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"Splinter village," located on the USCG Academy grounds, was the site for an early version of the Training and Qualification Program. Story begins on page 91. (Official U.S. Coast Guard photo)

New Directions in Coast Guard Training

CDR R. J. Asaro

The subject of this article is the Training and Qualification Program for Coast Guard marine safety personnel and how the program has responded to the growing complexity of the marine safety field and the shaping forces of law, technology, and diminishing resources.

Historical Background

At Coast Guard Headquarters, two offices have responsibility for what the field and the public see as "marine safety." The Office of Merchant Marine Safety ("M") is responsible for vessel inspection, documentation of vessels, licensing and certification of mariners, the technical aspects of vessel construction and cargo carriage, and the investigation of marine casualties. The Office of Marine Environment and Systems ("W") is responsible for the safety and security of harbors and waterways, the enforcement of environmental law in federal waters, and response to discharges of oil and hazardous materials. The offices complement each other. Field units consisting of Marine Safety Offices (MSOs), the Marine Inspection Offices (MIOs), and Captains of the Port (COTP) are the actual performers of these responsibilities. They inspect the vessels and facilities, monitor the clean-up of oil, and deal directly with the public in a multitude of settings and circumstances.

The Marine Environment and Systems program has its roots in late-19th-century efforts to provide cleaner waterways. Little was accomplished due to inadequate funds and the absence of widespread public concern until the late 1960s and early 1970s. As will be noted later in this article, a series of disasters focused attention on issues concerning the marine environment.

The Commercial Vessel Safety Program began in 1838 with the passage of a law to improve steam vessel safety in navigation. After a number of additional laws and several name changes over many decades, the agency which evolved was called the Bureau of Marine Inspection and Navigation (BMIN).

In an effort to maintain a stable and qualified workforce during World War II, in close liaison with other military services, the BMIN was placed under the Coast Guard. Most inspectors became commissioned or warrant officers, though some remained in civilian status. Following the war, the president determined that military execution of marine inspection responsibilities was in the best interest of the nation, and what had been a temporary measure in 1942 became permanent in 1946. BMIN inspectors mainly came from the ranks of merchant marine officers. They usually remained in a single geographical area for their entire careers, and commercial vessel safety was their only duty. For the most part, their training program consisted of following a more seasoned inspector who recommended to the Officer-in-Charge, Marine Inspection (OCMI) when an inspector was qualified to perform on his own.

There was no formal training program, and each OCMI determined the standards for being "qualified" in his area. Later, as new Coast Guard officers entered this field, entrance parameters changed because these officers primarily came from a Coast Guard background instead of a merchant marine background. They would rotate out of marine inspection into other Coast Guard duties for out-of-specialty tours, and they would leave a geographical area after their tour of duty. This regime required a different method of training.

In the early 1950s, this "different method"

CDR Richard J. Asaro is Chief of the Training Branch in the Coast Guard's Office of Merchant Marine Safety.

began as a home-grown course offered by CDR Lynn Parker, Executive Officer of the Reserve Training Center, New London, Connecticut. The physical area in which the course was taught, located on the grounds of the Coast Guard Academy, was called "splinter village" because the buildings were World War II temporary facilities. These temporary buildings served almost 20 years before being demolished.

As older BMIN officers left the service, the marine inspection indoctrination course was offered more frequently and became more formalized. LCDR William M. Benkert was assigned as the first formal school chief in 1953. He was also the first and only instructor. To alleviate that situation, he received assistance from the OCMI, New London, and CDR Fred Arzt, the Senior Investigating Officer in New York, who would travel to New London for the class sections to teach investigations and suspension proceedings. The course expanded to 12 weeks and eventually relocated in 1959, along with the Reserve Training Center, to its present site at Yorktown, Virginia. In the following decade, the course was refined, but it remained basically the same.

However, in the 1970s, a series of significant events dictated the necessity for change to the existing training program:

- The Coast Guard's Office of Marine Environment and Systems was formed in July 1971.
- The Federal Water Pollution Control Act of 1972, the Port and Waterways Safety Act of 1972, the Port and Tanker Safety Act of 1978, and the 1978 Amendments to the Outer Continental Shelf Lands Act of 1953 gave additional authority and responsibility to the Coast Guard in a number of areas of increasing national concern. Further, the Hazardous Materials Transportation Act (1975) expanded the Coast Guard's existing regulatory role in that area.
- A series of major marine disasters in the winter of 1976-77 focused public attention in the United States on the Coast Guard's role in protecting the environment and inspecting vessels for compliance with safety and pollution prevention regulations. The explosion of the SANSINENA in Los Angeles and the grounding of the ARGO MERCHANT off Nantucket, both of which occurred in December 1976, served as catalysts for U.S. initiatives pursuing international agreements under the aegis of the International Maritime Organization (IMO), formerly IMCO. The far greater pollution occasioned by the grounding of the AMOCO CADIZ in March 1978 refocused that attention and galvanized worldwide opinion on the need for international accord.
- "M" and "W" functions were merged at the field level in 1974 to form Marine Safety Offices. (In fact, many smaller units in the 1960s performed combined duties but were not called Marine Safety Offices because the Office of "W" had not been formed at that time.)

This graduating class poses on the steps of Lincoln Hall, a barracks building, for its official portrait, and provides quite a contrast to the "splinter village" class on our cover. (Photo provided by LCDR Bob Shilland.)

In response to the sweeping changes in the 1970s, the Marine Safety School in Yorktown developed a new 12-week course including elements of both programs and called it the Marine Safety Basic Indoctrination Course (MSBIC). The background and experience of personnel entering the programs during this period had also changed: very few entry-level inspectors had merchant marine experience, there were practically no remaining BMIN inspectors, and the experience level of field inspectors averaged 4 years or less. In addition, a variety of initiatives were being proposed at the international level designed to make tankships safer and to reduce pollution from vessels. This resulted in a proliferation of regulations containing complex technical provisions.

Reserve Training Center Yorktown, early view prior to new construction. (Official U.S. Coast Guard photo)

In the early 1980s, a new set of problems emerged:

- Coast Guard budget and personnel allowances were being cut.
- Program officials addressed the gradually eroding expertise base. Problems were created by requiring all entry-level officers to learn both the "M" and "W" programs during an initial tour, where formerly the officer was only required to learn one or the other program.

By 1981, these forces necessitated another change in the training philosophy.

Implementing Change

In an effort to reduce costs and to train more effectively and more efficiently, personnel from both the Marine Safety School and the Headquarters Marine Safety Training Staff sought alternatives to the teaching methods that were in place. The solution chosen was Instructional Systems Development (ISD). The basic tenet of this system is to teach only what is needed to perform the immediate job and to teach it only when it would be reinforced soon thereafter on the job (e.g., under the previous system, one learned investigating-officer skills in the basic indoctrination course, but the officer might not perform those functions until 2 years later.)

Beginning in 1981, while continuing to teach a full curriculum, the staff at the Marine Safety School completely rewrote its courses to ISD parameters. The convening of new courses began in October 1984.

ISD formalizes the best elements of older teaching methods, but it also adds several new concepts. The system may be summarized as follows:

1. Need-to-know training.
2. Program management of the learning process.
3. Feedback.
4. Modification of training.

Supplementing these general factors, the Coast Guard program has also implemented three additional elements:

5. **Training ports:** specialized learning centers for commercial vessel safety at Marine Inspection Office, New York, New York; Marine Inspection Office, New Orleans, Louisiana; Marine Safety Office, Puget Sound, Seattle, Washington.

6. **Multidimensional training:** self-paced lesson plans, resident professional technical training, videotapes, on-the-job (OJT) training manuals.

7. **Formal performance evaluation:** qualification requires completion of a formalized training program **and** a final review by a training panel at the unit.

There is no hard-and-fast rule as to how long it takes to become a qualified commercial vessel safety inspector. However, beginning in 1987, the Training Ports will graduate about 35 vessel inspectors annually, enough to meet program depletion through routine attrition. The present training program develops commercial vessel safety inspectors through resident courses, post-graduate training, industry training, videotapes, and OJT. Specialized, non-Coast Guard training is also available in more than 160 areas with the average inspector completing 8 resident courses during a career. Courses address such topics as welding and metallurgy, non-destructive testing, investigation of marine casualties and violations, inspection and operation of various shipboard systems, response to oil and hazardous substance discharges, handling of explosives and bulk hazardous materials, offshore drilling equipment and operations, and occupational safety.

In addition to their teaching and course development duties, the staff of the Marine Safety School also coordinates the learning objectives of the non-Coast Guard resident training to ensure consistency and efficiency throughout the program. With the delegating of certain inspection functions to the American Bureau of Shipping (ABS), the need for consistent regulatory interpretation assumes increased importance. As such, the Bureau has been invited to audit two inspection courses at the Marine Safety School. They have accepted this invitation, with the possibility that certain ABS surveyors may attend all or parts of these courses in the future at ABS expense.

A significant part of the overall ISD training philosophy is the feedback element. Students themselves evaluate the courses. Six months after the course, both the students/trainees and their commands evaulate the field effectiveness of the course. The trainees are also evaluated periodically on the progress of their OJT manuals, and there is a final evaluation upon completion of the OJT manual to determine qualification for a particular skill area.

Conclusion

Training is now more specialized. In the revised system, all training is job-directed: a concentrated effort with mandatory feedback to ensure accuracy and relevance. A first-tour inspector will spend 2 years at a designated training port learning the "inspection" side of the program. After that, the inspector is transferred to a non-training port to develop additional depth of experience. There is no longer a requirement that the marine safety inspector also learn environmental response in the first or second tour. Other trainees in the environmental protection/port safety and security areas will also spend their first tour specializing much in the manner of the Commercial Vessel Safety trainee.

By clearly specifying program goals, determining the most effective and efficient teaching methods, concentrating learning effort in one of two broad areas, and providing frequent performance feedback, the training program now in effect fulfills a longstanding Coast Guard dictum: we are doing more with less, but we are doing it better. ↕

Hamilton Hall, present home of the Marine Safety School at Reserve Training Center, Yorktown. (Official U.S. Coast Guard photo)

The Marine Safety Center

LCDR John E. Veentjer

Initiatives taken by the Coast Guard in the Commercial Vessel Safety (CVS) Program over the past 4 to 5 years have been successful in reducing the manpower intensiveness in this program. In the area of technical plan review, initiatives have shifted some of the workload to third-party organizations, thus reducing former backlogs. In addition, current plan review workload is dispersed geographically to the point where regional offices are no longer warranted. With the continued downturn in shipbuilding, particularly in the United States, and the prospect of ever-reducing budgets, the Coast Guard has decided to reorganize the resources associated with the CVS technical function. Thus, the regionally based field technical offices are being consolidated in the establishment of a new Headquarters unit, the Marine Safety Center (MSC), during the summer of 1986.

The CVS Program is the longstanding federal program established to promote safety in the design, construction, and operation of commercial vessels. In response to more recent legislation, the CVS Program is also concerned with the design and operation of vessels so as to minimize pollution of our environment. The basic objective of the CVS Program is to minimize deaths, personnel injuries, property loss, and environmental damage associated with the operation of vessels and other facilities engaged in commercial or scientific activity in the marine environment. This objective is pursued through the development and enforcement of federal laws and regulations and the implementation of international agreements.

LCDR John E. Veentjer is a Staff Engineer in the Coast Guard's Ship Design Branch, Marine Technical and Hazardous Materials Division, Office of Merchant Marine Safety.

Concerns over vessel safety date back to the early 1800s, when the introduction of steam propulsion into ships was accompanied by catastrophic accidents resulting in loss of life, injury, and property loss or damage. Alarmed at the frequency and severity of steamboat boiler explosions, the Congress passed the first federal law for steamboats in 1838. This law set requirements for manning by competent personnel, specified certain firefighting and lifesaving equipment, required vessels to be inspected, and provided for the issuance of certificates of inspection attesting to the steamboat's seaworthiness. Throughout the century to follow, there was additional legislation in reaction to disasters which broadened the scope of the program, improved the program administration, and reassigned the responsibilities. The CVS Program was transferred to the Coast Guard from the Bureau of Marine Inspection and Navigation (BMIN) in 1942 for the duration of World War II. (The Bureau of Marine Inspection and Navigation was formed in 1932 by consolidating the Bureau of Navigation and the Steamboat Inspection Service.) Ultimately the transfer was made permanent. Until 1967, when the Coast Guard was transferred to the Department of Transportation, the CVS Program had been administered within the Treasury Department.

On behalf of the Commandant of the Coast Guard, the Chief, Office of Merchant Marine Safety (G-M), administers the Commercial Vessel Safety Program. G-M is comprised of several divisions, including the Marine Technical and Hazardous Materials Division (G-MTH) which is directly responsible for the administration of the technical functions of the CVS Program. G-MTH is the result of a reorganization which incorporated elements of the former Merchant Marine Technical Division (G-MMT) and the former Cargo and Hazardous

Materials Division (G-MHM). At this same time, several elements of the former G-MMT were moved to the existing Merchant Vessel Inspection Division (G-MVI).

The merchant marine technical functions were established in a 1939 reorganization of the Bureau of Marine Inspection and Navigation on the basis of recommendations of "the Committee on Commerce" investigating the marine casualties involving the MORRO CASTLE and the MOHAWK. Having found the U.S. vessel inspection laws defective in many respects, this Committee, with the assistance of a select group of qualified technical experts, prepared and recommended implementation of required fundamental vessel construction rules. Subsequently, a technical section, to render judgment on all matters having to do with the design and construction of ships, was established within the BMIN and transferred, in 1942, to the Coast Guard.

Beginning in 1957, technical offices were established regionally as staff elements of the appropriate District Marine Safety Division; i.e., Merchant Marine Technical Branch (mmt), in the Third Coast Guard District (New York); the Fifth District (Portsmouth), which was the last to be established in 1972 and closed in 1981; the Eighth District (New Orleans); the Ninth District (Cleveland), which was closed in 1983; and the Twelfth District (San Francisco). At that time there was a need to bring the technical staff closer to the inspection areas in order to facilitate discussions between industry and the Coast Guard and to speed up and improve the plan review and approval procedures. These offices were charged with providing commercial vessel plan review services and technical guidance to Coast Guard field offices and the marine industry within their designated geographic area of responsibility.

The CVS technical functions generally involve the review and approval of vessel plans and certain shipboard equipment and systems to ensure compliance with the federal safety and pollution abatement standards. When U.S. commercial vessel interests contemplate the construction of a new vessel, their naval architects are guided by standards found in federal regulations, codes of classification and engineering societies, and "good marine practice." Vessel plans, which vary in sophistication depending upon the vessel type and size, normally are submitted for review and approval to the appropriate Coast Guard technical office (soon to be the Marine Safety Center) or, in certain specified cases, to the third-party organizations designated to act on behalf of the Coast Guard. Plans for small passenger vessels (those regulated under 46 CFR Subchapter T) are normally submitted to and reviewed by the local Officer in Charge, Marine Inspection (OCMI). During the initial inspection, the actual construction of a vessel is closely compared to the approved plans.

The idea of consolidating the field technical offices has been studied for a number of years; however, the regional workloads until recently still justified certain field technical offices. Today, the distribution and type of plan review workload has changed markedly. The continued decline in U.S. shipbuilding has had its greatest impact on standard cargo, passenger, and tank ship construction. However, an increasing number of small passenger vessels, vessels being converted from foreign-flag registry to U.S.-flag, and vessels classed by classification societies other than the American Bureau of Shipping are receiving plan review by the Coast Guard. These latter categories have not been affected by the recent agreements delegating certain plan review to third parties. Also, rather than being regionally located in a few port areas, the workload originators are now scattered throughout the country and the world.

These changes in the workload, and the fact that reductions in the work force were certain in 1986, dictated that some form of reorganization of the technical resources would be necessary if the technical services were to be continued at their current level. Thus, after studying the options again, the Coast Guard decided to consolidate the field technical offices, thereby centralizing the plan review functions. This consolidation results in staffing efficiencies without affecting the level of review or increasing the turnaround time for review.

The Marine Safety Center will be an independent Headquarters unit under the technical control of the Chief, Office of Merchant Marine Safety. Initially, the MSC will provide for the centralization of the plan review functions, simply by consolidating the field technical offices. Thus, the internal organization of the MSC will be much along the lines of its predecessor (mmt) offices; i.e., a Hull Division, an Engineering Division (Machinery and Electrical Branches) and a Cargo Division. Additionally, the MSC will become the repository for commercial vessel plan review records now retained at Headquarters by

continued on page 102

Protecting the Marine Hazardous Chemical Worker -- A Status Report

LCDR Rex J. Prosser

Historically, the Coast Guard's and marine industry's efforts to promote health and safety in the marine environment has been on prevention of explosive and oxygen-deficient atmospheres. The focus primarily has been on design, operational control through training and licensing, and the Marine Chemist program. In the mid-1970s, it was recognized there might be serious health hazards as well. The Coast Guard, recognizing that personnel working with hazardous materials might be facing adverse occupational exposures, developed regulations concerning tank entry, use of protective equipment, and exposure standards for suspected carcinogens such as benzene. In addition, the Coast Guard published guidelines on asbestos and noise in Navigation and Vessel Inspection Circulars (NVICs) 5-80 and 12-82 respectively. In 1983, the Coast Guard initiated a prototype occupational health and safety program in the Eighth Coast Guard District for its marine safety personnel. The program utilized elements of industrial hygiene, medical monitoring, and training to reduce adverse occupational exposures. It is hoped this program will be expanded to other Coast Guard Districts. The goal of the Coast Guard as specified in the Commercial Vessel Safety Operating Program Plan is to reduce adverse occupational health exposures of Coast Guard and marine safety personnel and merchant marine by 50 percent by 1992.

Who are these workers?

LCDR Rex J. Prosser is Staff Industrial Hygienist in the Cargo and Hazards Branch, Marine Technical and Hazardous Materials Division, Office of Merchant Marine Safety.

For the purpose of researching the magnitude of the problem, the term "marine hazardous chemical worker" (MHCW) was used to denote individuals working in the marine industry who may be exposed to potentially hazardous chemicals in the course of performing their jobs. Marine hazardous chemical workers fall into four generic categories:

- Marine chemical transport workers (tankers and barges).
- Chemical terminal dock workers.
- Offshore oil/gas drilling and production workers.
- U.S. Coast Guard field personnel.

The U.S. Coast Guard has broad responsibility for the safety and health of MHCW personnel. This responsibility is derived in part from the Marine Inspection Laws of the United States, the Occupational Safety and Health Act, and the Outer Continental Shelf Lands Act. Each of these provides basic authority, but specifically, the provisions of 46 U.S.C. 3306(a) and 3703(a) are broad enough to authorize a comprehensive occupational safety and health program. To clarify the responsibilities in areas where the federal authority overlapped, a Memorandum of Understanding between the Coast Guard and the Occupational Safety and Health Administration was signed in March 1983.

To discharge its occupational health and safety responsibility more effectively, the Coast Guard has sponsored research to identify and document the work activities performed by MHCW personnel that involve exposure to po-

tentially harmful substances. Additionally, occupational exposure studies have been carried out during these investigations to characterize the duration and the level of chemical concentrations to which MHCW personnel are actually exposed in their jobs. This information is needed to quantify and assess exposures and to determine whether additional regulations or implementation of voluntary standards by the marine industry are required to provide for the health and safety of MHCW personnel.

Research To Identify Hazardous Exposures

To better understand the hazards the marine hazardous chemical workers could encounter as a result of the job activities, a series of Coast Guard-sponsored research projects were initiated to

- identify potential hazardous agents in the maritime work environment,
- identify work activities with hazardous exposure potential,
- develop mathematical models, validated through field experiments, to allow prediction of work exposure levels, and
- further quantify exposures by personal sampling in the work environment.

The research projects sponsored by the Coast Guard's Office of Merchant Marine Safety were titled "Investigation of the Hazards Posed by Chemical Vapors Released in Marine Operations" and "A Crew Exposure Study." These projects accomplished the above objectives for the four generic marine hazardous chemical worker classes. The research results identified chemical agents, such as toxic/flammable vapors and gases, particulates (dust and fumes), and bulk liquids, which are potentially hazardous to worker health. Physical agents, such as noise and heat stress, were also identified as important factors in the maritime work environment affecting health and safety.

Work activities with the highest hazardous exposure potential include

- confined space entry,
- cargo transfer and gauging,
- certain maintenance activities,
- certain facility inspections,
- emergency response, and
- marine terminal work during open product loadings.

As part of the research, mathematical models were developed to predict worker exposure for work activities downwind of vents where vapor emission during cargo loading could represent a potential exposure hazard. Additional models were developed to predict residual vapor concentrations in ship and barge tanks during entry and work. These models and experimental data have shown that there is potential for worker exposures exceeding exposure values considered toxic.

Environmental monitoring utilizing personal sampling pumps and dosimeters on workers during their work activities confirmed the experimental data. Figure 1 provided a summary of vapor exposures for those work activities with the greatest exposure potential. The figure shows that for some work activities, a significant number of exposures exceeded the short-term exposure limit (STEL), a concentration to which a worker should not be exposed in

Figure 1

DISTRIBUTION OF VAPOR EXPOSURES FOR VARIOUS WORK ACTIVITIES

ITEM	%>STEL
Periodic open gauging	14
Open tank topoff	19
Restricted gauging-sounding tube(all)	0
Tank wash and ventilating	6
Tank entry	22
Hose hookup/disconnect	5

(Results based on approximately 400 exposure samples)

excess of this value for work periods of 15 minutes or longer. It is significant to note that 22 percent of the exposures monitored during tank entry and work exceeded the STEL.

Toxicological Assessments

The research showed that a simplified definition of hazardous sources, equipment, and work practices for marine personnel was not possible, and furthermore, that the work does not follow a normal 8-hour day schedule that is characteristic of other industries. Maritime exposures are difficult to evaluate in terms of usual American Conference of Governmental Industrial Hygienists' threshold limit values (TLVs) and the Occupational Safety and Health Administration's personal exposure limits (PELs). Therefore, a method was needed to provide a toxicological assessment of the documented marine occupational exposures. The exposure data was assessed in accordance with a methodology developed specifically for marine work activities.

Toxicological assessments were made of the measured and predicted exposure data. The following conclusions were reached:

- Both the measured and the predicted exposure data indicate that the marine environment is a toxicologically hostile environment. Under certain conditions, concentrations of chemicals may be sufficiently high to cause marked toxic effects in exposed marine workers.
- Host factors (age, health, personal habits) and environmental/work conditions unique to marine operations may potentiate the toxicity of chemicals in the marine environment.
- During tank entry and open tank gauging, there is an enhanced potential for exposure to hazardous concentrations of chemical vapors.
- Because the marine environment is a toxicologically hostile and hazardous environment, the need exists to control and reduce exposures of marine workers to chemicals and to monitor their health status.

On the basis of these findings, corrective measures were recommended by the Coast Guard's contractor to reduce occupational exposures in the marine work environment. These recommendations were incorporated by the contractor into the final research study. The recommended corrective action was the implementation of a marine occupational safety and health program. This program includes an effective industrial hygiene (IH) program to control, reduce, and monitor exposure levels, and a medical monitoring program to serve as a check on the effectiveness of the IH program.

Occupational Safety and Health Program

After studying the initial research efforts, the Coast Guard has initiated a third research project entitled "Study To Improve the Health and Safety of Marine Hazardous Chemical Workers." The objective of this study is to develop a comprehensive occupational health plan that can be implemented by the maritime industry for all marine hazardous chemical workers covered by U.S. Coast Guard responsibility.

A comprehensive occupational safety and health program would include the following elements:

- Identification of hazardous workplace substances.
- Development and implementation of appropriate engineering controls to reduce workplace concentrations.
- Development and use of safe work practices.
- Establishment of maritime occupational exposure standards.
- Provision of adequate training and education regarding handling of toxic chemicals.
- Routine monitoring of environmental concentrations in confined spaces before entry.
- Establishment of routine industrial hygiene survey audits of standard work practices.
- Establishment of medical monitoring, at specified intervals, of all personnel potentially exposed to toxic chemicals in their routine duties.

On the basis of the previous research, the comprehensive occupational safety and health

program specifically covers tank ship and barge personnel who work in the bulk liquid transport industry, and Coast Guard field personnel in Captains of the Port Offices, Marine Inspection Offices, and Marine Safety Offices. The program under development includes industrial hygiene and medical monitoring elements (figure 2). The major elements of the industrial hygiene part are shown in figure 3, and the medical monitoring part in figure 4. The key program interfaces are shown in figure 5. The Occupational Safety and Health Program summarized by figures 2 through 5 has resulted from a four-task research activity. The four work elements are as follows:

Task I - Background Study. The objective of this task (completed in 1984) was to perform an extensive background study in scenario form to identify and document the work activities that involve exposure to potentially hazardous chemicals for the various classes of MHCW personnel.

Task II - Environmental Monitoring. The objective of this task (completed in October 1985) was to develop an environmental monitoring program applicable to the MHCW scenarios identified in Task I. The monitoring plan includes the use of safe work practices, chemcial concentration measuring instrumentation, and personal protective equipment to minimize the workers' exposure to hazardous materials during work.

Task III - Medical Monitoring. The objective of this task (completed in January 1986) was to develop a medical monitoring program for MHCW personnel which will detect adverse health effects that are associated with the occupational exposure to hazardous materials. The medical monitoring plan involves gathering information through the use of work histories, measured exposure levels, medical questionnaires, physical examinations and laboratory tests, and an automated data base management system. The medical monitoring requirements were combined with the IH requirements to define the Occupational Safety and Health Program.

Task IV - Trial Implementation. The objective of this task is to develop a plan for implementing the Occupational Safety and Health Program in the Coast Guard and in elements of the maritime transportation industry. The 6-month trial implementation that was conducted at the Marine Inspection Office and Port Safety Station, Houston, and at the Marine Safety Office, Galveston, has been completed. Overall, the Coast Guard personnel participating in the program feel they have increased their awareness of safety and health-related issues and are performing their field marine safety duties in a safer manner. The 6-month industry implemention is scheduled to begin in July 1986.

Figure 2

ELEMENTS OF A MARINE WORKER HEALTH AND SAFEFTY PROGRAM

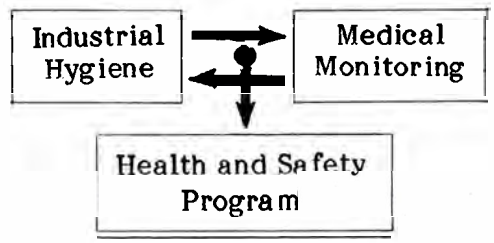


Figure 3

ELEMENTS OF INDUSTRIAL HYGIENE PROGRAM

Identification of hazardous substances in the workplace

Identification of work activities with potential exposure to hazardous substances

Development of work practices and controls to limit worker exposure

Performance of periodic occupational exposure monitoring

Review of work practices and controls to evaluate their effectiveness

The final product of this MHCW research study will be a stand-alone report which will describe the comprehensive Marine Occupational Safety and Health Program and will provide guidance on how such a program can be tailored by the various maritime interests to meet their particular needs. At this point in

Figure 4

ELEMENTS OF MEDICAL MONITORING PROGRAM

Identification and classification of marine hazardous substances

Definition of marine populations and organizations

Determination of methods for obtaining exposure information

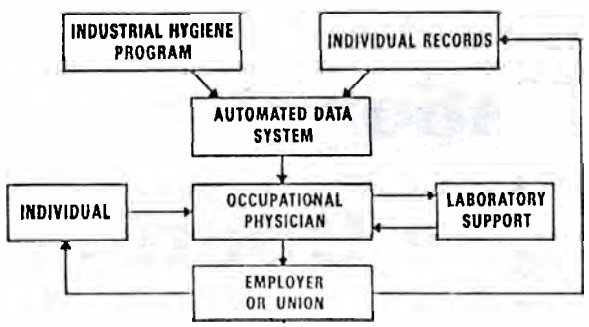
Definition of medical monitoring procedures and exam frequencies

Development of medical questionnaires and forms

Design of a supporting automated data system

Figure 5

MARINE HEALTH AND SAFETY SYSTEM INTERFACE



the project, the Coast Guard has not decided what course of action it will follow to implement this program with the maritime industry. The tentative approach is to distribute the final report via a Navigation and Vessel Inspection Circular. However, some changes to current regulations due to the cumulative findings of our research may be necessary. It is anticipated this final report will be available to the general public by the summer of 1987. The contractor has presented several oral status reports to maritime companies, marine interests, and the Coast Guard during the course of the research studies, and several additional presentations are being scheduled. Currently, several of the interim reports from the MHCW study and final reports from our previous research work are or will soon be available through the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161. These reports may be ordered as follows:

Order #AD-A 128-537, "Investigation of the Hazards Posed by Chemical Vapors Released in Marine Operations, Final Report, April 1983." Definition of marine terminal work activities and hazardous substances, quantification of hazardous exposure levels in marine terminal operations, and development of mathematical models to predict toxic and flammable concentrations in the work environment.

Order #AD-A 128-768, "Hazardous Chemical Vapor Handbook for Marine Tank Vessels, Final Report - Phase II, April 1983." A description of mathematical models developed for the marine operations study including procedures for the use of the computer programs developed for (1) near-field atmospheric dispersion of heavier-than-air chemical vapors discharged from tanks during loading, and (2) gas freeing and entry of cargo tanks.

Order #AD-A 118-179, "A Crew Exposure Study - Phase II, Volume I - Offshore. Final Report - Phase I, June 1984." Identification of work activities, hazardous substances, and a quantification of exposure levels for offshore oil and gas facility operations.

Order #AD-A 155-233 (Part A) and Order #AD-A 157-308 (Part B), "A Crew Exposure Study - Phase II, Volume II - At Sea, Part A and B, April 1985." Identification of work activities, hazardous substances, and a quantification of exposure levels during work activities on merchant vessels at sea.

The following reports will be available through NTIS after May 1, 1986. At the time this article was printed, several order numbers were not available. Please contact the Coast Guard's Cargo and Hazards Branch at (202) 426-1577 to obtain the order numbers not shown:

Order #AD-A 163-316, "Development and Application of a Method for Toxicologial Assessment of Occupational Exposures to Chemicals in Marine Operations, Addendum to Final Report, September 1985." A review of toxicological information relative to marine activities

and the development of a method for toxicological assessment of marine occupational exposures.

Order #AD-A 164-718, "Development of an Environmental Monitoring Program - Volume I of Task II, Final Report, October 1985." Development of an environmental monitoring plan in support of the IH portion of the Marine Occupational Safety and Health Program. Information is provided on safe work practices, toxic and flammable gas monitoring instruments, chemical hazard information, protective equipment, and training.

Order #AD-A 164-452, "Review of Environmental Monitoring Devices -Volume II of Task II, Final Report, October 1985." Provides specific information on available instrumentation for monitoring toxic gas, oxygen, and explosiveness; can be used as a selection guide for selecting environmental monitoring instruments for a specific application.

"A Medical Monitoring Program for the Marine Hazardous Chemical Worker - Volume I of Task III, Final Report, January 1986." Provides specific information on the development of the Medical Monitoring Program for the Occupational Safety and Health Program; includes specific information on marine hazardous substances, merchant vessel personnel, guidelines for industrial hygiene, guidelines for biological monitoring, records for logging potential exposures, and data management systems.

"A Marine Hazardous Substance Data System - Volume II of Task III, Final Report, January 1986." Provides detailed information on marine hazardous substances, including classification of substances regarding their hazard potential, supporting documentation to Volume I of Task III.

"Biochemical and Medical Information for Marine Hazardous Substances - Volume III of Task III, January 1986." Presents a set of biochemical and medical information for 179 hazardous substances found in the marine environment.

Limited copies of the Toxicology Assessment and the Task II report can be obtained by calling the Hazardous Materials Branch, (202) 426-1577. ↕

MARINE SAFETY CENTER

~~continued from page 96~~

the G-M Planning Staff (G-MP-2). The MSC will also provide a framework on which to add other related "operational" functions now performed within the Office of Merchant Marine Safety.

The MSC will be located in the Coast Guard Headquarters Building in Washington, DC. The Washington area was selected on the basis of several factors, including (1) recognition of the area as an expanding naval architect/marine engineer center (many naval architectural firms and vessel owners/builders are already physically represented in the area) and (2) the area's excellent access to domestic and international transportation.

The target date for operations at the Marine Safety Center is July 1, 1986. The plan review functions will be assumed gradually, on a limited basis, by a special transition team during the preceding months to ensure a smooth transfer from the three regional field offices. About June 1, 1986, all new plan review work will be diverted from the regional offices to the transition team. The regional offices will complete, or transfer to the MSC, their ongoing projects, and they will close before October 1, 1986.

(Editor's Note: The **Proceedings** will publish the MSC's address and phone number as soon as the information is available.) ↕

National Safe Boating Week

June 1-7, 1986

Automated Notices to Mariners

CAPT William J. Brogdon

A navigator prepares to visit an unfamiliar port. One of his more important, and more labor-intensive, tasks is correcting the ship's charts. He has to sort through the Notices to Mariners, listing all the applicable ones, before he can even begin the corrections.

How would you like to reduce the work by getting a listing of all Weekly corrections applicable to a specific chart? How about oil rig locations, or Hydrolants? This information is available now, by computer, from the Defense Mapping Agency.

There is a modern system in operation which uses a computer to search through the Weekly Notices to Mariners and list the appropriate corrections. Nearly any microcomputer and a 300 or 1200 baud modem can be used to gain access to the system. In order to use the system, you must first obtain authority from the Defense Mapping Agency, Hydrographic/ Topographic Center (DMAHTC), Code HNN, Washington, DC 20315. DMAHTC sends a user manual and assigns an access code so that you may use the Automated Notices to Mariners system.

Using a modem, connect your computer to the telephone system. Set up the parameters as directed in the manual: full duplex, 8 bits, 1 stop bit, no parity. The end-of-line setting of XON-XFF works correctly. Set up a file to receive the notice so that you can print it later. **Note:** The telephone area code is 301, not 202, as listed in the manual.

The system works beautifully. It saves a great deal of the research which is necessary to extract information from the Weekly, and it makes chart correction much simpler. In port, you have only to gain access to a telephone line with a personal computer. There is no charge for using the system, but of course you must pay the telephone charges. Ships at sea with satellite communications can link with a telephone line by satellite to get the latest corrections. It takes a few minutes to get the corrections for one chart at 300 baud, the slowest rate.

The list of corrections does not, however, contain all the information. The Weekly was designed for large ships, and it excludes much information for channels less than 15' deep. Neither does it have the discrepancies and the temporary changes which are included in the Coast Guard's Local Notice to Mariners.

The Coast Guard is moving toward an automated Local Notice to Mariners capability. The first step requires the Districts to adopt a standard format for Locals, and to transmit them to Headquarters by modem rather than by mail. We intend to have a data base for the Local at each Coast Guard District; users will be able to extract information from it.

It is part of a larger project to tie together the Broadcast Notices to Mariners, the Local Notice to Mariners, the Light List, and servicing information used by Coast Guard units. The project is designed to make the information more accurate, more timely, and far easier to use. The **Proceedings** will provide further information on this project as it develops. For now, though, a navigator can get many benefits from the DMAHTC Automated Notice to Mariners system. ↕

Captain William J. Brogdon is Deputy Chief, Office of Navigation, U.S. Coast Guard Headquarters.

Statistics of Casualties

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

The master of a vessel is required by law to report a marine casualty within 5 days after its occurrence to the nearest Coast Guard Marine Inspection Office or Marine Safety Office. The following summary represents casualties for which reports were received at Coast Guard Headquarters during calendar year 1983. These casualties, involving commercial vessels, were required to be reported to the Coast Guard whenever the casualty resulted in any of the following:

- an accidental grounding or an intentional grounding which also meets any of the other reporting criteria or creates a hazard to navigation, the environment, or the safety of the vessel;
- loss of main propulsion or primary steering, or any associated component or control system, the loss of which causes a reduction of the maneuvering capabilities of the vessel. Loss means that systems, component parts, subsystems, or control systems do not perform the specified or required function;
- an occurrence materially and adversely affecting the vessel's seaworthiness or fitness for service or route, including but not limited to fire, flooding, or failure of or damage to fixed fire extinguishing systems, lifesaving equipment, auxiliary power generating equipment, or bilge pumping systems;
- loss of life;
- injury causing a person to remain incapacitated for a period in excess of 72 hours; or
- an occurrence not meeting any of the above criteria but resulting in damage to property in excess of $25,000. Damage includes the cost of restoring the property to the service condition which existed prior to the casualty, but must exclude the cost of salvage, gas freeing, and drydocking. It also does not include such items as demurrage.

Every event involving a vessel or its personnel which meets any of the conditions of a reportable casualty is of great concern to the Coast Guard. A number of reportable casualties are not investigated by the Coast Guard simply because they are not reported. Thus, it is of the utmost importance that the masters of all vessels ensure that all casualties are reported.

Major Casualties That Occurred in Calendar Year 1983

Two major casualties resulting in total loss occurred in 1983. These are described on the following page:

Calendar Year 1983

Collier MARINE ELECTRIC

At 0251, February 12, 1983 (all times are Eastern Standard Time, +5 zone time), the collier MARINE ELECTRIC, while enroute from Norfolk, Virginia, to Brayton Point, Massachusetts, with a full load of steam coal, reported to the Coast Guard that she was taking on water and going down by the head. Gale-force weather conditions existed at the time. At 0415, February 12, 1983, as the vessel's crew was preparing to abandon ship, the MARINE ELECTRIC capsized, throwing most of the 34 crewmen into the water. Rescue efforts by U.S. Coast Guard and U.S. Navy aircraft and surface vessels and by merchant vessels resulted in the recovery of 3 survivors and 24 bodies. Seven persons remain missing and are presumed dead. The overturned stern of the vessel remained visible until approximately 1130, February 12, 1983. At that time, the vessel sank in about 120 feet of water, approximately 30 nautical miles east of Chincoteague, Virginia. The Commandant has determined that the actual cause of the casualty is unknown. The most probable cause was determined to be the wasted top plating of the dry cargo hatch and wasted main deck plating which permitted boardings seas to flood the vessel's forward spaces.

Drillship GLOMAR JAVA SEA

About 2355 on October 25, 1983, the 400-foot-long U.S. drillship GLOMAR JAVA SEA capsized and sank during Typhoon Lex in the South China Sea about 65 nautical miles south-southwest of Hainan Island, People's Republic of China. Of the 81 persons who were aboard, 35 bodies have been located, and the remaining 46 persons are missing and presumed dead. The GLOMAR JAVA SEA is currently resting on the bottom of the sea in an inverted postion in about 315 feet of water; its estimated value was $35 million.

The actual cause of this casualty and the actual sequence of events was not established with certainty. However, the most probable cause was a result of the following combination of factors: the shifting of the vessel's cargo, the loss of the vessel's watertight integrity, the vessel's substantial list which affected stability, and finally, the severe environmental conditions of Typhoon Lex. These factors led to the eventual capsizing and sinking of the drillship GLOMAR JAVA SEA.

The statistical tabulation presented below is intended to summarize the casualty experience for the entire commercial fleet. Because the summary is so all-encompassing, use of the statistics may lead to erroneous conclusions if the limitations of the data are not well understood. The Marine Safety Evaluation Branch of the Marine Investigation Division will gladly asist in quantifying those limitations for each specific need.

Comments and recommendations for changes or improvements in the statistics should be addressed to Commandant (G-MMI-3), U.S. Coast Guard, 2100 Second Street, SW, Washington, DC 20593.

Tables of statistics begin on the next page.

Table 1

Summary of Commercial Vessel Total Losses by Nature of Casualty and Vessel Size for 1983

	FOUNDERED		FIRE/EXPLOSION		COLLISION		GROUNDING		HULL/MACHINERY DAMAGE		MISSING		OTHER	
	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT	No.	GT
FREIGHTSHIP														
Less than 100 GT			1		1	46								
100-199														
200-299														
300-499														
500-1599														
1600-4999														
5000-9999														
10,000-19,999	1	13757												
20,000 and Above														
~~TANKSHIP~~														
Less than 100 GT														
100-1599														
1600-4999														
5000-9999														
10,000-19,999														
20,000-39,999														
40,000-99,999														
100,000 and Above														
PASSENGER VESSEL (inc. ferries)														
Less than 100 GT	6	261	1	20	1	16			2	89				
100-1599														
1600-4999														
5000 and Above														
~~TUG/TOWBOAT~~														
Less than 100 GT	~~14~~	~~751~~	~~3~~	~~179~~	~~1~~	~~92~~			~~1~~	~~87~~				
100-199	~~13~~	~~2055~~	~~3~~	~~484~~	~~1~~	~~192~~	~~1~~	~~123~~						
200-299														
300-999			~~2~~	~~674~~	~~1~~	~~459~~								
1000 and Above														
~~OFFSHORE SUPPLY~~														
Less than 100 GT														
100-199							1	198						
200-499														
500 and Above														
MODU														
Less than 300 GT	2	291	1	79										
300 GT and over	1	5930												
PLATFORM														
FISHING VESSEL														
Less than 100 GT	86	3160	57	2240	29	1057	22	721	19	605			4	167
100-199	14	2014	7	1006	1	101	3	427	1	117				
200-499	1	331												
500-999														
1000 and Above														
State Numbered	16	102	9	12	5		1		5		2		1	
TANK BARGE														
Less than 500 GT	1													
500-999			1	835	1	760	1	680						
1000 and Above			1	1434			1	1522						
FREIGHT BARGE														
Less than 100 GT					2				1					
100-999	1	794			4	3368	1	799	1	694			2	988
1000 and Above	1	1400			2	2598	1	1617					1	2168
Unknown														
MISCELLANEOUS														
Less than 100 GT	8	231	3	87	7	34	1	7					1	
100 and Above (SP)							1	172						
100 and Above (NSP)	3	361							2	611				
FOREIGN FLAG														
Freight	1	2295												
Tank														
Other														

Table 2A

Total Losses During 1983
Type of Vessel by Age of Vessel

Type vessel Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN
FREIGHTSHIP	1						2	
TANKSHIP								
PASSENGER VESSEL (inc. ferries)	1		1	2	2	1	3	
TUG/TOWBOAT	6	7	5	6	2	3	10	1
OFFSHORE SUPPLY			1					
MODU		3	1					
PLATFORM								
FISHING VESSEL	44	44	37	24	17	13	62	3
STATE NUMBERED	5	2	6	8	3		12	3
TANK BARGE	1			1		1	2	1
FREIGHT BARGE	3	2	4	3			4	1
MISCELLANEOUS	6	2		4	1	4	5	4

Table 2B

Total Losses During 1983
Nature of Casualty by Age of Vessel

Casualty Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN
FOUNDERED	27	25	23	22	11	7	51	4
FIRE/EXPLOSION	25	15	11	12	5	7	12	1
COLLISION	7	5	13	3	4	3	14	6
GROUNDING	6	5	2	6	3	2	9	1
HULL/MACHINERY DAMAGE	1	8	6	3	2	2	9	1
MISSING		1		1				
OTHER	1	1		1		1	5	

Table 3

Summary of Commerical Vessels Not Involved in a Total Loss by Nature of Casualty and Vessel Size for 1983

	FLOODED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	WEATHER DAMAGE	OTHER
	No.	No.	No.	No.	No.	No.	No.
FREIGHTSHIP							
Less than 100 GT			3	9	9		5
100-199			6	2	2		
200-299			10	2			
300-499				1			
500-1599			8	5	1		3
1600-4999			8	5	6		2
5000-9999	1	4	13	10	6		1
10,000-19999	2	7	51	31	49	6	13
20,000 and Above		4	22	38	44	3	10
TANKSHIP							
Less than 100 GT					2		
100-1599			5	3	3		1
1600-4999			3	1	2		1
5000-9999		2	1	5	1		2
10,000-19,999		4	16	18	23	1	6
20,000-39,999		5	15	29	18	3	5
40,000-99,999		2	9	10	15		1
100,000 and Above					3		
PASSENGER VESSEL (inc. ferries)							
Less than 100 GT	12	11	39	33	55	3	14
100-1599			6	4	19		3
1600-4999	1	1	2	5	5		1
5000 and Above			1		1		
TUG/TOWBOAT							
Less than 100 GT	11	14	98	91	30	4	36
100-199	7	15	179	164	40	2	33
200-299	1	6	55	82	9		6
300-999		4	81	264	25		11
1000 and Above			7	33	4		3
OFFSHORE SUPPLY							
Less than 100 GT	1	3	10	6	3	2	4
100-199		1	8	3	3	1	
200-499		2	17	1	2	1	1
500 and Above							
MODU							
Less than 100 GT			1		1	1	2
100-299	1		2			2	
300 GT and Above		1	22	1	5	3	6
PLATFORM		4	6	2	1		3
FISHING VESSEL							
Less than 100 GT	80	44	76	111	301	7	128
100-199	18	8	30	44	75	1	24
200-499		2		2	1		3
500-999		2	1	2			1
1000 and Above		2	1	1	1		1
State Numbered	7	5	7	24	28		22

Table 3
(continued from previous page)

	FLOODED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	WEATHER DAMAGE	OTHER
	No.	No.	No.	No.	No.	No.	No.
TANK BARGE							
Less than 100 GT			4	12			
100-499				4	2	1	4
500-999			34	97	10	9	4
1000 and Above	1	5	142	218	28	2	15
FREIGHT BARGE							
Less than 100 GT			1	2			
100-999	1	3	227	468	44		50
1000 and Above	4		65	109	6	1	18
Unknown			51	86	4		16
MISCELLANEOUS							
Less than 100 GT	1	4	155	8	28	2	62
100 and Above (SP)	5	6	12	106	4		1
100 and Above (NSP)	2	2	18	6	4		4
FOREIGN FLAG							
Freight	2	5	69	74	36	1	20
Tank		6	21	27	8		10
Other		2	14	10	3		2

Table 4A

Vessels Not Involved in a Total Loss During 1983
Type of Vessel by Age of Vessel

Type vessel Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN
FREIGHTSHIP	92	77	86	47	38	6	48	8
TANKSHIP	33	60	36	14	26	13	32	1
PASSENGER VESSEL (inc. ferries)	41	43	37	23	14	22	35	1
TUG/TOWBOAT	312	301	158	157	83	105	186	13
OFFSHORE SUPPLY	34	23	8	3		1		
MODU	31	7	3	2	1	2		2
PLATFORM	3	1		2				10
FISHING VESSEL	152	177	123	125	54	47	275	14
STATE NUMBERED	17	14	14	13	5	6	12	12
TANK BARGE	105	122	120	93	52	25	41	34
FREIGHT BARGE	385	255	151	115	54	26	17	153
MISCELLANEOUS	92	43	37	39	21	25	35	138

Table 4B

Vessels Not Involved in a Total Loss During 1983
Nature of Casualty by Age of Vessel

Casualty Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN
FLOODED	24	28	16	22	8	13	39	6
FIRE/EXPLOSION	38	29	35	17	12	6	30	6
COLLISION	414	342	187	142	85	67	136	155
GROUNDING	534	461	326	289	135	92	163	158
HULL/MACHINERY DAMAGE	156	180	126	103	76	60	196	26
WEATHER DAMAGE	21	5	10	5	8	1	3	2
OTHER	110	78	73	55	24	39	114	33

Table 5A

Summary of Commercial Vessel Casualties During 1983
by Cause* and Nature of Casualty

PERSONNEL	FOUNDERED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	HULL/MACHINERY DAMAGE No.	MISSING No.	OTHER No.
Inatt. to duty	1		6	4	1		1
Judgmental error	8	1	102	196			5
Carelessness	7	9	8	7	2		1
Lack of knowledge	1		5	9			
Relied on floating ATON				2			1
Failed to							
Account wind/current	2		93	119			
Use nav. equip/charts				5			
Use radiotelephone							
Ascertain position			2	54			1
Establish Pass Agreement			11	1			
Keep Proper Lookout	2		30	11			
Keep Right of Channel			2				
Comply w/Rule, Reg, Procedure		2	12	1			
Proceed at Safe Speed	1		8	2			4
Yield Right of Way			2				
Stress							
Fatigue			3	17			
Physical impair.			1	1			
Intoxication			1	1			
Improper Loading	19	1			2		
Improper Maintenance	9	7			37		2
Improper Mooring/Tow	8		6	2	2		10
Improper Securing/ Rigging	15		1	1			
Improper safety Precaut	1	2	2				2
Operator Error	21	5	90	199	12		11
Other	14	6	24	34	11		3

* Cause is first one listed in each record

Table 5B

Summary of Commercial Vessel Casualties During 1983 by Cause* and Nature of Casualty

ENVIRONMENT	FOUNDERED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	HULL/MACHINERY DAMAGE No.	MISSING No.	OTHER No.
Adverse weather	33		31	103	12		44
Adverse current	20		27	13	11		23
Debris	1		8		7		1
Ice	1		2	2	1		
Lightning					1		
Shoaling			3	159	2		
Submerged object	4		95	2			
Channel hazard			9	76			2
Inadequate AtoN							
Other	1		10	8			

Table 5C

Summary of Commercial Vessel Casualties During 1983 by Cause* and Nature of Casualty

MATERIAL RELATED	FOUNDERED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	HULL/MACHINERY DAMAGE	MISSING No.	OTHER No.
Failed Materials:							
Structural	116	11	15	18	48		21
Mechanical	57	34	5	3	346		15
Electrical		33	1	4	50		25
Corrosion					11		
Normal Wear			1		29		
Improper welding	1	2	1		5		
Improper riveting							
Steering failure			4	2	2		
Fouled propeller	2			5	8		56
Inadequate:							
Lighting			2				
Stability	5						1
Lifesaving equip							1
Firefighting equip		1					
Controls							
Lubrication					14		
Maintenance				1	19		10
Insufficient fuel			4	9	2		5
Propulsion Failure					16		
Fatigue Failure	2	1	9	12	8		1
Other	28	25	5	40	60		25
CAUSE UNKNOWN	96	107	57	23	115	4	12

* Cause is first one listed in each record

Table 6

Deaths/Injuries Resulting from Total Loss of Commercial Vessels During 1983

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY	MISSING	OTHER	TOTAL
FREIGHTSHIP	31/0							31/0
TANKSHIP								
PASSENGER VESSEL	0/1							0/1
TUG/TOWBOAT	16/3							16/3
OFFSHORE SUPPLY								
FISHING VESSEL	54/5	0/4	3/0	3/0	2/1		1/0	63/10
STATE NUMBERED	11/0	0/4	1/2		2/0	6/0		20/6
MODU	81/0							81/0
PLATFORM								
FREIGHT BARGE								
TANK BARGE								
MISCELLANEOUS	3/1		4/0					7/1
TOTAL								218/21
LICENSED OFFICER	20/0		0/1					20/1
CREW	175/8	0/6	4/1	3/0	4/1	6/0	1/0	193/16
PASSENGER	1/2		3/0					4/2
OTHER		0/2	1/0					1/2

Table 7

Deaths/Injuries Resulting from a Commercial Vessel Not Involved in a Total Loss During 1983

	FLOODED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY	WEATHER DAMAGE	OTHER	TOTAL
FREIGHTSHIP		0/3	0/2		1/1		2/3	3/9
TANKSHIP		0/4	0/1		1/1		0/1	1/7
PASSENGER VESSEL		0/2	0/4	1/3	0/2		0/3	1/14
TUG/TOWBOAT		0/7	7/6		1/2	0/1	1/8	9/24
OFFSHORE SUPPLY		2/0	0/6	0/1		0/3		2/10
FISHING VESSEL	0/1	2/3	1/4	0/3	0/1		3/0	6/12
STATE NUMBERED		1/0	0/1	1/0			3/0	5/1
MODU			0/2		4/7	0/1	0/1	4/11
PLATFORM		0/1						0/1
FREIGHT BARGE			0/1				5/0	5/1
TANK BARGE		0/2	1/1		0/1		1/9	2/13
MISCELLANEOUS		1/3	2/11	0/2	0/1		3/2	6/19
TOTAL								44/122
LICENSED OFFICER		0/5	0/1		0/1	0/1	0/2	0/10
CREW		5/16	5/20	1/4	7/13	0/4	15/17	33/74
PASSENGER		0/1	6/15	1/3			2/3	9/22
OTHER	0/1	1/3	0/3	0/2	0/2		1/5	2/16

Table 8

Other Deaths/Injuries Onboard Commercial Vessels During 1983 (Not Related to a Vessel Casualty)

	SLIP/ FALL ONBOARD	FALL OVER BOARD	DISAPPEAR	STRUCK BY OBJECT	PINCH OR CRUSH	BURN SCALD	ELECTRIC BURN/ SHOCK	CUT	CAUGHT IN LINES	ASPHYXIA	SPRAIN OR STRAIN	DIVING	UNKOWN OR NOC	TOTAL
FREIGHTSHIP	4/73	2/	2/	7/34	4/27	/7	1/2	/10		1/	/18		5/69	26/240
TANKSHIP	1/20	1/		1/19	/8	/2		/1	/2	3/	/11		/21	6/84
PASS. VSL.	/19	3/5	1/	/6	1/5					1/		7/2	2/16	15/53
TUG/TOWBOAT	/15	15/3	1/	1/17	1/6	/2			/3		/5		1/10	19/61
FISHING VSL	1/8	12/2	6/	2/17	1/16	/1	1/	/3	/2	1/2	/8	3/2	5/28	34/97
OFFSHORE SPLY		1/	2/	/2						4/		1/1	1/3	9/6
STATE NUMBERED														
MODU	1/39	1/2		3/53	/37	/9		/2	/3		/30		/47	5/222
PLATFORM	1/92	3/4	2/	1/76	/58	/20	1/1	/10	/4	2/	/90	/3	/112	10/470
FREIGHT BARGE	/1	2/		/1							/1	1/		3/3
TANK BARGE	/3			/1			/1			2/	/1		/5	2/11
MISCELLANEOUS	/1	2/		/1	1/6							2/1	1/6	6/15
TOTAL														140/1268
LICENSED OFFICER	/24	2/		2/14	1/14	/3	/1		/1	3/	/3		1/17	9/77
CREW	6/241	34/11	13/	13/203	5/144	/36	3/3	/25	/14	7/1	/153	3/1	8/266	92/1098
PASSENGER	/6	3/5	1/	/4	/3					1/		8/2	2/9	15/29
OTHER	2/7	6/		3/12	2/5	/2		/2		4/1	/8	3/6	4/21	24/64

Table 9

Summary of Commercial Vessel Casualties and Involvements by Nature of Casualty for 1983

Involvements With Total Losses	FOUNDERED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	HULL/MACHINERY DAMAGE No.	MISSING No.	OTHER No.	TOTAL
Casualties	165	83	56	36	34	2	9	385
Involvements	165	89	56	36	34	2	9	391

Involvements Without Total Loss	FLOODED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	HULL/MACHINERY DAMAGE No.	WEATHER DAMAGE No.	OTHER No.	TOTAL
Casualties	150	167	665	1113	804	45	398	3342
Involvements	156	173	1528	2158	923	55	519	5512

In each issue of the **Proceedings**, the column "Nautical Queries" contains material that is representative of questions asked on Coast Guard licensing examinations. Staff at the U.S. Coast Guard Institute prepare "Nautical Queries" using a variety of reference works. The Institute's staff receives many inquiries about the reference publications used, so as a service to **Proceedings** readers, we are publishing a list of primary references used to develop questions for deck licenses and certificates.

Readers who wish to obtain copies of these publications should contact the commercial publisher or should place orders through local nautical bookstores or distributors. Government publications are available at government bookstores, the U.S. Government Printing Office, or through distribution agents for the Defense Mapping Agency and National Ocean Survey.

Many "Nautical Queries" questions in the data bank are developed from publications that have now been superseded; however, the answers can usually be determined from the current references. While the publications listed in this article are the ones used at the Institute, any authoritative, recognized publication similar to the texts listed can substitute as a study resource.

Government Publications

Defense Mapping Agency
Hydrographic/Topographic Center
Office of Distribution Services
Attention: DOCS
Washington, DC 20315-0010

American Practical Navigator - Vols. I & II

International Code of Signals - HO102

Radio Navigational Aids - PUB117A

Sight Reduction Tables, Vol. 2 - HO229

Radar Navigation Manual - HO1310

Maneuvering Board Manual - HO217

Nautical Chart Symbols and Abbreviations - Chart No. 1

National Ocean Survey
Riverdale, MD 20737-1199

Tide Tables

Tidal Current Tables

United States Coast Pilot - Vols. 2 & 3

Coast Guard
G-CMA-3
2100 Second St., SW
Washington, DC 20593

Light Lists, Vols. I, II, and V

Manual for Safe Handling of Flammable and Combustible Liquids (CG-174)

Navigation Rules (M16672.2A)

Chemical Data Guide for Bulk Shipment by Water (M16616.6)

Merchant Ship Search and Rescue Manual (M16130.1)

Miscellaneous

Nautical Almanac - U.S. Naval Observatory

Marine Fire Prevention, Firefighting, and Fire Safety - Maritime Administration (MARAD)

Ship's Medicine Chest and Medical Aid at Sea - U.S. Department of Health, Education and Welfare

33 CFR 1-199, Government Printing Office

46 CFR 1-40, Government Printing Office

46 CFR 40-69, Government Printing Office

46 CFR 90-105, Government Printing Office

46 CFR 140-155, Government Printing Office

46 CFR 156-165, Government Printing Office

49 CFR 100-177, Government Printing Office

References Published by
Cornell Maritime Press
P.O. Box 456
Centreville, MD 21617

Tugs, Towboats and Towing - Brady

Primer of Towing - Reid

Modern Ships - LaDage

Guide to Sound Ship Structure - D'Arcangelo

Ship Business, Cargo Loss and Damage - McFarland & Wells

Introduction to Steel Shipbuilding - Baker

The Business of Shipping - Kendall

Shipmaster's Handbook on Ship's Business - Martin

Purser's Handbook - Armstrong

Chartering and Charter Parties - Cooley

Nautical Rules of the Road - Farnsworth

Automatic Radar Plotting Aids Manual - Bole and Jones

Mariner's Gyro Navigation Manual - O'Hara

Ship Handling in Narrow Channels - Plummer

Shiphandling for the Mariner - MacElrevey

Stability and Trim for the Ship's Office - LaDage and Van Gemert

American Merchant Seaman's Manual - Haylor

Tanker Operations - Marton

Encyclopedia of Nautical Knowledge - McEwen and Lewis

Merchant Marine Officer's Handbook - Turpen and MacEwan

References Distributed in the United States by
Sheridan House
145 Palisade Street
Dobbs Ferry, NY 10522

Ship Stability - Derrett

Basic Shiphandling - Willerton

Thomas' Stowage - Thomas, Agnew and Cole

Tanker Handbook for Deck Officers - Baptist

Merchant Ship Construction - Pursey

Practical Ship-Handling - Armstrong

Nicholl's Seamanship and Nautical Knowledge - Cockcroft

Liquefied Petroleum Gas Tanker Practice - Woolcott

The Boatswain's Manual - Miller

Seamanship Notes - Kemp and Young

Notes on Cargo Work - Kemp and Young

Business Law and the Shipmaster - Hopkins

Ship Construction, Sketches and Notes - Kemp and Young

The Oil Rig Moorings Handbook - Vendrell

Notes on Meteorology - Kemp and Young

References Published by
The Petroleum Extension Service
University of Texas at Austin
BRC-2, 10100 Burnet Road
Austin, TX 78758

Rotary Drilling Series

Unit I, Lesson 10 - Safety on the Rig

Unit V, Lesson 2 - Spread Mooring Systems

Unit V, Lesson 3 - Buoyancy, Stability and Trim

Unit V, Lesson 4 - Jacking Systems and Rig Moving Procedures

Unit V, Lesson 6 - Vessel Inspection and Maintenance

Unit V, Lesson 7 - Helicopter Safety

Unit V, Lesson 8 - Offshore Crane Operations

Unit V, Lesson 9 - Life Offshore

References Published by
U.S. Naval Institute
2062 Generals Highway
Annapolis, MD 21401

Farwell's Rules of the Nautical Road - Bassett and Smith

Weather for the Mariner - Kotsch

Heavy Weather Guide - Kotsch and Harding

How To Survive on Land and Sea - Craighead

The Use of Radar at Sea - Wylie

Dutton's Navigation and Piloting - Maloney

References — Other Publishers

Knight's Modern Seamanship - VanNostrand
Reinhold Publishing Co.
450 W. 33rd St.
New York, NY 10001

Meteorology - Dunn
McGraw-Hill
Princeton-Hightstown Rd.
Hightstown, NJ 08520

Piloting, Seamanship and Small Boat Handling - Chapman
Hearst Corp.
959 Eighth Ave.
New York, NY 10001

This Is Sailing - Creagh-Osbourne
Hearst Corp.
959 Eighth Ave.
New York, NY 10001

The Deckhand's Manual
Inland Waterways Safety Service Co.
PO Box 6476
New Orleans, LA 70114

Cargo Handling - Immer
Work Saving International Co.
1638 19th St., NW
Washington, DC 20009

Water Survival and You
Harry Lundeberg School of Seamanship
Piney Point, MD 20674

Inquiries about this material should be directed to Mr. Barry Farnsworth, U.S. Coast Guard Institute, telephone (405) 686-4417. We wish to thank Mr. Stewart Walker, Chief, Deck Branch, U.S. Coast Guard Institute, for compiling this list for the ***Proceedings.***

Nautical Queries

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

ENGINEER

1. Auxiliary boilers are divided into several classifications, one of which is

A. watertube supercritical circulation.
B. watertube forced circulation.
C. firetube controlled circulation.
D. firetube express circulation.

Reference: Osbourne, Modern Marine Engineer's Manual, Vol. I

2. What is the average piston speed of an engine with a 12-inch stroke operating at 900 RPM?

A. 450 ft/min
B. 900 ft/min
C. 1500 ft/min
D. 1800 ft/min

Reference: Maleev, Diesel Engine Operation and Maintenance

3. A pressure-velocity compounded impulse turbine consists of

A. velocity compounded with reaction pressure compounding.
B. several rows of moving blades attached to diaphragms.

C. two or more stages of velocity compounding.
D. two or more rows of nozzles in which there is no pressure drop.

Reference: Osbourne, Modern Marine Engineer's Manual, Vol. I

4. Trunk-type diesel engine pistons are most effectively cooled by heat

A. radiated through the engine block.
B. conducted through the piston crown.
C. transferred to water-cooled cylinder walls.
D. transferred to lube oil on the cylinder wall.

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

5. Which of the following conditions would cause only one burner solenoid valve to close on an automatically fired, two-burner boiler?

A. Loss of the forced draft fan
B. Low boiler water level
C. High boiler water level
D. A faulty coil in the solenoid valve

Reference: 46 CFR 63.05-50

DECK

1. The water pressure in a flooded compartment open to the sea is greatest along the

A. bulkheads adjacent to the holed plating.
B. bulkhead opposite the holed plating.
C. deck.
D. overhead.

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

2. Advection fog is most commonly caused by

A. air being warmed above the dew point.
B. a warm continental air mass moving over the ocean.
C. a rapid cooling of the air near the surface of the earth at night.
D. warm, moist air being blown over a colder surface.

Reference: Donn, Meteorology

3. Longitudinal distribution of cargo has an effect on

A. GM.
B. trim.
C. the rolling period.
D. all of the above.

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

4. Which vessel sounds the same fog signal when underway or at anchor?

A. A sailing vessel
B. A vessel restricted in her ability to maneuver
C. A vessel constrained by her draft
D. A vessel not under command

Reference: COMDTINST M16672.2A

5. Some grade B cargoes can be lost through

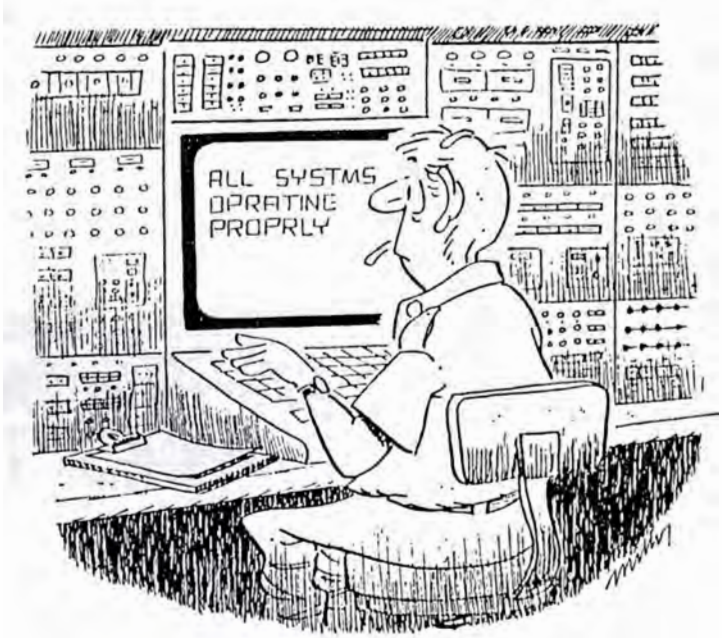
A. condensation.
B. gravitating.
C. evaporation.
D. thieving.

Reference: Baptist, Tanker Handbook for Deck Officers

ANSWERS

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

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



Hung M. Nguyen

Vinyl Chloride

Vinyl chloride is a very important commercial monomer having the group (CH_2=CH-). It is made from the reaction of acetylene and hydrochloric acid and is produced either as a liquid or gas. It is colorless and has a pleasant, sweet odor. At ambient temperatures, vinyl chloride is a flammable gas. It has a severe explosion risk at concentrations of 30,000 parts per million. Although it is heavier than air, vinyl chloride may travel a considerable distance to a source of ignition and then flash back. Fires involving vinyl chloride result in the production of highly toxic combustion products, such as hydrogen chloride and carbon monoxide.

At temperatures between 20°C and 100°C, molecules of vinyl chloride polymerize to become polyvinyl chloride. Because of its low price and excellent properties, polyvinyl chloride is used in large quantities in the production of fibers, film, pipes, rubber products, molded articles of all kinds, artificial leather, and coatings.

In combination with other compounds such as vinyl acetate, vinyl chloride helps produce polymeric materials that are tough, flexible, have good electrical insulating properties, and strong resistance to chemical degradation. Because of these characteristics, these materials are used for sheeting upholstery, luggage, packaging, and for electrical insulation. They are also used for coating and molding resins.

In 1974, a rare liver cancer called angiocarcinoma was found in and linked to workers in vinyl chloride manufacturing plants. As a result of this linking, standards have been developed to limit workers' exposure to less than a one part per million average over an 8-hour day. The Food and Drug Administration has banned the use of polyvinyl chloride in food packages because there is evidence that they might contain traces of vinyl chloride. In addition, vinyl chloride's use in aerosol sprays has also been prohibited.

Hung M. Nguyen was a First-Class Cadet at the Coast Guard Academy when this article was written. It was written under the direction of LCDR J.J. Kichner for a class on hazardous materials transportation.

Chemical name:	Vinyl Chloride
Formula:	CH_2=CH-
Synonyms:	chloroethylene VCL vinyl c monomer VCM chloroethene
Physical Properties:	
boiling point:	-13.8°C (7.2°F)
freezing point:	-153°C (-244.8°F)
vapor pressure: 20°C (68°F)	2300 mm Hg
Threshold Limit Values (TLV)	
time weighted average:	200 ppm; 516 mg/m^3
short term exposure limit:	500 ppm; 1290 mg/m^3
Flammability Limits in Air	
lower flammability limit:	4% by volume
upper flammability limit:	26% by volume
Combustion Properties	
flash point:	-77°C (-108°F)
autoignition temperature:	472°C (882°F)
Densities	
liquid (water=1):	0.969
vapor (air=1):	2.2
U.N. Number:	1086
CHRIS Code:	VCM
Cargo compatibility group:	35 (Vinyl Halides)

All persons handling vinyl chloride should avoid direct contact with the chemical. They should wear gastight safety goggles, rubber gloves, aprons, shoes, and a self-contained breathing apparatus. Inhalation of vinyl chloride gas at high concentrations can cause dizziness, anesthesia, and lung irritation. If the chemical is inhaled, move the victim to fresh air. If the victim's breathing has stopped, artificial respiration must be given. Because liquid vinyl chloride will cause frostbite of the skin, the affected area should be washed with plenty of water for at least 15 minutes, and the contaminated clothing should be removed. A physician should be notified.

Vinyl chloride is normally shipped as a liquefied compressed gas in pressure cylinders and tank cars. The U.S. Department of Transportation lists vinyl chloride in Part 172.101 of Title 49, Code of Federal Regulations, as a flammable compressed gas. The International Maritime Dangerous Goods Code (IMDG) lists it on page 2123. In the bulk mode, the U.S. Coast Guard regulates vinyl chloride as a liquefied gas under Subchapter O of Title 46, Code of Federal Regulations. The International Maritime Organization (IMO) includes it in its Gas Code. ↨

Keynotes

Final Rule

CGD 84-091, International Regulations for Preventing Collisions at Sea; 1972 COLREGS Demarcation Lines (March 6)

The Coast Guard has updated the identifiable lines to delineate water upon which International Regulations for Preventing Collisons at Sea, 1972 (COLREGS) apply and waters upon which Inland Navigation Rules apply. These rules become effective on April 7, 1986.

Notice of Proposed Rulemaking

CGD 85-098, Boating Safety; Fuel System Standard (March 20)

The Coast Guard proposes to amend its regulations on fuel systems for recreational boats by incorporating SAE Standard J 1527, December 1985. The intended effect of the proposed amendments is to specify four grades of fuel hose that are more resistant to alcohol permeation which results from an increasing level of aromatics and alcohol in the fuels. Comments must be received on or before June 18, 1986.

Interim Final Rule

CGD 86-016, Combination Load Lines (March 24)

This interim final rule corrects an unintended inequity in the present load line regulations for unmanned deck cargo barges which operate in both the Great lakes and the ocean (dual service). This interim final rule allows the use of the equivalent of a Great Lakes summer load line mark on dual service stability limited deck cargo barges.

Confirmation of Interim Rule as Final

CGD 85-094, Licensing of Pilots; Annual Physical Examination (March 31)

This confirms without change the interim final rule published on December 23, 1985, that amended the annual physical examination requirements for pilots to allow first-class pilots to take the required physical examination at any time during the calendar year, with the stipulation that the time between each physical examination may not exceed 13 months. This rule provides flexibility in scheduling physical examinations in order to accommodate the employment practices in the merchant marine.

Requests for copies of NPRMs should be directed to the Marine Safety Council. The address is Commandant (G-CMC), U.S. Coast Guard, 2100 Second Street, SW, Washington, DC 20593; telephone (202) 426-1477. The office, Room 2110, is open between the hours of 8:00 a.m. and 3:00 p.m. Monday through Friday. Comments are available for inspection or copying during those hours.

Safety First !!!