Continued on next page.....

The MARIA COSTA in waters off Cape Henry. Photo by Mort Fryman, Virginia-Pilot Ledger-Star.

meeting, the MARIA COSTA remained underway offshore in the vicinity of Light Station Chesapeake.

The next day a meeting was held in which Costa Lines detailed a salvage plan including diver inspection of the hull, patching the source of hull leakage and pumping the contaminated waters off the vessel. The preliminary results of the samples of contaminated water showed that there was a concentration of approximately 5,000 parts per million (ppm) in the No. 4 starboard tank, No. 3 hold and No. 5 starboard tank. After this meeting a COTP order was drafted which prohibited the MARIA COSTA from entering Chesapeake Bay until the hold flooding was stopped.

On March 1, 1979 ocean divers conducted an underwater hull survey which revealed two horizontal cracks on the port side. The lower crack was 16 feet long and varied in width from a hairline to one-half inch. It was located 4 feet above the bilge keel, about 22 feet below the waterline. The upper crack was 10 feet long, approximately the same width as the other, and was located 2 feet above the lower crack. They did not locate any other cracks or hull penetrations at this time.

The State Water Control Board and the U.S. Fish and Wildlife Service proposed that the contaminated water be dumped into the sea. Due to official concern over this proposal, the EPA revised their earlier decision approving ocean dumping and recommended that the material be chemically neutralized. If neutralization was infeasible, dumping of the material at sea would be permitted if the operation were performed 200 miles offshore. However, the COTP was doubtful that the vessel was seaworthy to the extent of sailing that far, into unprotected ocean waters.

Authors Lindak and Haas boarding the MARIA COSTA.

It was then suggested that the contaminated water be offloaded into a chemical barge. The Regional Response Team (RRT) and the National Response Team (NRT) were convened to discuss the feasibility of this proposal. Both groups recommended that "EPA issue an emergency or other dumping permit to the M/V MARIA COSTA in order to transfer all the pesticide-contaminated water in the ship to a suitable barge. This barge will transport the liquid to a site east of the Gulf Stream for disposal. All detoxification treatment possible should be undertaken prior to dumping."

On March 9, a wooden patch was placed onto the hull of the MARIA COSTA. EPA then issued a dumping permit to the barge REBECCA K in order to dispose of the contaminated water as per the recommendations of the RRT and NRT. About 1,400 tons of contaminated liquid were pumped into the REBECCA K, then dumped in an EPA-designated site about 250 miles off the coast of New Jersey.

On March 13, the No. 3 hold reflooded. A second wooden patch was installed and about 1,450 tons of liquid were loaded into the REBECCA K. It became apparent, however, that the wooden patch was not watertight, and a steel patch would have to be installed.

On March 22, the steel patch was installed and pumping of the hold water started once again. This time, the patch was effective. The COTP allowed the MARIA COSTA into port after the leakage was calculated to be only 10 tons per hour.

After approval of detailed hull repair plans and associated personnel safety measures, the MARIA COSTA repairs were completed in drydock and she departed the shipyard on April 7, 1979. The next day, after a final inspection by COTP personnel, the vessel sailed enroute to Spain.

THE HISTORY AND HAZARDS OF ORGANOPHOSPHATE COMPOUNDS

A sidelight worth noting occurred during the MARIA COSTA incident. Two scientists from the National Oceanic and Atmospheric Administration (NOAA) arrived to check samples from the No. 4 starboard tank. Before boarding, they had blood samples taken. They spent an hour and a half on the vessel and found that the tank samples indicated a concentration of 130 ppm of ethoprop. Upon disembarking, they again had blood samples taken. The results showed a marked change in the red blood cells and plasma indicative of poisoning by organophosphate (O-P) compounds.

Organophosphates have been used as pesticides for nearly 40 years. The first O-P insecticide, called

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TEPP, was introduced in Germany as a substitute for nicotine during the 1940's. Other related organophosphates were developed as chemical warfare agents.

Even though TEPP proved to be a very effective insecticide, its extreme toxicity and rapid decomposition in the presence of moisture led to the development of more stable compounds. Parathion, developed in 1944, became one of the most widely used O-P insecticides. Parathion is still used extensively today, but the agricultural chemical industry has since developed many other less hazardous alternatives such as diazinon, malathion, ethoprop and abate. Table 1 gives some of the relative acute toxicity data available from Casarette and Duall[1] and the National Institute for Occupational Safety and Health: Registry of Toxic Effects of Chemical Substances (RTECS).[2]

TABLE 1

Relative Toxicity of Some O-P Insecticides

Compound	* LD50 in male rats (mg/kg)	
	Oral	Dermal
TEPP	1.1	2.4
Parathion	13	21
Ethoprop	34	60
Diazinon	108	200
Malathion	1375	4444
Abate	8000	4000

**This is a means of measuring acute toxicity; the lower the number, the more toxic the material tested. Readers may wish to refer to "Chronic Chemical Exposure," August 1979 Proceedings.*

Shortly after parathion was developed and manufactured, acute toxicity studies on experimental animals revealed signs of poisoning that resembled excessive stimulation of cholinergic nerves. These nerves transmit the signals or impulses of the brain to the limbs of the body (arms and legs), the heart and the glands (tear, salivary). A chemical is formed at the end of each nerve in order to transmit the brain signal to the next nerve in line. Once it has performed its job it must be chemically broken down. If this is not done the nerve will be in a continuous state of stimulus, leading very quickly to paralysis. O-P insecticides inhibit the breakdown of this chemical, resulting in overstimulation of the nerves. Signs and symptoms of O-P insecticide poisoning include tightness across the chest, increased salivation, increased sweating, nausea, vomiting, abdominal cramps, diarrhea, abnormal heart rates, involuntary urination, miosis (constriction of the pupils of the eyes) and leg and arm weakness possibly leading to paralysis.

The central nervous system (brain and spinal chord) may also be affected, resulting in tension, insomnia, tremors, convulsions, and depression of respiratory and circulation systems. The immediate cause of death (which usually occurs within 24 hours after exposure to high concentrations) in fatal O-P poisonings is asphyxia resulting from complete respiratory failure.

Organophosphate compounds can enter the body through inhalation, ingestion or through dermal (skin) contact. The symptoms of O-P poisoning listed above may be local in effect because exposure to vapors, dusts or aerosols can directly affect the eyes, upper respiratory tract and the secretory glands of nose and throat. Gastrointestional cramps may appear immediately after oral ingestion and localized sweating may be seen at the site of any O-P contact with skin.

In addition to these local effects, the O-P compound can be absorbed into the blood through the lungs, gastrointestinal tract and skin, and thus exert its toxic action throughout the body.

Two antidotes are available to protect against acute O-P poisoning effects. One antidote immediately relieves many of the distressing symptoms, reduces heart rhythm abnormalities and dries secretions in the nose and lungs. The other increases the metabolic rate of the O-P compound and frees the enzyme.

THE HAZARDS OF MOCAP

Mocap 10G, a Mobil Chemical Company product, is a 10 percent granular organophosphate insecticide and nematicide (a chemical substance which is specifically formulated to destroy parasitic worms found in the

Continued on next page.....

1 Casarette and Duall, Toxicology, MacMillan Publishing Company, Inc., N.Y. 1975.

2 National Institute for Occupational Safety and Health, Registry of Toxic Effects Toxic Effects of Chemical Substances, Vol. I, II, Cinn, 1977.

soil). In addition to its use on corn, tobacco, peanuts, sugarcane, sweet potatoes and seedlings, it also controls insect populations in commercial turf.

The active ingredient of Mocap, *ethoprop*, is bound to an inert substance such as clay, which comprises 90 percent by weight of the pesticide. Ethoprop is one example of toxic O-P pesticides which are all characterized by a similar chemical structure (they may all be considered derivatives of phosphoric acid) and exhibit a similar mode of action.

From information contained in the Toxicology Data Bank[3] any human poisoning by Mocap should be considered analogous to parathion poisoning and treated accordingly. The signs and symptoms of poisoning by this O-P pesticide are the same as those listed before. Additional information available through this data system is shown in Table 2.

The chemical structure of ethoprop is shown on the following page. It is, as previously described, a derivative of phosphoric acid.

Continued on next page.....

TABLE 2

ETHOPROP

Vapor pressure 3.5×10^{-4} mm Hg @ 26°C

Clear, pale yellow liquid

Slightly soluble in water 750 ppm

Readily soluble in organic solvents (acetone, ethanol, hexane, xylene)

NIOSH RTECS LD50 Rats 34 mg/kg (oral)

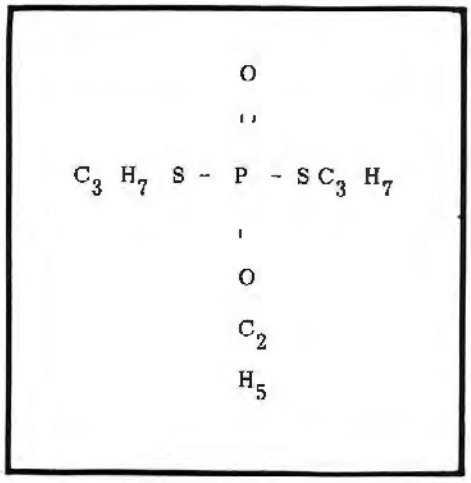
NIOSH RTECS LD50 Rats 60 mg/kg (percutaneous)

GOSSELIN Toxicity Rating: 5 (extremely toxic: probable oral lethal dose (human) 5-50 mg/kg; between 7 drops and teaspoon for 70 kg person (150 lb)).

SAX Toxic Hazard Rating: 3 (high; analogous to parathion)

SAX - Disaster Hazard: Dangerous (parathion). When heated to decomposition it emits highly toxic fumes of NOx, POx, SOx.

[3] Toxicology Data Bank, a subfile of the MEDLARS Systems, National Library of Medicine, National Institutes of Health, Bethesda, MD.



The chemical structure of ethoprop.

TABLE 3

Acute Toxicity of ETHOPROP

Species	LD50 (96 hr)
Grass shrimp	56.4 ppb
Fiddler crab	1.6 ppm
Blue gill sunfish	0.27 ppm
Rainbow trout	2.1 ppm

SHIPPING REQUIREMENTS FOR MOCAP

Both national and international regulations govern the carriage at sea of generic groupings of pesticides. However, none specifically address Mocap. For example, Mocap 10G is not regulated under the Department of Transportation shipping regulations because it does not meet the criteria for a Class B poison as stated in the U.S. Code of Federal Regulations (49 CFR 173.343). These criteria evaluate the toxicity of a substance under certain controlled laboratory tests including ingestion, inhalation, and skin absorption.

The key point is that each substance must be evaluated in light of the above criteria while in the form in which it is offered for transportation. In other words, pure ethoprop does indeed fall within the definition of a Class B poison. However, as it is shipped--in a 10-percent active ingredient, 90-percent inert ingredient granular form--it does not meet any of the criteria for a Class B poison and thus is not regulated under the DOT regulations.

What are the international shipping requirements, if any, for the transport of Mocap 10G at sea? The *Transport of Dangerous Goods*, prepared by the United Nations Committee of Experts on the Transport of Dangerous Goods, contains a list of recommendations. These recommendations include a list of the principal dangerous materials shipped in packages, classification and shipping information, and packaging and labeling data. While these recommendations do not, in themselves, have the legal force of national regulations, they are of great value, and many of them are incorporated into the requirements generated by other international bodies such as IMCO (Intergovernmental Maritime Consultative Organization). Mocap is not specifically listed in the index to *Transport of Dangerous Goods*; the closest entry which might be applicable is "Organophosphorus pesticides (compounds and preparations) toxic, n.o.s. (not otherwise specified), class 6.1, U.N. number 2783." However, Mocap is specifically listed in Table 6.1, "Classification of Pesticides by Principal Formulation," and is assigned packing group II. This information is modified by Table 6.2, which again lists Mocap but further states that 0-16 percent Mocap in pesticides is not classified with regard to packing groups.

A recently approved, soon to be published revision to this table specifies that ethoprophos (Mocap) in percentages from 3 to 10 in solid pesticides must be assigned to packing group III. From this information, we can conclude that the existing packing recommendations for Mocap are practically nonexistant. They will become more stringent, but will continue to be dependent upon the concentration of the active ingredient in the pesticide.

The IMCO *Dangerous Goods Code* contains a set of international rules and requirements governing the carriage of dangerous goods at sea. Detailed packaging, labeling, shipboard stowage, and other pertinent data are tabulated for an extensive number of hazardous materials. The IMCO requirements have been fully or partially adopted and incorporated into the national regulations of over 30 countries. How does the IMCO *Dangerous Goods Code* address Mocap? The General Index to the Code reveals that Mocap (or any of its synonyms) is not specially addressed. The closest commodity entries that might be applicable are "Pesticides, high hazard, (a) solid, n.o.s." or "Pesticides, low hazard, (a) solid, n.o.s."

In general, the high hazard solid pesticides are found in IMCO Class 6.1 poisons, whereas the low hazard solid pesticides have been placed in IMCO Class 9, "Miscellaneous Dangerous Substances." The percentage of active ingredient in the pesticide is the basis for determining whether a pesticide is a high or low hazard commodity. By diluting or reducing the percentage of active ingredient, a pesticide can shift from a high to a low hazard substance. The maritime shipping requirements are relaxed accordingly. The active ingredient concentration dividing line between IMCO Class 6.1 and IMCO Class 9 for a particular pesticide is not universally accepted. There are existing guidelines, but in general, the competent

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authority of the country concerned makes the final determination as to whether a specific pesticide is a high or low hazard substance. The United States currently regards Mocap 10G as low hazard under the provisions of the IMCO *Dangerous Goods Code* for shipment at sea, since this pesticide is currently considered to be unregulated under U.S. regulations. The DOT, as U.S. competent authority, thus requires no special packing or labeling for Mocap 10G since it is considered to be a non-hazardous commodity.

IN CONCLUSION

The MARIA COSTA incident illustrates how a maritime transportation casualty can accentuate the otherwise latent toxicity of an unregulated agricultural pesticide. In situations of this nature, cooperation and mutual assistance of government officials and industry manufacturing and transportation company personnel are essential. By working together, a relatively expeditious solution was formulated and applied to a complex, unprecedented problem. This prevented a possible major maritime environmental pollution incident. Fortunately, there were no lasting personnel health injuries as a result of ethoprop exposure. While successful resolution of this incident was costly in terms of resources utilized and magnitude of effort required, the lessons learned and beneficial results achieved were well worth the cost.

The MARIA COSTA is now in Genoa, Italy with contaminated cargo still in the No. 3 hold. A disposal site for this material has been found in West Germany. However, the cost for transporting the cargo and the Italian government's demand that all of the active pesticide be neutralized has kept the MARIA COSTA from conducting normal operations.

About the Authors

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Lt. Haas, a 1973 graduate of the Coast Guard Academy, received postgraduate training in chemistry and environmental health sciences (toxicology) from the University of Michigan. Since coming to the Cargo and Hazardous Materials Division at Coast Guard Headquarters, he has contributed to the *Proceedings* in addition to preparing articles for publication in other professional journals, such as the Journal of Veterinary and Human Toxicology. Recently, Lt. Haas has lectured on chemical hazards at the Coast Guard Reserve Training Center, Yorktown, Virginia and at the Maritime Institute of Technology and Advance Graduate Studies. He has also been instrumental in the developmental stages of a National Cancer Institute epidemiological study of Coast Guard marine inspectors, and is presently serving as the secretary of the Chemical Transportation Advisory Committee's Subcommittee on Personal Protection.

Commander John E. Lindak

Commander John Lindak is Chief of the Hazard Evaluation Branch of the Cargo and Hazardous Materials Division at Coast Guard Headquarters. A 1963 graduate of the Coast Guard Academy, he has served aboard several Coast Guard cutters within their engineering departments and also as engineering officer. While assigned to the Office of Research and Development at Headquarters from 1969 to 1973, he was project officer for a number of chemical hazard evaluation projects including anhydrous ammonia, chlorine and liquid natural gas. Commander Lindak also worked on the preliminary development of CHRIS, the Coast Guard's Chemical Hazard Response Information System. His current duties involve assessing and disseminating information about the physical, chemical and toxicological properties of hazardous materials shipped aboard vessels.

ANNUAL INDEX

Volume 36

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) The operator of each vessel engaged in a vessel-to-vessel oil transfer operation must keep a signed copy of the declaration of inspection for

A. ten days.
B. one month.
C. six months.
D. one year.

REFERENCE: 33 CFR 156.150(f)

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

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

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

REFERENCE: Merchant Marine Officers Handbook

(3) If a vessel is not sailing foreign, the Master must submit an Oil Record Book to the Coast Guard every

A. month.
B. two months.
C. three months.
D. six months.

REFERENCE: 33 CFR 151.35(h)

(4) Each pressure gage used in an oil transfer operation must be accurate to within

A. one percent.
B. three psi.
C. five percent.
D. ten percent.

REFERENCE: 33 CFR 156.170c(3)

(5) The pressure, which the manufacturer represents to be the minimum bursting pressure, for each hose assembly must be at least

A. 300 psi.
B. 400 psi.
C. 500 psi.
D. 600 psi.

REFERENCE: 33 CFR 154.500(b)

ENGINEER

(1) What is one purpose of the back seating feature designed into refrigeration system valves?

A. To prevent air from leaking into the system when the line is under vacuum.
B. To prevent moisture from freezing in the packing and distorting the gland.
C. To allow changing the packing with the system in operation.
D. To prevent the valve cap from backing out under pressure.

REFERENCE: Nelson

(2) Which type of bearing lubrication scheme can carry the highest unit loading?

A. Ring lubricated bearings
B. Disk lubricated bearings
C. Pressure lubricated bearings
D. Oil whip lubricated bearings

REFERENCE: Harrington

(3) What is the greatest source of torsional vibration in a geared turbine drive?

A. Gear excited critical vibrations
B. Propeller excited vibrations
C. Turbine rotor imbalance
D. Changing shaft thrust

REFERENCE: Harrington

(4) The seat of a butterfly valve will most likely be constructed of

A. Monel.
B. Stellite.
C. A resilient material.
D. Admiralty metal.

REFERENCE: Principles of Naval Engineering

(5) When a waste heat boiler is installed in the exhaust from a main propulsion diesel engine, the exhaust gas bypass would be used

A. at high loads to prevent overloading.
B. at low periods to prevent corrosion in the boiler.
C. during periods of high steam demand.
D. when the turbocharger is in use.

REFERENCE: Maleev

ANSWERS

Deck
1. B; 2. D; 3. B; 4. D; 5. D

Engineer
1. C; 2. C; 3. B; 4. C; 5. B

MERCHANT MARINE SAFETY PUBLICATIONS

The following publications may be obtained from the nearest marine safety office, marine inspection office or by writing: **Commandant (G-CMA/TP26), U.S. Coast Guard, Washington, DC 20593.** Because changes to the rules and regulations are made from time to time, these publications can be kept current between revisions only by referring to the Federal Register. (Official changes to all Coast Guard authored federal regulations are published as final rules in the Federal Register on Mondays or Thursdays.) Following the title of each publication in the table below are the dates of the most recent editions and changes, if any.

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

CG No.	TITLE OF PUBLICATION
CG-101-1	Specimen Examinations for Merchant Marine Deck Officers (2nd and 3rd Mate) (4-77).
CG-101-2	Specimen Examinations for Merchant Marine Deck Officers (Master and Chief Mate) (7-1-78).
CG-108	Rules and Regulations for Military Explosives and Hazardous Munitions (4-72).
CG-115	Marine Engineering Regulations (8-77).
CG-123	Rules and Regulations for Tank Vessels (8-77). Ch-1, 4-78.
CG-169	Navigation Rules - International - Inland (5-77).
CG-169-1	Colregs Demarcation Lines (7-77).
CG-172	Rules of the Road - Great Lakes (7-72).
CG-174	Manual for the Safe Handling of Flammable and Combustible Liquids and Other Hazardous Products (9-76).
CG-176	Load Line Regulations (2-71).
CG-177	Yacht Admeasurement and Documentation (9-72).
CG-182-1	Specimen Examinations for Merchant Marine Engineers License (2nd and 3rd Assistant) (4-75).
CG-182-2	Specimen Examinations for Merchant Marine Engineer Licenses; First Assistant Engineer, Steam and Motor, any Horsepower (4-76).
CG-182-3	Specimen Examinations for Merchant Marine Engineer Licenses; Chief Engineer Steam and Motor, any Horsepower (4-76).
CG-190	Equipment Lists (8-1-77).
CG-191	Rules and Regulations for Licensing and Certificating of Merchant Marine Personnel (11-76) Subchapter B.
CG-227	Laws Governing Marine Inspection (7-75).
CG-239	Security of Vessels and Waterfront Facilities (5-74).
CG-242	International Conventions & Conferences on Marine Safety (6-51).
CG-257	Rules and Regulations for Cargo and Miscellaneous Vessels (9-77). Ch-1, 3-17-78.
CG-258	Rules and Regulations for Uninspected Vessels (4-77). Ch-1, 3-78.
CG-259	Electrical Engineering Regulations (7-79).
CG-268	Rules and Regulations for Manning of Vessels (7-77).
CG-293	Miscellaneous Electrical Equipment List (6-73).
CG-323	Rules and Regulations for Small Passenger Vessels (7-77). Ch-1 3-78.
CG-329	Fire Fighting Manual for Tank Vessels (1-74).
CG-388	Chemical Data Guide for Bulk Shipment by Water (1976).
CG-403	Great Lakes Pilotage Regulations (7-76).
CG-439	Bridge to Bridge Radiotelephone Communications (12-72).
CG-467	Specimen Examinations for Uninspected Towing Vessel Operators (10-74).
CG-474	When You Enter That Cargo Tank (3-76).
CG-478	Liquefied Natural Gas, Views and Practices, Policy and Safety (2-76).
CG-480	Oil Pollution Control for Tankermen (6-75).
CG-482	Benzene Safe Handling Practices (12-76).
CG-486	Shippers Guide to Hazardous Materials Regulations (Water Mode) (8-77).
CG-491	Safety for Small Passenger Vessels (8-77).
CG-497	Rules and Regulations for Recreational Boating (7-77).
CG-515	Rules and Regulations for Foreign Vessels Operating in the Navigable Waters of the U.S. (2-78).
CG-518	Marine Investigating Officer's Regulation Handbook (2-78).
CG-526	Utilizing the Packaged Hazardous Materials Regulations, 49 CFR (5-78).
Safety of Life at Sea: Convention, with Regulations, London, June 17, 1960.	
Specifications for Merchant Vessel Equipment (Subparts of Chapter Q, 46 CFR, parts 160 to 164.	

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