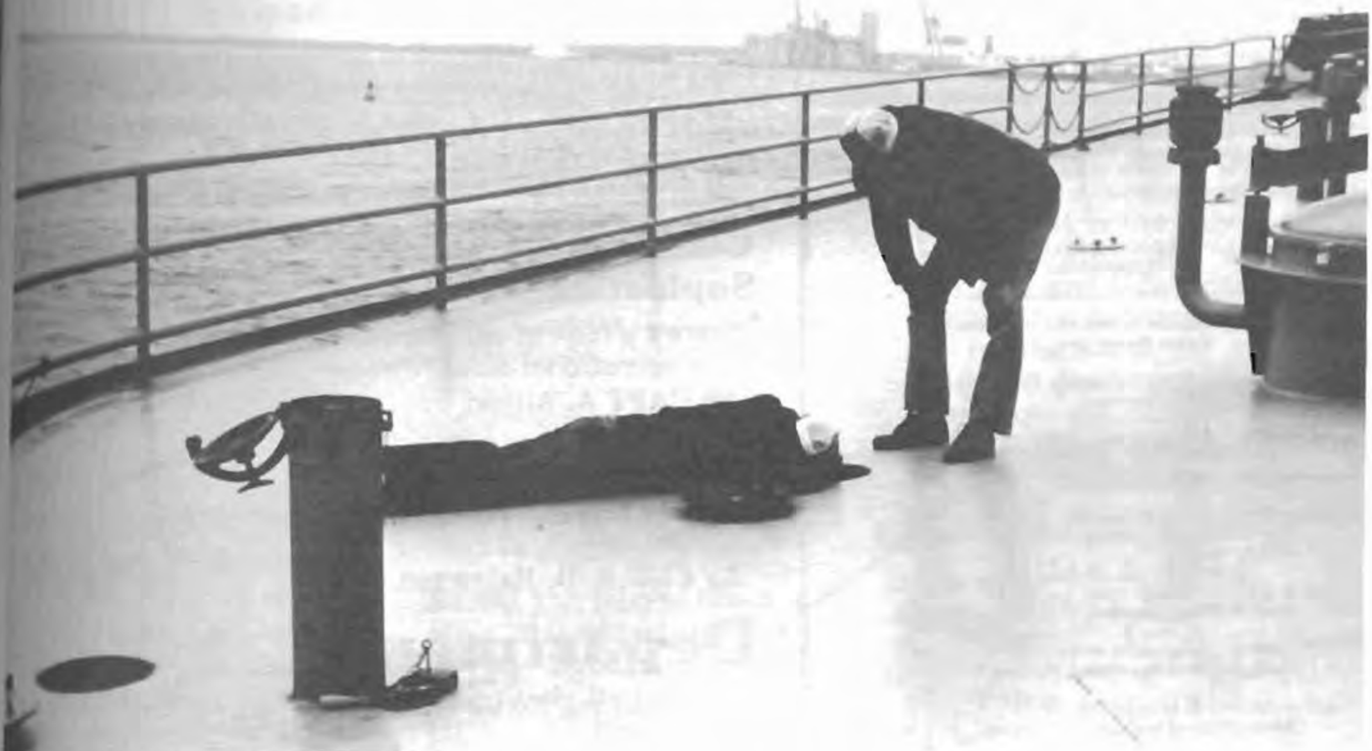
Proceedings

of the Marine Safety Council



"That can't be one of our employees."

United States
Coast Guard

October/November 1983

Proceedings
of the Marine Safety Council

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

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Protests to the contrary notwithstanding, employees too often inspect just-cleaned tanks by sticking their heads into them. Safer methods do exist, and personnel who come into contact with chemicals should be careful to minimize exposure. "Could this line of work be hazardous to your health?" begins on page 224.

Letters to the Editor

Correction on NVIC No.

I very much enjoyed CDR Fred B. Halvorsen's article entitled "Death by Asphyxiation" printed in the September 1983 issue of the *Proceedings*. I would like to point out, however, that the Navigation and Vessel Inspection Circular (NVIC) dealing with Coast Guard policy changes regarding the type of respiratory protective devices required on board Coast Guard-inspected manned tank vessels is NVIC 13-80 in lieu of NVIC 10-80.

CDR L. M. Patton
U.S. Coast Guard Marine Safety Detachment
Lake Charles, LA

We stand corrected. Thanks—Ed.

Nautical Queries Answer No Longer Correct

The June 1983 issue of the *Proceedings* contains a sample license exam question based on information from my book *Tanker Operations*. Through no fault of yours, the answer given is no longer correct.

The question concerns the use of a combustible gas indicator. (Question: "Which statement is true concerning combustible gas indicators?" Answer: "B. They do not work properly where there is a lack of oxygen.") Many tankers are now provided with Tankscope combustible gas indicators which work well in low-oxygen atmospheres. This development is largely the result of the now widespread use of inert gas systems on tankers.

The current edition of my book describes the Explosimeter-type of combustible gas indicator, which, as stated, does not work properly in low-oxygen or inert atmospheres. This device is still in widespread use on tankers and other types of vessels.

A revised edition of *Tanker Operations* is scheduled for publication early next year. This new information on combustible gas indicators will be included. Also, an entire new chapter on inert gas systems will be included.

Captain G. S. Marton
Yreka, California

A Vote for "I," "M," and "O"

Should the International Maritime Organization be known by its acronym, "eemo," or strictly by its letters, "I," "M," "O"? ("IMO"—'Tain't no small potatoes," August 1983) Surely, as the Japanese delegate suggested, the latter usage is preferable.

Not only does the acronym "eemo" presumably mean "small potatoes" in Japanese, it also connotes a maritime disaster of unprecedented scale. The Norwegian steamer IMO collided with the munition-laden French steamer MONT BLANC in Halifax harbor in 1917. The resulting manmade explosion killed 2,000 people and was without equal until the detonation of the first atomic bomb. I'm for "I," "M," "O," and no acronym.

Robert H. Vorck, Jr.
Camp Springs, MD

New Edition of Reference Released

Stability and Trim for the Ship's Officer is a reference for the U.S. Coast Guard Deck licensing examinations. In addition, it is the only book on ship's stability that addresses the IMO and U.S. Coast Guard regulations concerning stability requirements for the carriage of grain in bulk aboard merchant vessels.

I believe mentioning the new edition could be quite newsworthy.

William E. George
Editor, *Stability and Trim for the Ship's Officer*
New York, NY

Agreed. See the Nautical Queries section for details—Ed.

Could this line of work be hazardous to your health?

The number of new and exotic chemicals being carried by ship is constantly increasing. This has led to increased concern for the safety of merchant mariners.

by LT Kyle Blackman
Marine Safety Technology Branch
Office of Research and Development

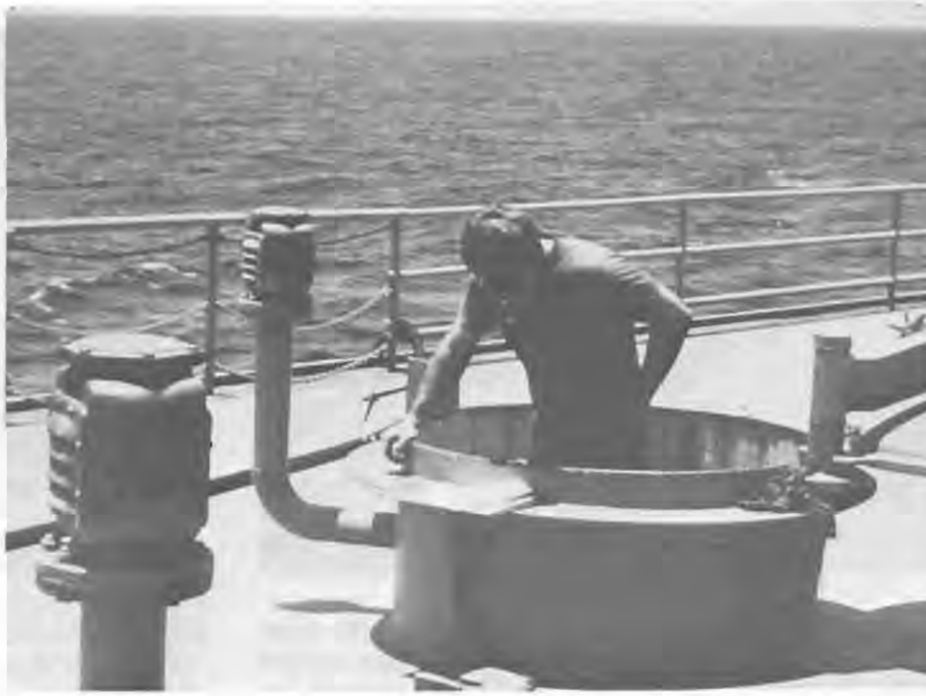
Concern over mariners' safety has grown as the nature of bulk liquid and gas cargoes has changed. Prior to World War II, this type of cargo was confined largely to petroleum. Shortages during the war led to the development of synthetics, and ships began carrying products refined from petroleum and highly specialized synthetic chemicals. Eventually, the sophisticated trade known as the "parcel tanker trade" developed. In this type of trade, as many as 40 different chemicals can be carried on a single ship. Looking at only a few cargoes, a mariner today might see such diverse commodities as "caustic soda," "vinyl chloride," "propylene oxide," "tetraethyl lead," and "toluene diisocyanate."

Among the hazards posed by such chemicals is their flammability/explosivity. A fire or explosion involving these chemicals could result in the total destruction of a ship. A second hazard is their toxicity. They can be "acutely" toxic; this means that a person exposed to a high concentration for a relatively short period of time will suffer adverse effects which appear almost immediately. In serious cases, these can include disability and even death. Repeated exposure to lower concentrations of a chemical can result in long-term, or "chronic" impairment of health. This second type of toxicity can also result in death in some cases.

Exposure to chemicals can also have more subtle effects on health. If crew members are exposed to relatively low concentrations of vapors during routine operations, their central nervous systems could be affected. This may cause them to make errors in judgment which might jeopardize the safe operation of the ship. A further concern is a phenomenon which researchers have just begun to study: the possible synergistic effect of these chemicals. Essentially, this is a "the-sum-is-greater-than-the-parts" phenomenon: the combined effect of two chemicals is greater than the sum of the individual effects of the chemicals alone. Carbon tetrachloride and ethanol, for example, are both, in their own right, toxic to the liver. Exposure to both chemicals, however, can cause much more liver damage than one would expect from looking at the individual effects.

Fortunately, concern about the effects of chemicals is not limited to the maritime community. The Coast Guard can make use research being done under the National Toxicology Program as well as that being done by such bodies as the National Fire Protection Association, the National Institutes of Health, and the Environmental Protection Agency, to name only a few. Unfortunately, however, most of this research deals with hazard control in an industrial situation, not in the unique environment of maritime transportation. Maritime personnel are in potentially greater danger than the average industrial worker for a number of reasons:

- They have novel work schedules. Employment in the marine industry does not fall within the guidelines of an eight-hour day and five-day workweek.



"Gee, I'm brave." Here we have a man entering a tank with poor skin protection, no respiratory protection, and no support team on deck.

- They may be exposed to a great number of chemicals, sometimes two or more at one time.

- They are likely to move among different ships and different trade routes. This may frequently bring them into contact with chemicals with which they have had no previous experience.

Because of the vastly different hazards and working conditions of the maritime industry, the marine environment does not compare with that of shore-based industry, and the direct adoption of the standards of the Occupational Safety and Health Administration would seem inappropriate. Recognizing that many of the chemicals routinely shipped pose substantial risks to the members of the maritime community, the Coast Guard has decided that these risks must be systematically evaluated.

The Coast Guard has started its evaluation by singling out those persons in the maritime field who, it can be reasonably assumed, will be exposed to chemicals as a part of their employment. These have been narrowed down to four groups: Coast Guard personnel involved in marine safety programs, merchant mariners who work with chemicals, employees of the offshore industry, and employees of waterfront facilities. In an attempt to assess the risks involved in being employed in this group, the Coast Guard has developed a series of research projects aimed at identifying, evaluating, and controlling the hazards connected with exposure to toxic chemicals. The steps involved in this effort are:

1. measuring actual exposure to chemicals,

2. evaluating this exposure and determining the level of risk it poses,

3. determining which operations are hazardous, and

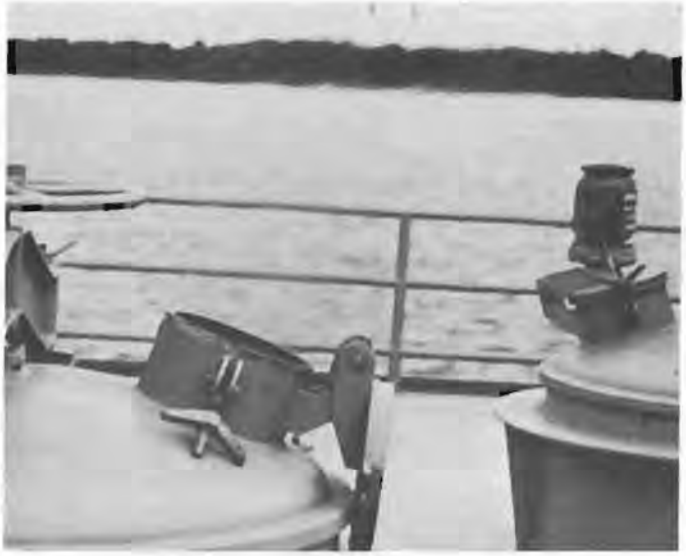
4. developing a comprehensive occupational health and safety program. Such a program would consist of:

   a) mathematical models for predicting exposure levels,

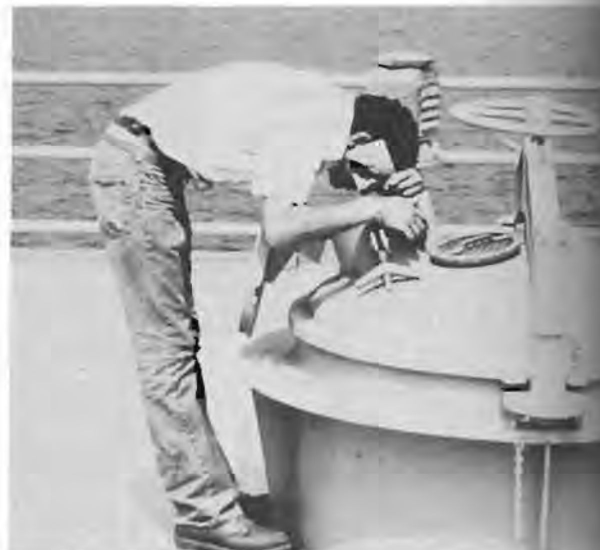
   b) modification of work practices,

   c) improved requirements for carriage of new chemicals, and

   d) training aids.



A vapor plume (the blurred area) can be seen forming where vapor emerges from an ullage cap. Mariners should be aware that vapors are emitted through these openings during loading.



"Boy, this smells good." Obviously the mes about vapor plumes hasn't hit home with people; this man is sticking his head dire into the opening during a loading operation.

Background

Cause and effect are the two areas that must be studied if the risks to personnel involved in chemical transportation are to be determined. The Coast Guard is thus taking two complementary approaches in its research. Southwest Research Institute (SwRI), of San Antonio, Texas, is covering "cause." This institute is studying the environment of perso likely to come in contact with chemicals documenting their work practices and chemical concentrations to which they are posed. Its three projects consist of:

These men, in the process of disconnecting, show a total lack of concern for their skin. Only one has gloves; they all have short sleeves; one goes so far as to wear shorts.

1) a study of hazards posed by chem vapors released in marine terminal op ations,

2) a crew exposure study, and

3) a study to improve the health and sa of marine workers exposed to chemic

"Effect," the impact of such exposure on ma ners' health, is being covered by the Natio Cancer Institute (NCI), based in Washingt DC. NCI is conducting two epidemiolog studies (i.e., looking for common inciden disease) for the Coast Guard:

1) a cancer mortality study of marine spectors employed prior to 1974, and

2) a cancer morbidity study (that is, ca which did not result in death) of Co Guard personnel who were removed fr active duty as a result of health pr lems or physical inability that prohi them from performing their ass duties.

Of the two types of research, the study of the environment of marine personnel is likely to yield more valid results, since it will measure actual conditions. The epidemiological studies, on the other hand, will be limited by the small size of the population being studied. The number of persons whose health has been impaired and for whom records have been kept is very small; once allowance has been made for a sampling error, the results of the studies may be statistically insignificant.

To ensure that it was on the right track with its five research projects, the Coast Guard commissioned the National Academy of Sciences to conduct an independent survey on the subject of exposure to chemicals. In its report, "Principles of Toxicological Interactions Associated with Multiple Chemical Exposures," the Academy confirmed that the five projects did indeed cover the important hazards. It also pointed out that multiple exposures to chemicals was a little understood subject and that little research was being conducted on it.

The SwRI Studies

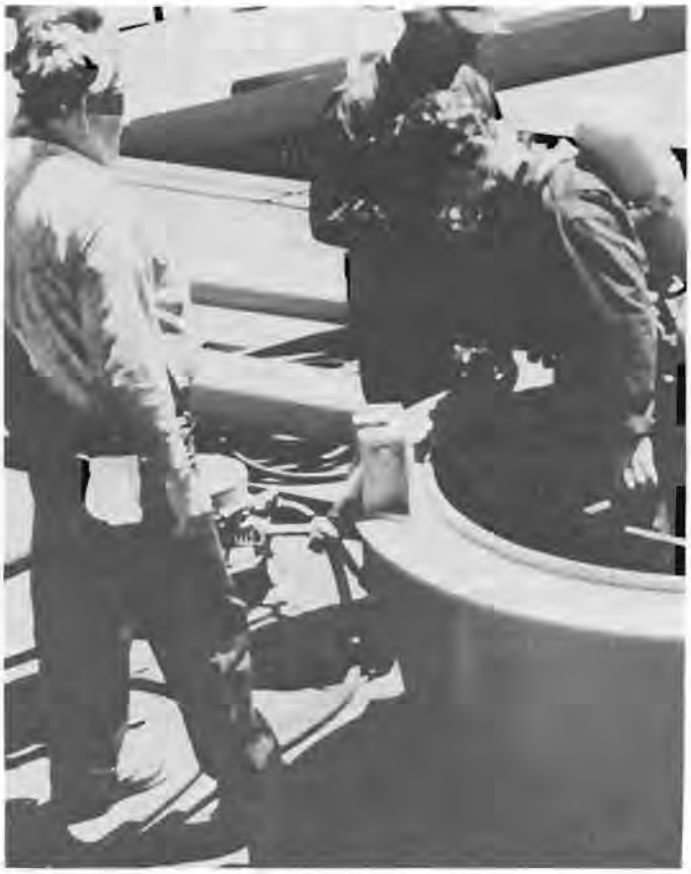
1) Investigation of the Hazards Posed by Chemical Vapors Released in Marine Operations

This study was completed in early 1983. Two reports have been issued: one on the investigation itself, Report No. CG-D-10-83, Accession No. AD A128537, and a handbook detailing the computer models and their use, Report No. CG-D-12-83, Accession No. AD A128768. Both are available from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The study consisted of the following elements:

- a background study to identify potentially hazardous operations,
- the development of mathematical models which can be used to predict vapor concentrations on deck and in tanks,
- verification of the models' validity through laboratory and full-scale experiments, and
- development and testing of a pilot program for biological monitoring of shipboard employees. This part of the study is continuing and will appear as a report addendum.

The following operations were examined during the background study: the hooking up and disconnecting of cargo-loading hoses, cargo loading and tank topping, cargo offloading, tank cleaning by machines, tank mucking, tank entry for inspection, and tank gauging.

The Coast Guard had anticipated that two types of operations would prove to be the most hazardous: loading, because of vapor emissions on deck, and entry into tanks for inspection or maintenance. The study bore this out. SwRI found that, on deck, simple changes in work practices could have an enormous impact on controlling exposure. By simply standing upwind of the gauging or venting device, for example, an employee could effectively remove himself from the danger area. (Unfortunately, not all problems can be so easily corrected. On a calm day, for instance, a vapor plume will rise from its source and then settle onto the deck where employees are working.) As far as tank entry is concerned, the problem of exposure may be solved by merely diluting the



This man is almost properly equipped for tank entry. He is wearing a self-contained breathing apparatus, and he has a support team on deck. He lacks only protective gloves.

vapor concentration to the point where there is no risk. It should be remembered, however, that the formation of vapors from residual cargo is continuous. Some chemicals were observed for several days and never reached safe concentrations because vapors from the cargo residue formed so rapidly. The seriousness of the vapor formation problem will depend on the ambient temperature and whether or not ventilation blowers are being used.

TABLE 1

Summary of Sampling Test No. 2

Activity	Chemical	Duration (minutes)	Concentration (ppm)	TLV-TWA/STE (ppm)
Topping off	Toluene	35.37	199	100/15
	Hexane	35.37	2	100/125
	Hexane	34.93	944	100/15
Gauging	Hexane	40.75	66	100/12

While the vapor hazard investigation was directed mainly at the gathering of area concentration data for use in prediction models, some personnel exposure samples were taken. These, which appear in Table I, were measured in parts per million (ppm). The title in the last column of the table, "TLV-TWA/STEL," refers to the Threshold Limit Values set by the American Conference of Governmental Industrial Hygienists. "TWA" stands for Time Weighted Average; the ACGIH recommends that employees with a traditional workweek breathe a concentration no greater than this, averaged over their eight-hour workday. The "STEL" is the Short Term Exposure Limit. Employees may have to be exposed to concentrations higher than the TWA during emergencies; if so, such exposure should not exceed the STEL and it should be of short duration (no more than 15 minutes), it should occur no more than four times in one day, and there should be an interval of at least 60 minutes between periods of exposure.

In two of the cases shown in the table the STEL was exceeded. In the second case, involving hexane, the concentration to which the employee was exposed was about six times the STEL, and the exposure time was more than double the recommended maximum of 15 minutes. In such an instance, the employee could be expected to soon exhibit the effects of acute toxicity, in this case, narcotic depression of the central nervous system. In and of itself, this condition is not very serious. However, the ship's safety could be compromised. The employee's reaction time would be slowed, his coordination would diminish, and he would not be able to perform his tasks quickly. Unfortunately, we do not have the data to connect instances of this type of exposure to vessel accidents. Such accidents are usually attributed simply to "human error."

Development of a model for predic vapor concentrations will give the Coast G a method of evaluating the effectivenes current regulations on gauging, venting, entry into cargo tanks. Also, when new ch icals are being reviewed, officials will be to evaluate the risk of exposure for all pos combinations of gauging and venting. Coast Guard will then be able to ensure th special requirements that a chemical will handled in the safest manner possible.

As an extension of the modeling, the Co Guard would like to develop a hazard predic handbook. This would enable personnel to p dict vapor concentrations of chemicals at "man breathing height" (five feet from the of the deck). Such predictions would be ba on the physical properties of the cargo, gauging and venting arrangements, the lo rate, and meteorological conditions.

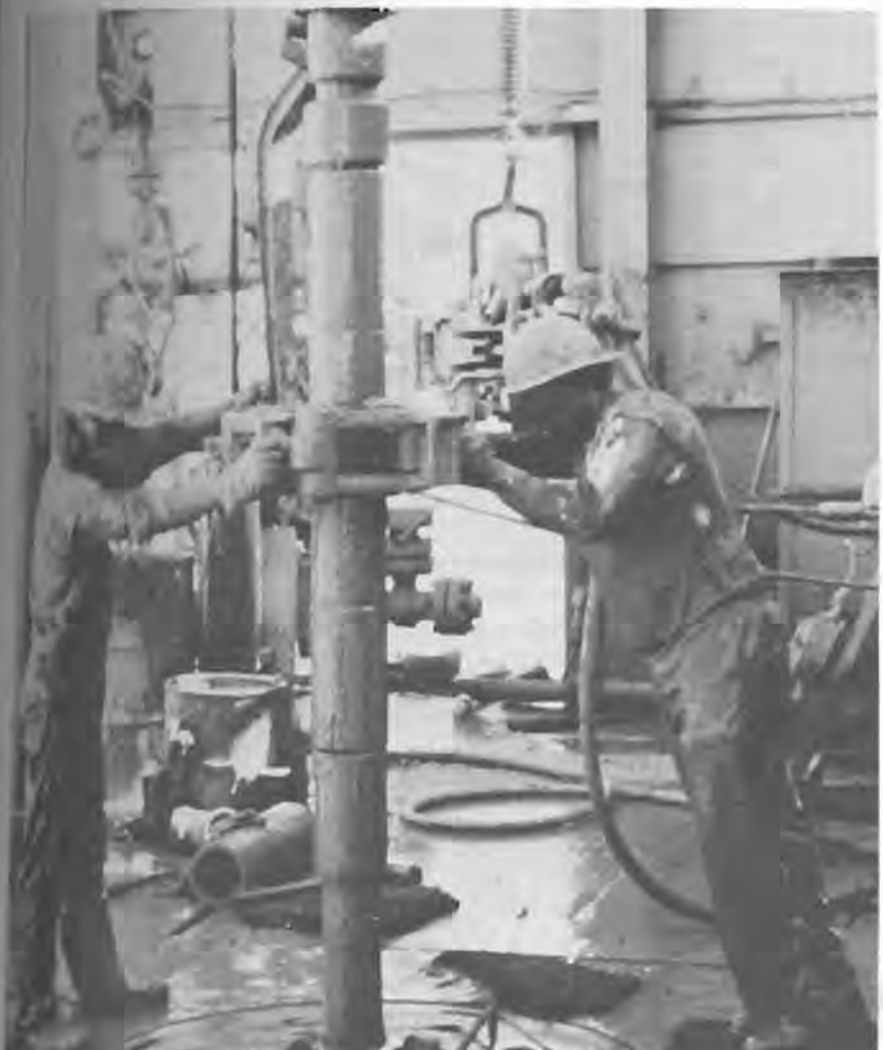
The final element of this project, the logical monitoring program, was given a run with three chemicals. These chemicals, their natural or metabolized form, were sured in the blood, urine, and exhaled bre In the second phase, the list of candidate ch icals for monitoring was expanded to 1 preparation for a full-scale biological moni ing effort. At present SwRI is attempting schedule such an effort. The biological m toring program is intended to measure actual "body burden" on marine personnel amount of a chemical that actually gets the body as a result of exposure). The combi tion of environmental data on concentrat and the biological data on body burden serve as a means of assessing cases of o exposure and deciding when an individual sho be removed from duties involving exposur allow for recovery. (It should be noted that biological sampling is not an entirely reliable means of measuring body burden. The amount of a chemical taken into the body varies from individual to individual according to his physical condition and metabolism.)

2) Crew Exposure at Sea

This study covered employees during the transit phase of vessels carrying hazardous chemicals and during operations on the outer continental shelf.

Researchers observed work practices and found that, although normal work hours are four hours on followed by eight hours off, considerably longer work periods were required during certain operations. This was true of tank loading and topping off, for example. In some instances, employees were found to work as long as 48 hours without a break. No safe average exposure level has been determined for such long work periods. Certainly, employees are being exposed to concentrations exceeding the TWAs and STELs during many of these operations.

Marine personnel are unique in that they are physically restricted to a vessel most of the time. This raises the question of whether they are being exposed to cargo vapors continuously, without getting a true recovery period between watches or work times. Crew quarters have been tested for vapor concentrations, and the Coast Guard has found no evidence so far that they contained any measurable cargo vapors.



Employees in the offshore industry face a hazard from toxic additives in the drilling mud that often covers their skin.

SwRI is assessing chemical exposure documented to date to estimate the level of risk posed to employees. Since work schedules dictate that employees sometimes spend lengthy periods in the presence of chemicals, SwRI may recommend that lower maximums be set for the concentrations to which the employees can be exposed. If SwRI finds that the risk is less than expected, it may recommend that exposure to levels exceeding the TWAs and STELs be permitted, provided such exposure is infrequent and of short duration. The results of this study will ultimately determine what type of control program the Coast Guard institutes, since it is this study that will establish the seriousness of the risks involved and determine whether more or fewer controls are needed to protect the safety and health of marine workers.

The offshore phase of the study indicated that employees in the offshore industry experienced only sporadic exposure to "fugitive emissions" of methane, ethane, and some propane. ("Fugitive emissions"

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TABLE 2

Summary of Occupational Exposures

Activity	Chemical	Duration (minutes)	Concentration (ppm)	TLV-TWA/STEL (ppm)
Tank entry	Toluene	37.3	230	100/150
		36.1	197	100/150
		38.4	229	100/150
Restricted gauging	Ethyl alchohol	261.5	25	1,000/-
		133.3	61	1,000/-
		255.5	19	1,000/-
	Toluene	261.5	1	100/150
		133.3	1	100/150
		255.5	1	100/150
	MEK	261.5	0	200/300
		133.3	0	200/300
		255.5	1	200/300
Open gauging	Toluene	35.4	199	100/150
	Hexane	35.4	2	50/-
		34.9	944	50/-
		40.8	66	50/-
Tank mucking	EDC	85	700	10/15
Tank stripping	Chloroform	94	47	10/50

would come from such sources as miscellaneous leaks and would not be a routine part of the job.) The work schedule among offshore employees seems to be a consistent 12 hours on, 12 hours off for 7 days on the facility followed by 7 days off. SwRI uncovered some unanticipated hazards in this phase of the study. The study had been set up to cover toxic vapors; SwRI found that offshore employees also faced a hazard from toxic drilling mud additives—their skin was often covered with the muds from the drilling floor—, toxic dust, and noise. The study was expanded to include these areas, and drafting of this section of the report has begun. The risks run by these employees will also be assessed.

Table II shows data on some of the cases of exposure studied so far. As is evident from the figures, restricted gauging (using a tube to determine how full a tank is) can greatly reduce the exposure of the person doing the gauging; in the case of toluene, the use of restricted gauging reduced the exposure by a factor of about 200, from a level constituting overexposure to a level that was barely detectable. The table

Some painful facts came to light in SwRI's documentation of work practices.

also shows that, in the ca[...] both toluene and eth[...] dichloride, entry into a [...] resulted in exposure [...] well in excess of [...] recommended safe concen[...]tions. As anticipated, c[...] loading and entry into c[...] tanks proved to present [...] greatest hazards.

Some painful facts cam[e to] light in SwRI's documentati[on] of work practices. In [...] cases, operators and empl[oy]ees were not complying [...] current regulations. In [...]tion, their attitude tow[ard] skin contact with chemic[als] was found to be one of [...] disregard. Many times c[...] members were observed [...]ing no more than tennis shoes and gym sh[...] during hook-up or when loading hoses [...] being disconnected. Such apparel clearly [...]fords insufficient protection against the re[...]al cargo that is always present at the c[...] manifold. Minimal common sense—the wear[ing] of rubber gloves, boots, trousers, and a lo[ng] sleeved shirt—could prevent skin contact [in] such situations. As for exposure to vap[ors,] anyone who gauges a tank by turning his fa[ce] directly into an expansion trunk or ullage op[en]ing will subject his lungs to the undiluted v[...] of the cargo tank. Here again, the use of [a] little common sense would cut down the pote[n]tial for exposure significantly; an employ[ee] need only stand upwind of the source and ke[ep] his head above the opening.

3) The Study to Improve the Health a[nd] Safety of Marine Workers Exposed [to] Chemicals

The contract for this last study by Sout[h]west Research Institute was awarded in Aug[ust] 1982, and the study is beginning to move rap[...]

The goal of the study is development of a comprehensive occupational health program based on the results of the first two projects. Included in the program will be:

- various means of preventing or minimizing exposure to chemicals. These could take the form of engineering controls (i.e., designing the ship to minimize exposure), administrative controls (for example, keeping employees out of unsafe areas), or personnel protective measures (requirements for the use of protective equipment, for instance);

- an environmental monitoring program to determine the extent of exposure;

- a medical monitoring program to assess the impact of exposure on the health of marine workers; and

- an educational program to help the maritime community implement the first three programs. This could take the form of audiovisual aids or presentations to labor and management.

In this last project, the Coast Guard sees the emphasis as not on developing more regulations but on demonstrating to the maritime community that a real risk exists and that controlling the risk is in many cases a matter of education: recognize the problem, and in many cases you can eliminate it by using common sense. The Coast Guard's goal is not to write new occupational health regulations but rather to show individual companies what they can do. However, the SwRI studies will give the Coast Guard a better means of determining an appropriate height for venting systems and the best type of gauging systems. The models for predicting vapor concentrations will enable the Coast Guard to better control the flammability hazard of chemicals in marine bulk transportation. The Coast Guard intends to implement the occupational health program derived from these studies for its own personnel assigned to marine safety duties, as well.

The Coast Guard sees the emphasis as not on developing more regulations but on demonstrating to the maritime community that a real risk exists and that controlling the risk is in many cases a matter of education . . .

The NCI Epidemiological Studies

1) The Cancer Mortality Study of Marine Inspectors

This study was designed to help the Coast Guard determine what risk of getting cancer its marine inspectors face as they carry out their regulatory duties in connection with the commercial vessel safety program. Marine inspectors have much in common with the general maritime community, from their entry into cargo tanks for inspection to their merely being present on vessels during cargo operations. They also face an additional hazard in that some inspectors visit several vessels in a single day and may be exposed to five or six chemicals over the course of the normal workday. If the study shows a larger number of certain types of cancers than would normally be found in men of this age, race, etc., it can be reasonably assumed that merchant mariners are also likely to be at risk.

The progress of this study has been slow because of the large number of records to be located and examined. The Coast Guard and the National Cancer Institute are now looking into death certificates and sorting cases of exposure according to the duties and location of the victim. Barring further difficulties, the study should be ready in mid-1984.

2) The Cancer Morbidity Study of Coast Guard Personnel

This study, which will be completed in early 1984, will indicate whether there is an excess among Coast Guard personnel of those cancers normally associated with overexposure to chemicals. The study group consists of personnel that have been removed from active duty since 1954 because of cancer of the genito-urinary, skin, nervous, lymphatic, or hematopoietic (blood and blood-forming organs) systems. The control group consists of other Coast Guard personnel free of these types of cancer matched to the cancer cases on the basis of age, race, sex, and status (officer or enlisted). Probable exposure levels will be compared for the two population groups. This will enable researchers to determine whether there is a disproportionate number of cancer cases among Coast Guard personnel involved in activities where there is a high potential for chemical exposure. As mentioned earlier, however, the small size of the study group may make it impossible to get significant results.

Results to Date

Work done on the five studies thus far indicates that:

- The most hazardous operations in terms of exposure are tank entry and cargo loading.
- Some of the recorded exposure levels exceed the recommended limits for short and long duration.
- Computer models can aid in predicting hazards on deck and in tanks.

This employee is using a restricted gauging device. Since the sounding tape extends to the liquid in the tank, there is little danger of his breathing dangerous vapors. Note the non-standard apparel; originality in a dress code is not recommended.

- Computer models can aid in devel requirements for new chemicals.
- Of the cases of chemical exposure rec ed, the majority tend to fall into category of high concentration and duration. Such cases of exposure te occur infrequently.
- Modifying common work practices se to be a simple, effective method of mizing exposure to chemicals.
- Restricted gauging devices and ot types of installed equipment may not required for a particular cargo but sh be used because they reduce exposure.
- Restricted gauging is very effectiv reducing exposure.

Yet to be answered are the following q tions: What was the level of risk involve the recorded cases of exposure? How ap cable are existing standards on exposure? useful is biological monitoring? What prop of engineering, administrative, and person protective measures will minimize the r associated with exposure to chemicals?

The Coast Guard feels that the set-up of research projects is nearly ideal. Prog toward a comprehensive safety and health gram is greatly aided by the fact that So west Research Institute won the contract all three of the projects on the environment marine personnel. The three can thus be tre ed as a single project, and compatible repor methods can be used. The work being done the National Cancer Institute will stand al It will not be incorporated into the ov effort until published reports of the proj are released through the National Tech Information Service of Springfield, Virg The benefit of this arrangement is that NCI's work will not prejudice the work of S and the NCI's work will serve as an indepen assessment of the measurable effects of ex sure to chemicals which could cause cancer.

The Coast Guard itself will do a trial ru the health and safety program so that it have a chance to make final corrections bef delivering the finished program. It is convin that an educational program for the mariti community is the most cost-effective route the goals of increased health and safety for marine workers likely to be exposed to haz ous chemicals.

Chemical Carriers: Sophisticated Ships

There's a lot to know and learn about these ships, which can have as many as 40 cargo tanks and carry up to 30 different cargoes. Below is a basic lesson in chemical carriers — their trade, design, and regulations.

by CAPT A. Allievi

On any given day, there can be as many as 800 chemical carriers (140 of them larger than [illegible],000 deadweight tons) transporting 1,100 bulk liquid products in international and coastal trades.

The carriers are built to transport chemical products that have special containment and handling requirements for reasons of safety, cargo properties, and cargo quality control. In concept, chemical tankers can range from relatively simple to very sophisticated ships, some built to carry a single commodity having special characteristics, others capable of transporting an extensive range of chemicals of widely varying characteristics.

Chemical tankers, in general, and parcel-chemical tankers, in particular (a parcel-chemical tanker is one that is capable of carrying up to 50 products of different quality simultaneously), constitute a type of tankship of distinct design that serves the chemical trade. The sophisticated parcel-chemical tanker of today, being distinct in both design and operation, should not be confused with the less specialized petroleum product tanker. Considering a typical ship with 40 cargo tanks carrying 30 different cargoes, one can see that it is the use of these ships, not just their design and construction, that defines them. First built in the late 1950s, specialized chemical tankers have become a fast-growing sector of the shipping industry.

The cargoes

The products shipped on chemical carriers belong to families of chemicals such as organic and inorganic acids, alcohols, aldehydes, alkalies, amines, esters, ethers, glycols, glycol-ethers, halogenated compounds, halogens, ketones, nitriles, and phenols which are widely used in the production of commodities such as fungicides, insecticides, disinfectants, synthetic rubbers, plastics, fibers, soaps, detergents, dye-stuff and ink, and fertilizers and in the food, pharmaceutical, cosmetic, textile, paper, and film industries.

Chemical tankers also carry a variety of products which one would not think of as being "chemical" in nature—wines, molasses, vegetable oils, and animal fats—but which in fact belong to one of the above-listed chemical groups and require as much care as many other cargoes.

The cargoes moved by chemical tankers represent about 6 percent of liquid cargoes moved by all ships. Most of these cargoes usually have a very high commercial value and strict quality specifications.

Of the cargoes shipped on chemical tankers, petrochemical products make up the largest group (about 35 percent). In the strictest sense, petrochemicals are those products derived wholly or partly from petroleum or natural gas. Second in importance is caustic soda (sodium

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Captain Allievi, of the Transportation Department of Esso Europe, Inc., is presently chairman of the International Chamber of Shipping Chemical Carriers Sub-Committee and chairman of the Inter-Industry Study Group on Inert Gas on Chemical Carriers.

hydroxide), one of the basic raw materials of the alkali industry, with 11.6 percent.

The third place in worldwide cargoes carried by chemical tankers (10.9 percent) is occupied by clean petroleum products and then, in order, coconut oil (7.5 percent), inorganic acids (6.2 percent), vegetable oils (4.9 percent), animal oils and fats (4.8 percent), palm oils (4.5 percent), and petroleum specialties such as lubricating oils and additives (4.5 percent).

Furthermore, in many cases, various grades of the same products are shipped, each requiring, in view of the end use, differing degrees of segregation, cargo care, and quality control.

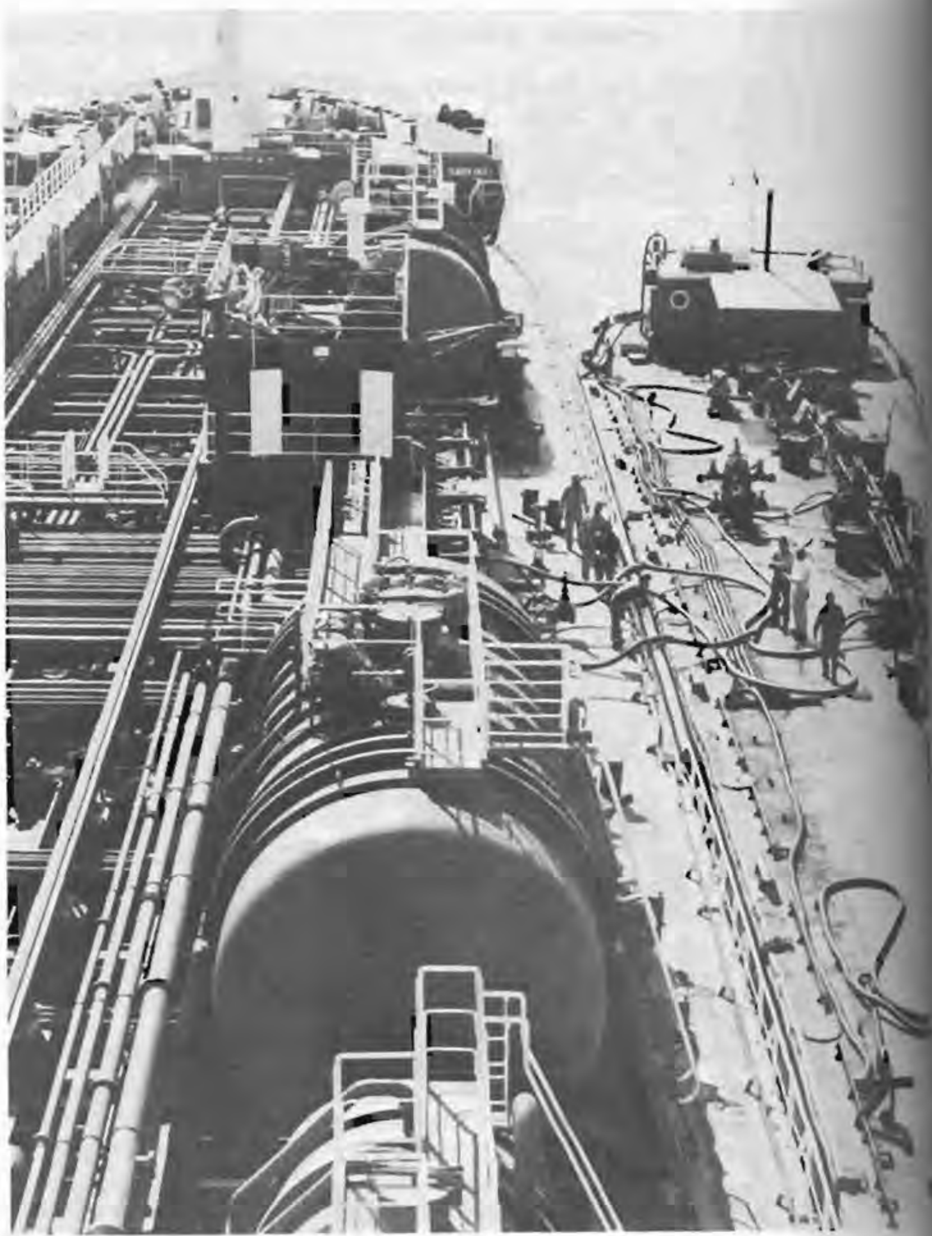
Because some cargoes are flammable, toxic, noxious, or corrosive, strict cargo-quality and cargo-handling requirements must be met. T many properties and characteristics which inherent to the trade are taken into consideration when the chemical tanker is designed.

The chemical tanker

SOLAS 1974/78 (Chapter II-2, Regulation defines a "chemical tanker" as a tanker constructed or adapted and used for the carriage any liquid product of flammable nature listed in the summary of minimum requirem of the Bulk Chemical Code.

Originally, chemical ships were merely conventional tankers modified for specialized service. But as the list of products grew

Many chemical carriers lighter complete loads of specific products to barges. This technique is being used more and more because the vessels carry so many different products to such a large number of ports. Photo courtesy of Stolt-Nielsen, Inc.



number and variety, converting ships to attain greater segregation of pumping and piping systems became unavoidable. Later, tankers of suitable sizes were converted and fitted with multiple piping and pumping systems. The bulkheads of the tanks were coated to protect scantlings against corrosion and to make it easier to clean the tank walls. The need to reduce corrosion and scales was of particular importance because every cargo tank had to be cleaned after each shipment. Cleaning was necessary because cargo sequence, particularly in view of the simultaneous carriage of very small and varied cargo quantities, was neither predictable nor controllable by the operators.

Compatibility of cargo tank coatings and the cargoes shipped was the next problem to be addressed, and a range of coatings, taking into account product suitability, was developed. This advance coincided with an ever-expanding list of exotic products for carriage.

More and more use was made of coated cargo space; further, greater portions of the cargo space of the ship were of clad (bonded) stainless steel in order to accommodate cargoes for which coatings were not suitable. This opened the way for additional trading opportunities for acid cargoes.

The shipping industry is currently engaged in constructing the fourth generation of chemical tankers. The major difference from those described above is that economy of scale is being realized by bringing the ships to a maximum size of 35,000 to 58,000 deadweight tons (sizes are limited to this range mainly by physical restrictions at loading ports and terminals).

Cargo-handling systems

The need to eliminate even the slightest contamination, along with the requirement for a pumping system which could perform properly given a wide range of cargoes, led to the development and introduction of submerged, usually hydraulically driven, deep-well cargo pumps.

The typical modern cargo pumping system has one separate submerged or deep-well cargo pump for each cargo tank, with each pump serviced by a separate cargo line; this provides complete cargo segregation, since no part of the system for one tank is common with another. In some instances, however, a cargo line on deck may be common to more than one deep-well pumping unit. A separate vent line for each tank prevents cross-contamination of products through the venting system.

Cargo operations

Operating a chemical tanker is demanding work because of the complexity of cargo operations. Attention must be paid to tank preparation and custody requirements, compatibility of coating and cargo, and compatibility of cargoes in adjacent tanks. Preparing and maintaining cargo tanks and their associated lines is no doubt the most important and demanding aspect of the complete cargo operation.

Because of the wide range of products involved and the different cargo linings, cleaning methods vary. Standards of cleanliness also vary considerably according to the cargo to be shipped and the ultimate use for which the cargo is intended. For instance, the standard of cleanliness required for methanol used in the chemical industry is very high, whereas the cleanliness standards for energy-grade methanol are minimal. The same concept applies to caustic soda if its end use is for papermaking or for aluminum manufacture.

Tank inspections range from simple visual inspections to exacting bulkhead wash tests intended to detect a few parts per million of potential contaminants.

Crew tank entry for final tank preparation is an exacting task. It is estimated that no fewer than 1,800 tank entries per year are required on a 46-tank chemical carrier, compared with an estimated 270 entries per year on a 30-tank product carrier or 30 entries per year on a 15-tank crude carrier, each making nine voyages a year.

Cargo-handling operations per se are rather straightforward. Loading is carried out through the ship's manifold into the designated cargo tanks, most of the time through dedicated lines.

Discharge is performed by using a deep-well pump (or a submersible pump) through permanent discharge piplines to shore or to another ship or, in some cases, directly from the pump stack head over the ship's side to coasters or barges. Generally, up to eight pumps can be run simultaneously, and an effort is made to discharge like parcels at the same time.

Regulations governing chemical tankers

The first recommendations for safe cargo handling were put forward by cargo manufacturers and users. Later the U.S. National Academy of Sciences (NAS) and the Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) assessed the potential hazards of a wide range of chemical substances.

While the NAS approach was directed mainly to the safety of personnel, the GESAMP work concentrated on the effects of the products on the marine environment.

The results of the work of both NAS and GESAMP were reviewed by the International Maritime Organization (IMO) and have become the basis for carrier design and operation regulations.

The NAS hazard rating profile was used as the basis for the IMO "Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk," which was adopted as Resolution A 212 by the IMO Assembly at its seventh session in November 1971. It was recommended that the Bulk Chemical Code be applied to ships built on or after April 12, 1972. It was also agreed that the Code should be applied to existing ships, as far as it was reasonable and practicable to do so.

A number of nations have implemented the Code through law. Others have left the matter to the discretion of shipowners and, when requested by the shipowner, issue a certificate of fitness under the Code after a satisfactory survey. In a number of states such certificates are needed by foreign-flag chemical tankers as a condition of entry into their ports.

Unfortunately, the Code is only a recommendation. However, since it provides for certification that may be requested by some nations as a condition for port entry, it has achieved a substantial significance.

Nonetheless, the shipping industry has been affected by the ambiguity of the status of the Code. Therefore, in 1974 the IMO Subcommittees on Ship Design and Equipment proposed that the Bulk Chemical Code and the just-completed Gas Carrier Code (IGC) be adopted as mandatory requirements in a convention.

The IMO Subcommittee on Bulk Chemicals, established at that time (1974), became responsible for the Bulk Chemical Code, the gas carrier codes, and other matters related to marine pollution by chemicals. In 1980 the subcommittee agreed to harmonize the format of the Bulk Chemical Code with that of the gas carrier code so that the two codes would be equally comprehensive. IMO is now working toward a code containing regulations to which the shipping industry must adhere.

Pollution prevention

Pollution prevention is strictly observed in chemical tanker operations. However, it will become more complicated when the MARPOL 1973 Annex II (Regulation for the Control of Pollution by Noxious Liquid Substances in Bulk) is implemented in October 1986.

The GESAMP hazard rating profile was used extensively in the preparation of a listing contained in Annex II. Several hundred chemicals were categorized, and for each chemical the aspects of polluting effects were investigated and used as the basis for rating by IMO. These were:

1. Bioaccumulation
2. Damage to living resources (food chain)
3. Hazard to human health
4. Reduction of amenities

For the purpose of MARPOL, products were placed in four categories—A, B, C, and D—with A covering the substances most harmful to aquatic life or human health and D the substances which are practically nontoxic; these pollution-oriented categories are considered when a cargo is assigned to a specific type of ship.

Safety

Chemical carriers enjoy an impressive safety record because of the Bulk Chemical Code, the intelligent design of ships, and the training of their crews.

IMO and the International Chamber of Shipping (ICS) were instrumental in achieving these goals together, but credit also goes to chemical tanker owners, who cooperated fully and invested heavily in safety equipment and in training their crews.

In addition to the safety regulations now in effect, a study covering all technical implications of installing inert gas systems (IGS) on chemical tankers is currently being carried out by the industry, and a final report will be submitted to IMO at the end of 1983.

The chemical industry has grown by leaps and bounds. It has been essential that the chemical carrier industry solve the problems caused by this rapid expansion and ensure the safe carriage of products. From its record, the industry seems to have done a good job in delivering chemical products and safeguarding the environment.

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The Line of Fire

How could hot work in an engine room be connected with an explosion in a cargo tank?

by CDR F. H. Halvorsen
Executive Officer
Marine Safety Office, Port Arthur, Texas

Photos courtesy of the newspaper BEAUMONT ENTERPRISE

This is the second in a series of three accounts of tank vessel casualties occurring in the Southeast Texas Gulf Coast area.

The SS MONTICELLO VICTORY Incident

This month's incident was an unusual one, at least in the experience of the author, but quite logical from the standpoint of the laws of physics and chemistry.

On May 31, 1981, the empty but non-gas-free U.S.-flag tank vessel MONTICELLO VICTORY suffered an explosion and subsequent fire in the after cargo tanks. A careful and detailed investigation by the Coast Guard and the National Transportation Safety Board pointed to a welder's torch in the engine room of the vessel as the most likely source of ignition. Investigators retracing the path of the flame front theorized that it had run through over 100 feet of 3-inch steel pipe and 21 feet of 2½-inch rubber hose to the vicinity of or directly into an open gassy cargo tank with engine-room slops and residue from a previous crude-oil cargo. Damage was initially estimated at $20 million. There were no injuries or deaths.

The vessel, built in 1961, was a conventional petroleum tankship. The cargo area was divided fore and aft into 11 cargo tanks and athwartships into 3 separate compartments.

A the time of the accident, the vessel had just finished carrying a cargo of "Forties Crude Oil" and had on board about 500 barrels of unpumpable clingage. This was distributed through 31 of its 33 cargo tanks (2 tanks were dedicated clean ballast tanks). The vessel had

This series of articles was adapted from a paper presented by the author at last year's session of the annual Marine Chemists' Seminar, held in San Francisco July 12 - 14, 1982.

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been offloaded on May 16 in Freeport, Texas, and directed to proceed to Port Arthur. The owners instructed the master to reduce the crew to a minimum number and go into an "idle" status in Port Arthur. When the explosion and fire occurred, only 10 persons were aboard, primarily licensed officers. The vessel's engineering plant was secured, and electrical power was being supplied from shoreside.

Prior to entering Port Arthur, the vessel had experienced excessive leakage past the shaft seal into the engine room. Water from leakage and engine-room bilge water were normally placed in the after peak tank for pumping overboard outside the 50-mile limit. However, because of the excessive leakage, the peak tank soon filled. The chief engineer had obtained permission from the master to use No. 11C cargo tank as an overflow tank, since it was already designated as a slop tank for cargo residue. The 100 feet of steel pipe and 21 feet of rubber hose mentioned above in connection with the flame front were an auxiliary line used to pump the bilge water to 11C. The plate from the Butterworth opening in the tanktop of 11C was set on top of the hose to hold the hose in place while water was pumped into the tank.

Upon the vessel's arrival in Port Arthur, the crew found that the auxiliary bilge discharge line was wasted and could no longer be used to transport water. A temporary line was rigged from the engine room bilges to tank 11C. This temporary arrangement was last used the day prior to the casualty.

At about 8 a.m. on the day of the casualty, the chief engineer directed the pumpman to remove and replace the wasted portions of the auxiliary bilge line in the engine room. At approximately 10 a.m., the pumpman burned an elongated hole in the auxiliary bilge line, fitted a 1-inch pipe nipple in place, and tack welded it. He stopped for lunch at approximately 11:30.

When the pumpman burned the hole in the line, he effectively opened a passage between the cargo area and the engine room. Air could move in either direction, depending on variations in pressure at the two ends of the pipe.

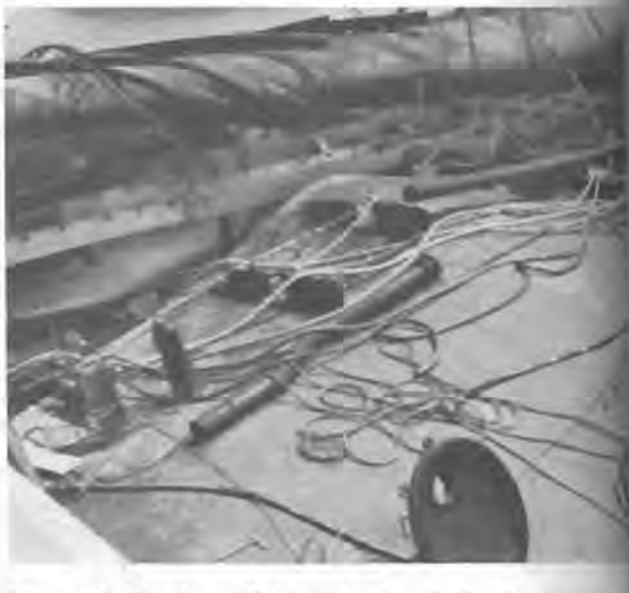
At approximately 1:15 p.m., the pumpman resumed work on welding the nipple insert into the auxiliary bilge line. At about 1:40 an explosion occurred in the after cargo tank area of the MONTICELLO VICTORY. The entire port side of the main deck from the aft end of tank 11C forward to a jagged line across tanks Nos. 8 and 9 was hurled over the port side of the vessel. All cargo piping, the catwalk, and other fittings above this area were dest and hurled in all directions. The aft pump deckhouse was blown up, aft, and to star literally inside out, ending up on the above. As a result of the explosion, tanks 10, and 11 were opened to the atmos Internal tank walls were extensively blown The most forceful explosion appeared to cargo tank 11C.

Explosion damage also extended into th deckhouse through an open door. The auxiliary line was torn apart at a lower lev the pumproom.

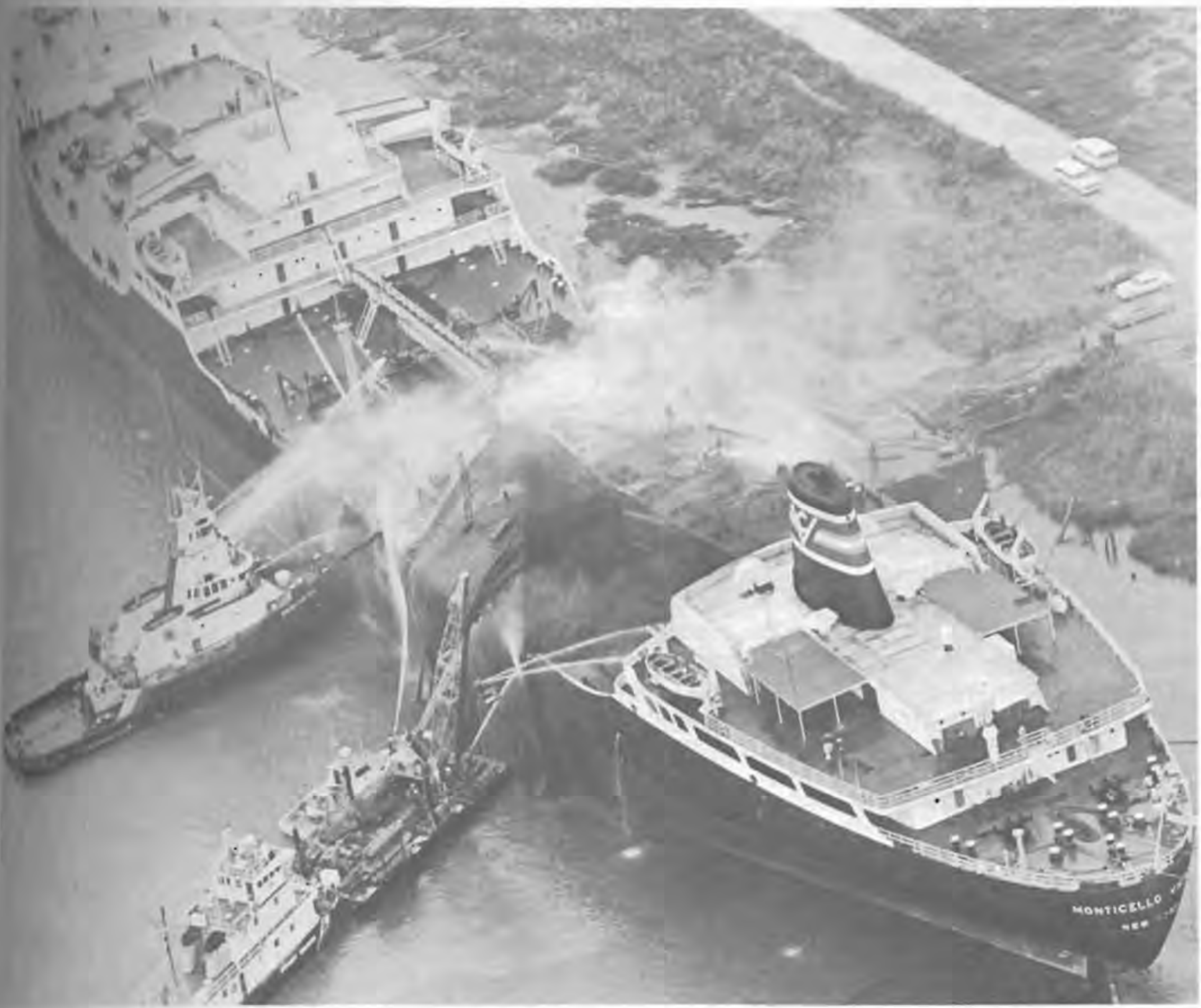
A stubborn fire started in the cargo mentioned above. Fortunately, it did spread to undamaged tanks. The fire brought under control and extinguished by firefighters, small Coast Guard floating u and a commercial towboat.

Analysis

All traditional causes of tank vessel ex sions were considered during the investig These traditional causes include hot work in cargo area, lightning, smoking in the ca area, an object falling in the tank with sub quent incendiary sparking, a collision or so other penetration of a cargo tank, and electrostatic discharge caused by movement an ungrounded object through a charged m Eyewitness testimony indicated that none these potential causes figured in this case. addition, a careful search of the area of explosion turned up no evidence of sabotage



The relatively mild explosion left damage in wake estimated at $20 million.



The internal tank explosion literally pealed open the main deck of the MONTICELLO VICTORY.

arson, thus discounting those possibilities.

The investigators determined that the only breach of the cargo tanks was the Butterworth opening to tank 11C. Eyewitnesses testified that at least one and possibly two hoses were led into the opening and the plate set down over the hoses. These hoses were the two hoses from the engine room carrying bilge waste to tank 11C. One witness thought that the rubber hose from the auxiliary bilge line was not led directly into the tank but was placed within a few inches of the opening. At any rate, the investigation soon centered on this Butterworth opening as providing a path for a flame front into the tank.

The next question to be addressed was the source of ignition. As noted earlier, there were no known sources of ignition in or around the cargo area. The only readily apparent and logical source of ignition on the vessel was the hot work being conducted in the engine room by the pumpman. How could the hot work in the engine room be connected with the Butterworth opening on the cargo deck? The obvious answer was the auxiliary bilge line.

An expert in flame propagation was brought in by the NTSB three days after the explosion to conduct an on-site survey of the vessel. He concluded that there was indeed a strong possibility that a flame front could have progressed from the engine room to the Butterworth opening through the approximately 120 feet of pipe and hose. His theory was in fact rather simple. The auxiliary bilge line was closed prior to the pumpman's cutting the line for repairs on the morning of the accident. When he cut the line he opened a clear path between the cargo deck and the welding operations.

The investigators determined that a natural draft was induced in the engine room, ostensibly a "chimney" effect drawing air from the bottom of the engine room toward the top. The day following the explosion, in fact, a Coast Guard investigator found a noticeable draft emanating from around the nipple which was being welded in the engine room. The investigators further theorized that the auxiliary bilge line had drawn vapors directly from the cargo tanks. Even if the end of the auxiliary bilge line was not located directly in the Butterworth opening, sufficient flammable vapors would have been present in the immediate vicinity of the opening to support a flame front.

At least a portion of the vapors in cargo tank 11C were in the flammable range—that is obvious from the fact that the top of the tank blew off from an internal explosion. What is not so immediately apparent is *how* these vapors got to be flammable. The cargo was reported to have a Reid Vapor Pressure of 7.5 psia and a flashpoint well below $70^{\circ}F$. Since temperatures were in the 80s, the tank could have been expected to be safely above the upper flammability limit.

It would have, had it not been for the Butterworth opening, which allowed the tank to "breathe" in response to temperature changes. As the tank was heated during the day, the tank vented. During the cooler nights, air was drawn into the tank, diluting the vapors to within the flammable range. Only a small portion of the tank needed to be in the flammable range for it to be destructively overpressured. It has been estimated, for example, that only four percent of a tank volume need be ignited to cause complete destruction of an integral tank.

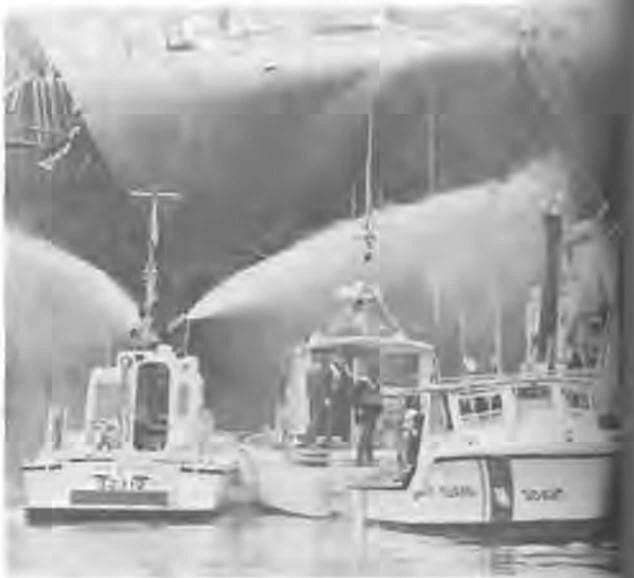
Flame propagation through a pipe is a well-documented phenomenon. The one question raised by this casualty was why the ignition did not occur until some four hours after the auxiliary bilge line had been breached. The simple explanation is that it took that long for vapors to be drawn through the 120 feet of hose and pipe. This is quite logical, considering the relatively small opening around the nipple, estimated to be about one square inch, and the natural vacuum in the engine room, estimated to be only a fraction of an inch water-gauge vacuum. When the flammable mixture did reach the welder's torch, the flame front progressed back through the pipe into the tank and ignited the flammable atmosphere inside.

Some Recommendations

It is patently unsafe to provide an op[en] vapor pathway from an area with a gas haz[ard] to an area where ignition sources are pres[ent]. The auxiliary bilge line should have been isol[at]ed from the cargo deck before repairs we[re] commenced. This could have been acco[m]plished by securing the gate valve on the ma[in] deck or by plugging the open line in the eng[ine] room. Either measure would have prevent[ed] vapors from being drawn to the welding oper[a]tion. More importantly, all persons engaged [in] marine activities in which flammable liqu[ids] are carried, used, or stored must be aware [of] the absolute necessity of maintaining [a] vapor-tight and liquid-tight envelope of a t[ank] containing a flammable liquid. In the case [of] the MONTICELLO VICTORY, the investigat[ors] found that the reduced crew had allowed [the] normal shipboard system of ensuring tank c[lo]sures to break down and had permitted [the] Butterworth opening on tank 11C to rem[ain] open for a number of days.

The Coast Guard Marine Safety Office [at] Port Arthur now takes great care to inspect [or] require inspection of all vessels in an "idle" [or] lay-up status. This includes certification by [a] Marine Chemist that gas-free conditions exist and that they continue to exist, as indicated [by] periodic reinspections.

Next month: the M/V OSWEGO HOPE incid[ent]



Coast Guard personnel maintain a reflash w[atch] and keep the hull of the MONTICELLO [VIC]TORY cool after extinguishing the fire.

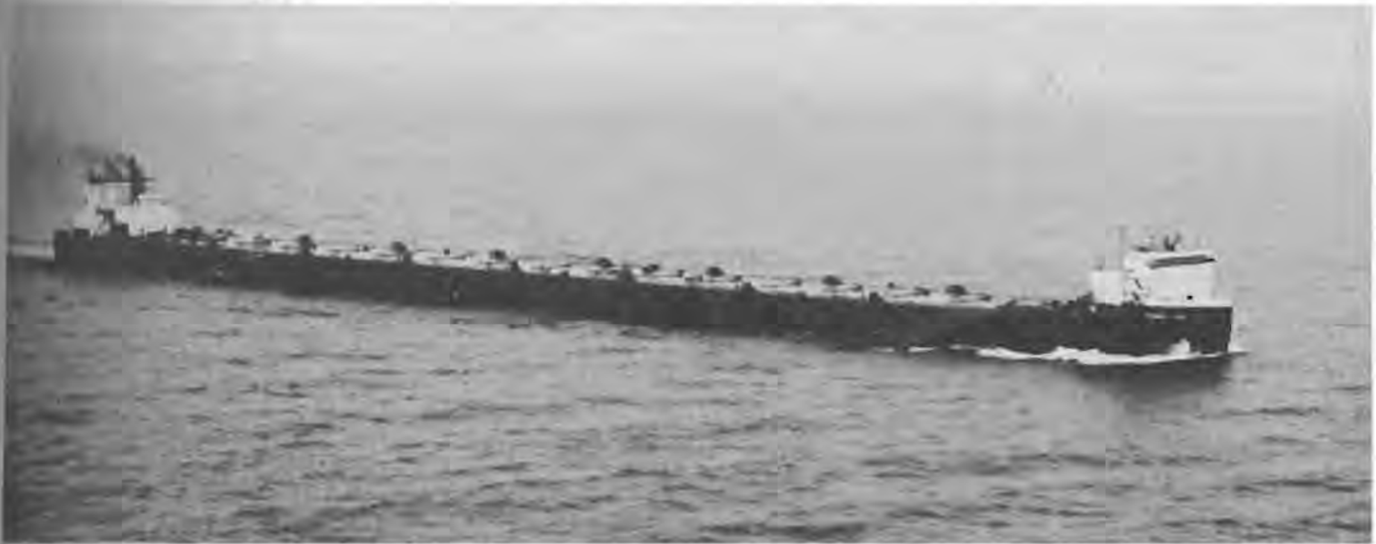
Stresses on Great Lakes Ore Carriers Studied

The Coast Guard has been publishing a series of reports on research into the longitudinal strength standards of Great Lakes ore carriers. The latest, an analysis of springing and wave-induced stress on the M/V STEWART J. CORT, covers three years of research efforts to adapt two wave measurement systems and collect and analyze data. Among the subjects covered were how well the magnitude of springing stresses can be predicted analytically, how springing and wave-induced stress combine to form extreme stresses, and how the results of the research might be used to improve present-day construction standards.

Full-scale experiments to assess the magnitude of the springing phenomenon of Great Lakes vessels began in the early 1960s after several large ore carriers (such as the M/V EDMUND FITZGERALD) sank on the Great Lakes. These ships typically have unusually large length-to-beam ratios. Many are over 1,000 feet long with beams of no more than 40 feet. These ships are subject to significant springing vibratory stresses. Present longitudinal strength standards were written for ocean-going ships, which are affected primarily by wave-induced stresses. In light of the additional stresses on Great Lakes ore carriers and the several losses, the sufficiency of the present standards is in question.

The work presented in this report includes a numerical simulation of the springing and wave-induced stresses and verification of the simulation's reliability. The findings match the actual ship response with the theoretical response.

Copies of this report, "An Analysis of Full Scale Measurements on M/V STEWART J. CORT During the 1979 and 1980 Trial Programs," can be obtained from the National Technical Information Service (NTIS), Springfield, Virginia 22161. Persons interested in ordering a copy should specify Coast Guard Report No. CG-D-25-82, Accession No. AD A127226. ⚓



The unusually large length-to-beam ratio of Great Lakes ore carriers like the M/V STEWART J. CORT makes them subject to significant springing vibratory stresses.

Keynotes

The Coast Guard published the following items of general interest in the Federal Register between July 21, 1983, and September 15, 1983:

Final rules:

CGD 09-82-06	Special Anchorage Area; Lake Betsie, Frankfort, Michigan, correction (published July 21)
CCG 11-79-02	Establishment of Safety Zones Around Structures on the Outer Continental Shelf (OCS) and the Navigable Waters of the United States, correction (July 21)
COTP New London CT Reg. 83-01	Security Zone Regulations; New London Harbor, Connecticut (July 21)
CGD 3 82-024	Drawbridge Operation Regulations; Wappinger Creek, New York (July 28)
CGD 77-196	Confined or Congested Waters (July 28)
CCGD 3-83-30	Safety Zone Regulations; New Jersey, New York Harbor, Newark Bay (July 28)
COTP Hmptn Rds Reg. 83-15	Safety Zone Regulations; James River, Virginia (July 28)
CGD 83-033	Operations Manual; Letter of Adequacy (August 1)
CGD 79-026	Ports and Waterways Safety; Control of Vessel Operations and Cargo Transfer (August 4; minor correction issued August 29)
CGD 79-105	Coast Guard Reserve (August 11)
CGD13 82-18	Anchorage Ground; Elliott Bay, Seattle, Washington (August 11)
CGD3 82-017	Drawbridge Operation Regulations; Harlem River, New York (August 11)
CGD 81-080	Ports and Waterways Safety; Offshore Traffic Separation Schemes; Galveston Bay (August 11)
CGD 80-009	Correction of Miscellaneous Disparities in 46 CFR Subchapter D, Tank Vessels (August 11)
CGD5-82-30	Anchorage Ground; Eastern Branch, Elizabeth River, Norfolk, Virginia (August 25)
CGD3 82-015	Drawbridge Operation Regulations; Hackensack River, New Jersey (August 25)
CGD3 82-019	Drawbridge Operation Regulations; Raccoon Creek, New Jersey (August 25)
CGD 79-153	Freeboards; Load Line Regulations (August 25)
CGD 82-063b	Revision of (Coast Guard) Staff Codes and Addresses, correction (September 1)
CGD 79-013	Identification of Boats (September 9)

CGD9-83-17	Drawbridge Operation Regulations; Ontonagon River, Michigan (September 15)
CGD 78-079b	St. Marys River Vessel Traffic Service, correction (September 15)
CGD3-83-51	Safety Zone Regulations; New Jersey, New York Harbor, Newark Bay (September 15)

Notices of proposed **rulemaking (NPRMs)**:

CGD7-83-04	Drawbridge Operation Regulations; Banana River, Florida (July 28)
CGD1-83-1R	Special Anchorage Area; Fore River, Portland Harbor, Portland, Maine, and Anchorage Regulations in the Zone of Marine Safety Office Portland, Maine, editorial changes (August 1)
CGD 81-059	Licensing of Officers and Operators and Registration of Staff Officers (August 8)
CGD 08-83-04	Drawbridge Operation Regulations; Bayou Teche, Louisiana (August 11)
CGD 08-83-05	Drawbridge Operation Regulations; Vermilion River, Louisiana (August 11)
CGD3-83-44	Regatta; Head of the Connecticut River, Middletown, Connecticut (August 18)
CGD 79-131	U.S./Canadian Cooperative Vessel Traffic Management System (August 18; correction issued August 30)
CGD3-83-29	Security Zone; New London Harbor, Connecticut (August 18)
CGD 81-079	Marine Engineering Regulations for Merchant Vessels; Acceptance of ASME S, E, A, and H Symbol Stamps for Power and Heating Boilers (August 18)
CCGD1-83-2-R	Establishment of a Special Anchorage Area in Mattapoisett Harbor, Mattapoisett, Massachusetts (August 25)
CGD3 82-023	Drawbridge Operation Regulations; Great Channel, New Jersey (August 25)
CGD3 82-036	Drawbridge Operation Regulations; Passaic River, New Jersey (August 25)
CGD 08-83-06	Drawbridge Operation Regulations; Lavaca River, Texas (August 25)
CGD5-83-05	Drawbridge Operation Regulations; Eastern Branch, Elizabeth River, Norfolk, Virginia (August 25)
CGD3 83-037	Drawbridge Operation Regulations; Harlem River, New York (September 1)
CGD 78-180	Special Requirements for Cargo Lightering Operations, Supplemental NPRM (September 9)
CGD 81-058	Boundary Lines; Supplemental NPRM and Notice of Public Hearings (September 15)
CGD 83-051	Ship Structure Committee; Notice of Meeting (September 15)
COTP Western Alaska	Public Meetings; Bristol Bay, Naknek/Kvichak Commercial Fishery District Vessel Traffic and Anchorages; Notice of Public Meetings (September 15)

Comments on the items described below and requests for copies of rulemakings or notices should be directed to the Marine Safety Council at the following address:

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

Comments may be delivered to the Marine Safety Council office, Room 4402 at Coast Guard Headquarters, 2100 Second Street, SW, Washington, DC, between the hours of 9:00 a.m. and 4:00 p.m. Monday through Friday. Comments will also be available for inspection or copying during those hours.

* * *

Confined or Congested Waters (CGD 77-196)

This final rule, published in the Federal Register July 28, 1983, eliminates the special operating requirements for vessels 1600 gross tons or more when operating in "confined or congested waters." The deleted requirements never became effective, as a list of "confined or congested waters" was never published.

Ports and Waterways Safety; Control of Vessel Operations and Transfers (CGD 79-026)

This rule, published August 4, 1983, implements the provisions of the Ports and Waterways Safety Act (PWSA) (33 U.S.C. 1221 et seq.). It will result in better protection for U.S. ports and harbors against the effects of vessel casualties and oil spills.

The rule delegates to Coast Guard District Commanders and Captains of the Port (COTPs) the authority contained in the PWSA to prohibit particular tankers from operating in the navigable waters of the United States or transferring cargo in a port or place subject to the jurisdiction of the United States when certain conditions exist. The rule also clarifies the existing regulations authorizing a COTP or District Commander to issue orders or regulations controlling vessel operations (Part 160 of Title 33 of the Code of Federal Regulations).

Licensing Structure (CGD 81-059)

On August 8, 1983, the Coast Guard published a notice proposing to amend the regulations concerning the licensing of officers and operators and the registration of staff members. The changes would implement provisions of Public Law 96-378.

The new structure would make it easier for mariners to follow career patterns in their various services and industries. The proposal would simplify the license structures for ocean and inland service, delete many of the "trade"-restricted licenses, and simplify the licensing procedure by redesigning the format of the regulations and adding easy reference tables. It would also minimize the impact of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW), scheduled to go into effect internationally in April 1984, by harmonizing most of the Coast Guard regulations with the Convention. The proposed amendments revise the regulations in Part 10 of Title 46 of the Code of Federal Regulations.

The proposal would also implement a provision of P.L. 96-378 requiring the presence of licensed officers on all vessels subject to inspection. Currently, small passenger vessel operators do not have the status "licensed officer." The proposal would modify the regulations for licensing personnel on small passenger vessels and move the regulations concerning this matter from Part 187 to Part 10 of 46 CFR.

In addition to the amendments to licensing regulations, some changes have been made to Parts 157, 175, and 185 of 46 CFR to keep terminology consistent (using "master" and "mate" as opposed to "operator" or "ocean operator," for example).

Comments on this item must be received by the Marine Safety Council on or before December 6. Questions should be directed to LCDR George N. Naccara, U.S. Coast Guard (G-MVP-), Washington, DC 20593; tel. (202) 426-2240.

Ports and Waterways Safety; Offshore Traffic Separation Schemes; Galveston Bay (CGD 81-080)

This final rule establishes a traffic separation scheme (TSS) for the approaches to Galveston Bay. The TSS is designed to increase navigation safety by separating inbound and outbound lanes of vessel traffic. The scheme is necessary because of severe traffic congestion and recent casualties in the Galveston approach area. This TSS was developed in accordance with the Ports and Waterways Safety Act (33 U.S.C. 1223) "to provide safe access routes for the movement of vessel traffic." It was formally adopted by the Maritime Safety Committee of the International Maritime Organization (IMO) in June 1983.

This rule adds a Part 167 to Title 33 of the Code of Federal Regulations. Part 167 contains general rules which will apply to future offshore traffic separation schemes developed for U.S. ports under the Ports and Waterways Safety Act. These general rules are needed because Coast Guard regulations do not currently define offshore traffic separation schemes. The Coast Guard anticipates establishing other TSSs and modifying existing TSSs; these will be added to the new Part 167.

Published on August 11, 1983, this rule becomes effective on January 1, 1984.

U.S./Canadian Cooperative Vessel Traffic Management System (CGD 79-131)

On August 18, 1983, the Coast Guard published an NPRM for its first international Vessel Traffic Service. The agreement with Canada covering the Straits of Juan de Fuca and adjacent waters was signed in 1979. Control and enforcement will be bilateral, involving two vessel traffic centers in Canada and one in Seattle. The Canadians published an NPRM and then discovered a need to amend their Shipping Act. The Coast Guard anticipates that all will be in order for simultaneous publication of U.S. and Canadian final rules in 1984.

Freeboards; Load Line Regulations (CGD 79-153)

These regulations clarify the freeboard requirements of the load line regulations. The clarifications are based on internationally accepted interpretations of the International Convention on Load Lines of 1966.

CGD 79-153 was published as an NPRM on February 4, 1982; the final rule was published August 25, 1983.

Special Requirements for Cargo Lightering Operations (CGD 78-180)

Published on September 9, 1983, this supplemental NPRM presents proposed regulations for the lightering of oil and hazardous materials cargoes in bulk from one vessel to another. It applies to the navigable waters of the United States and, if the cargo is destined for a port or place subject to the jurisdiction of the United States, the adjacent high seas.

This rulemaking is required under the terms of the Port and Tanker Safety Act of 1978. If adopted, the proposed rules will establish uniform safety and pollution prevention rules for vessels engaged in offshore lightering.

The notice contains substantial changes to the NPRM that was published on May 31, 1979. Comments must be received on or before November 8, 1983.

Boundary Lines (CGD 81-058)

The Coast Guard published this supplemental NPRM on September 15, 1983.

The Seagoing Barge Act was revised in 1980 to define a seagoing barge as one that proceeded outside the Boundary Lines to be specified in a rulemaking. The Coast Guard published proposed rules on June 7, 1982, that sought to establish lines for the Seagoing Barge Act and more clearly define the existing Boundary Lines. Substantial changes were made to those proposed rules as a result of the comments received. This supplemental NPRM incorporates the changes and allows for further comment prior to the publication of a final rule. Comments must be received on or before December 13, 1983.

Actions of the Marine Safety Council

At its August and September meetings, the Council considered only one item of interest to the public:

CGD 83-048 Advance Notice of Arrival

The Coast Guard recently reviewed the costs, benefits, and usefulness of requiring advance notice of arrival and departure from certain vessels. It concluded that the reporting requirements for vessels carrying some 200 "certain dangerous cargoes" are excessive and that reports should be required only from vessels carrying the more dangerous "cargoes of particular hazard."

Notices from vessels carrying "certain dangerous cargoes" have generally been used by Captains of the Port (COTPs) for supervising vessel traffic, planning emergency spill responses, and targeting examinations of vessels known to have histories of accidents or violations. A small number of the "certain dangerous cargoes," called "cargoes of particular hazard," pose a higher risk to ports and the environment because of their extreme toxicity, reactivity, or other unusual chemical properties. The Coast Guard believes that reports on the movement of these "cargoes of particular hazard" should continue to be required because of these cargoes' higher risk.

The proposed change in regulations will result in a 77 percent reduction in the number of notices required from the marine industry. In addition, reducing the number of required reports should make it easier for vessel operators to comply with the requirements and easier for the COTPs to enforce them.

An NPRM is scheduled to be published this winter. ⚓

To: The marine community

From: The U.S. Coast Guard

Subject: Changes in Coast Guard policy for retaining files

It has been the Coast Guard's practice to maintain case files on the commercial vessels it has certificated. These files, which include copies of selected approved plans, specifications, stability data, and related correspondence, have been used by many in the marine industry who did not maintain or could not locate vessel case file material.

The volume of plans submitted over the years has made it impossible for the Coast Guard to continue to maintain extensive files. This is true even with the reduction of material announced in Navigation and Vessel Inspection Circular (NVIC) No. 3-81. In the interest of cost-effectiveness, space conservation, and reduction of microfilm costs, the Coast Guard has decided to keep only the following at Headquarters: general arrangement drawings, trim and stability booklets or stability calculations if there is no booklet, loading manuals, operating manuals, descriptions of automation test procedures, descriptions of fire control plans, and stability letters.

Since the Coast Guard will no longer be maintaining complete files, owners and operators are encouraged to keep anything that might be needed for future reference. They should keep, for example, accurate vessel plans clearly reflecting the "as built" condition of their vessels and any major modifications or alterations. Those assuming new ownership of an existing vessel should try to obtain complete sets of plans as part of the purchase agreement.

The American Bureau of Shipping maintains extensive files on vessels it classes, and these may be obtained, at cost, on microfilm or as prints.

Chapter 20 of the Marine Safety Manual (COMDTINST M16000.3) (old CG-495) and NVIC No. 3-81 will be revised to reflect the new list of case file material to be maintained at Headquarters.

Chairman of Advisory Committee Honored

The Coast Guard Distinguished Public Service Award is the highest recognition accorded an individual who volunteers his services to the Coast Guard. This award was presented recently to Frank T. Stegbauer in recognition of his numerous contributions to the promotion of marine safety.

One example of Stegbauer's outstanding service to the Coast Guard and the Department of Transportation is his sustained and dynamic participation as a member of many maritime safety advisory committees. Among these are the Towing Safety Advisory Committee and its predecessor, the Towing Industry Advisory Committee, the Chemical Transportation Advisory Committee, and one of the earliest advisory committees sponsored by the Coast Guard, the Western Rivers panel.

Stegbauer's commitment to fostering a greater exchange of views and information between the Coast Guard and the shallow-draft inland and coastal waterway transportation industry contributed significantly to the establishment of the Towing Safety Advisory Committee. He has given that committee identity and direction for the past two years as its first chairman, and his dedicated personal commitment has inspired the participation of others who share his strong sense of responsibility to the public.

Stegbauer has enhanced the Coast Guard's ability to understand the impact of its programs on domestic inland transportation activities. His influence has also contributed greatly to the Coast Guard's efforts to ensure safety on the nation's inland and coastal waterways without overregulation.

Stegbauer is Executive Vice President of Southern Towing Co., of Memphis, Tennessee. ⚓

Do You Know How to Protect Your Boat from Lightning?

"Recommended Practices and Standards Covering Lightning Protection" describes the design and installation of a lightning protection system for all sizes and types of boats. A copy is available for $3 (including postage and handling) from American Boat and Yacht Council, P.O. Box 806, Amityville, New York 11701.

(Reprinted from the Radio Technical Commission for Maritime Services Newsletter, *Vol. 2, No. 8)* ⚓

New Members Appointed to Towing Safety Advisory Committee

The Secretary of Transportation recently appointed seven new members to the Towing Safety Advisory Committee. They are

Mark H. Allen
Port Manager
Indiana Port Commission

Captain Allen Scott
International Executive Vice President
International Organization of Masters, Mates and Pilots

J. Erik Hvide
President and Chief Executive Officer
Hvide Shipping, Inc.

Michael W. McFann
Assistant Manager, Fleet Operations
Ashland Petroleum Company

Otto B. Candies, Jr.
Vice President,
Otto Candies, Inc.

Frederick R. Hazard
Executive Vice President
Great Lakes Dredge & Dock Company

Lester C. Bedient
Consultant to Executive Vice President
Crowley Maritime Corporation

Replacing Frank T. Stegbauer as chairman of the committee is Steven T. Scalzo, Vice President of Foss Launch and Tug Company of Seattle, Washington. Stegbauer was reappointed to membership on the committee, as was Captain William Hugh Tuttle of Local 333 of the United Marine Division, International Longshoremen's Association, AFL-CIO, New York. TSAC also has seven members who are in the middle of their terms. ⚓

Two Boat Parades Planned for World's Fair

Water craft of all kinds will converge on New Orleans for the 1984 Memorial Day weekend as part of the 1984 Louisiana World Exposition to celebrate the theme "Rivers of the World—Fresh Water as a Source of Life."

Two major nautical parades are planned:

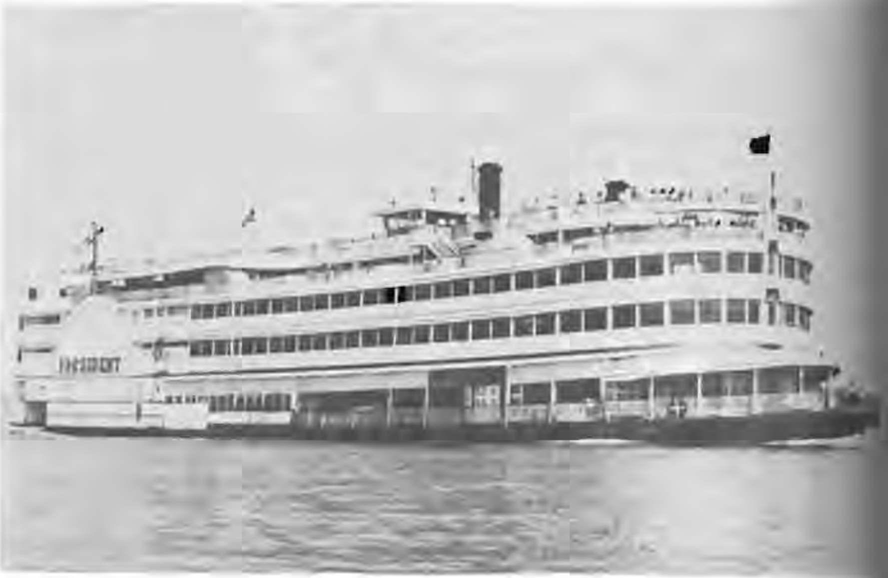
Sunday, May 27: The "OP SHIP '84 Parade"—a 70-mile procession of ships passing the reviewing stand, going upstream on the Mississippi River; and

Monday, May 28: The "Parade of All Nations"—2,500 sail and power yachts on Lake Pontchartrain, flying their national flags or the flags of their owner's homelands.

All types of craft, including commercial vessels, are welcome to participate in this festival. The river parade is for large, professionally crewed vessels with a minimum size of 40 feet and a cruising speed of at least 12 knots. The parade on Lake Pontchartrain will be limited to vessels with a draft not exceeding five feet.

Registration forms are available from Serge Helfer, Louisiana World Exposition, Inc., Entertainment Division, P.O. Box 1984, New Orleans, Louisiana 70158; tel.: (504) 566-2300.

Anyone knowing of an unusual contemporary or historical vessel is asked to contact the organizers of the festival at OP SHIP LTD., 919 Third Avenue, New York, New York 10022; tel.: (212) 752-7150.



A typical sight on the Mississippi and set to lead one of the parades being staged in connection with the Louisiana World Exposition is the PRESIDENT. Owned by the New Orleans Steamboat Co., it was originally built in 1923 as a steam-powered side wheeler. It was converted to diesel power in 1978.

National Maritime Show Set for April in Houston

The third annual National Maritime Show will be held April 25 - 27, 1984, at the Albert Thomas Convention Center in Houston. Previously held in Baltimore, the exhibition and conference have been expanded in scope to cover the entire maritime industry, including blue-water vessels, tankers, container ships, push boats, barges, tugboats, workboats, dredges, drilling ships, Navy and Coast Guard vessels, and other specialty craft.

Issuing a call for conference papers, show management said the conference will cover industry trends and forecasts, financing, state-of-the-art propulsion, and the fields of electronics, communication, and navigation.

The conference and exhibition will highlight the areas of offshore equipment and services, port-equipment construction and maintenance, high technology in shipbuilding and ship operations, and diving and salvage.

Individuals and companies interested in presenting a paper to the National Maritime Show Conference should submit a 300- to 400-word abstract to Peter Johnson, National Maritime Show Conference Committee, P.O. Box 721948, Houston, Texas 77272; tel.: (713) 879-8929.

The National Maritime Show is presented by Industrial Presentations, Inc., a professional trade-show management company hosting 20 industrial trade shows from 5 offices worldwide.

Amendment 20 to the IMDG Code Becomes Available

Amendment 20-82 to the International Maritime Dangerous Goods (IMDG) Code has been published in English and is now for sale.

Amendments to the IMDG Code are issued in loose-leaf format as additional or replacement pages to be inserted in the appropriate volumes of either the 1977 four-volume edition or the 1981 five-volume edition of the Code.

Amendment 20-82 was prepared by the International Maritime Organization Sub-Committee on the Carriage of Dangerous Goods and adopted by the Maritime Safety Committee at its 46th session in April 1982. The Committee agreed that the amendment should be implemented on December 1, 1983.

For sales from IMO Headquarters, Amendment 20-82 has been divided into two sets as follows:

1. Amendments to the General Introduction, to Annex I, and to Classes 1, 2, 3, 4, 5, 6, 8, and 9 (1,000 pages)

2. Amended Indexes (complete replacements, 220 pages) consisting of

   a) General Index (alphabetical) of dangerous goods of the IMDG Code, giving IMDG Code page numbers, UN numbers, classes, packaging groups, subsidiary risk labels, and references to Emergency Schedule (EmS) numbers and to Medical First Aid Guide (MFAG) table numbers, and

   b) Numerical Index of UN numbers (Table of UN numbers with corresponding IMDG Code page numbers, EmS numbers, and MFAG table numbers).

The prices, post free (surface mail), are £ 12.50 for Part 1, sales no. 238 82.21.E, and £ 3.50 for Part 2, sales no. 240 82.22.E. Persons wishing to order the publications from IMO Headquarters should direct their orders to IMO, Publications Section, 4 Albert Embankment, London SE1 7SR, England. Prepayment is required.

U.S. distributors are selling Amendment 20-82 as a single package. The price is approximately $50. Interested persons should call distributors to find out exact prices and postage and handling charges. Among U.S. distributors are the following:

Labelmaster
5724 North Pulaski Road
Chicago, IL 60646
Tel.: 1-800-621-5808

New York Nautical Instrument and Service Corporation
140 West Broadway
New York, NY 10013
Tel.: (212) 962-4522

Southwest Instrument Co.
235 West 7th Street
San Pedro, CA 90731
Tel.: (213) 519-7800

Other IMO publications now available, their sales numbers, and their prices if ordered from IMO Headquarters include the following:

Official Records of the International Conference on Limitation of Liability for Maritime Claims, 1976 (documents issued in connection with the Conference); sales no. 448 83.05.E, £ 10.00, and

Amendments to the Convention on the International Regulations for Preventing Collisions at Sea, 1972 adopted by the Assembly at its 12th session in November 1981; sales no. 906 83.06.E, £ 1.25. ⚓

Coast Guard Issues Call for Reservist Physician's Assistants

The Coast Guard is seeking graduates of selected Physician's Assistant Programs to serve in the Coast Guard Selected Reserve. Those applicants selected will receive direct warrant officer appointments. While most selectees will have inactive-duty status, some will be brought on board as active-duty personnel.

Persons selected under this program are chosen with the understanding that they will serve at least three years in a Coast Guard Selected Reserve Training Unit. After this period the member may request transfer to the Individual Ready Reserve.

A list of schools offering approved Physician's Assistant Programs and information on eligibility and applying for the positions are available from Coast Guard District Commanders or from Commandant (G-PMR), U.S. Coast Guard, Washington, DC 20593; tel.: (202) 426-1370. ⚓

Maritime Exhibition to be Held in New York

Expoship North America 84, an international maritime exhibition organized by Seatrade North America, has been set for March 19 - 23, 1984, at Pier 88 on Manhattan's West Side.

This event, which gives companies an opportunity to display their products and services, is expected to attract ship owners, shippers, shipbuilders/ship repairers, marine equipment manufacturers, bankers, brokers, and other senior representatives of marine companies from all over the world.

Sponsoring the exhibition are the American Institute of Merchant Shipping, the Council of American-Flag Ship Operators, the Federation of American Controlled Shipping, The National Industrial Transportation League, the National Maritime Council, and the Shipbuilders Council of America.

A Seatrade "Money and Ships" conference will be held in conjunction with the exhibition.

Details are available from Seatrade North America, Inc., The Whitehall Building, 17 Battery Place, New York, New York 10004; tel.: (212) 4… 6470.

Painting Guide Published

The Steel Structures Painting Council now has available in a new two-volume edition the "Steel Structures Painting Manual," which provides guidance on the painting of ships.

Volume 1, Good Painting Practice, describes the materials and procedures necessary for a successful coating program. This volume also describes painting practices for a variety of steel structures and includes separate chapters on marine painting and the painting of navy ships.

Volume 2, Systems and Specifications, provides combined performance-/composition-oriented specifications for applicable types of coatings and gives a basis for choice among alternatives.

More information on this publication and the Steel Structures Painting Council can be obtained by contacting the Sales Department, Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, Pennsylvania 15213.

(Reprinted from the Weekly Letter *of The American Waterways Operators, Inc., Volume XL, No. 33)* ⚓

Invitation for Comments on RTRP Still Open

In April 1983 the Coast Guard issued Navigation and Vessel Inspection Circular No. 4-83, "Guidelines Governing the Use of Reinforced Thermosetting Resin Pipe (RTRP) on Coast Guard Inspected Vessels." The guide tells what materials and installation requirements must be met in cases where RTRP has been approved as a substitute for the polyvinyl chloride pipe covered in the Coast Guard Marine Engineering Regulations. It was intended as an aide for Coast Guard technical offices, marine inspectors, materials manufacturers, vessel owners, designers, and others who deal in the design and approval of shipboard piping sytems.

Included in the circular was an appeal for "constructive comments and suggestions." Comments and suggestions regarding the use of RTRP are still welcome. They should be sent to Commandant (G-MTH-2), U.S. Coast Guard, Washington, DC 20593.

How Will Ships Fare in a Collision?

The Maritime Administration has released a technical report on "The Prediction of Motions and Structural Damage of Two Colliding Vessels." The three-volume study contains methodology and computer programs for predicting damage to ships involved in a collision.

It was prepared for MarAd by Hydronautics, Inc., of Laurel, Maryland.

Copies of the report are available from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The order numbers and prices are:

Volume I - Executive Summary, No. PB83-238220, $8.50;

Volume II - Mathematical Models for Prediction of Motions and Structural Damage of Two Colliding Vessels, No. PB83-238246, $13.00; and

Volume III - Formulas for the Prediction of the Resistance of Hull Structure to Collision Impact, No. PB83-2382… $8.50.

The entire set (No. PB… 238212) can be purchased for $26.

Chemical of the Month

Ethylene Glycol: $HOCH_2CH_2OH$

	Ethylene glycol	Antifreeze (Typical values)
Synonyms:	1,2-ethanediol glycol	
Physical Properties		
Boiling point:	198°C (388°F)	166°C (330°F) 108°C (226°F)*
Freezing point:	-13°C (9°F)	-37°C (-34°F)*
Vapor pressure at 20°C (68°F):	0.05 mm Hg	18 mm Hg
Threshold Limit Values (TLV)		
Time Weighted Average (TWA):	50 ppm; 125 mg/m^3	—
Short Term Exposure Limit (STEL):	—	—
Flammability Limits in Air		
Lower flammability limit:	3.2% by vol.	—
Upper flammability limit:	—	—
Combustion Properties		
Flash point (c.c.):	116°C (241°F)	—
Flash point (C.O.C.):	111°C (232°F)	121°C (250°F)
Autoignition temperature:	400°C (752°F)	413°C (775°F)
Densities		
Liquid (water = 1.0):	1.12	1.14
Vapor (air = 1.0):	2.6	—
Identifiers		
U.N. Number:	not assigned	
CHRIS Code:	EGL	
Cargo Compatibility Group:	20 (Alcohols, Glycols)	

(The two figures followed by asterisks are for 50% sol. anti-freeze. Readers may be interested in knowing that, at sea level, the boiling point of 50% sol. antifreeze in a car radiator with a 15 psi radiator cap is 129°C (264°F). As for cold weather, maximum protection against freezing would be afforded by a solution of approximately 70% antifreeze and 30% water, which would have a freezing point of approximately -68°C (-90°F). Note that continuing to increase the concentration does not necessarily lower the freezing point. Undiluted, 100% antifreeze has a freezing point of approximately -13°C (9°F)).

Here it is fall again, and many of you are preparing your cars for winter by adding antifreeze to their cooling systems. Most of the antifreezes sold to consumers are blends of corrosion inhibitors, anti-foaming agents, other additives, and this issue's Chemical of the Month—ethylene glycol.

Ethylene glycol was first produced in 1856 by the noted French chemist Charles-Adolphe Wurtz. It became commercially important during World War I, when the Germans used it as a substitute for glycerol *(see Chemical of the Month, December 1981)* in making explosives. It was first used as an antifreeze in about 1925 and by the early 1960s had taken over about 90 percent of the antifreeze market, beating out methanol (wood alcohol), its chief competitor.

Ethylene glycol is what's known as a "permanent" antifreeze, one that's left in the radiator year-round. For this it has its low volatility to thank; ethylene glycol does not evaporate out of solution the way alcohol does. Another plus point is that it raises the boiling point of water solutions and thus helps prevent overheating during warmer weather. Ethylene glycol offers a number of advantages over other substances that have been or still are used as antifreezes. Calcium chloride and sodium chloride (table salt) solutions are corrosive; ethylene glycol is not. Kerosene and petroleum-based oils cause the rubber hoses in automobile cooling systems to swell and, over time, deteriorate; ethylene glycol does not. Sugar and honey lose their stability in the heat; ethylene glycol does not. Finally, some of the alcohols used as antifreezes (methanol, ethanol, or grain alcohol, and isopropyl, or "rubbing," alcohol), are highly flammable in addition to being volatile; ethylene glycol scores low on both counts. One place where ethylene glycol has lost out to another glycol is where a less toxic substance is needed. In cooling systems for engines used near drinking (potable) water supplies and for cooling or freezing of food products, for example, propylene glycol is used.

Although antifreeze is usually green, that color is a dye added for identification. Ethylene glycol itself is a clear, colorless, practically odorless, slightly viscous liquid. It is completely soluble in water and is very hydroscopic (meaning that it picks up and retains water vapor from the atmosphere).

Approximately 40 percent of the ethylene glycol produced today goes toward the making of antifreeze. About 35 percent is used in the manufacture of polyester fibers, films, and coatings. The remainder is used in such products as latex and oil-based paint, aircraft deicing fluids, low-temperature explosives, ink, and pesticides, to mention only a few. Its hydroscopic properties make it ideal for dehydrating natural gas. Since it has such a wide range of uses, ethylene glycol is made in several grades.

Ethylene glycol's principal hazard is its toxicity. If swallowed, amounts of 60 to 100 ml (approximately 2 to 3 1/3 oz.) can cause serious injury or even death. (This would be equivalent to approximately 1/2 to 3/4 cup of a 50% sol. antifreeze mixture. It should also be noted that antifreeze contains additives which in themselves can be toxic.) Victims who swallow ethylene glycol should be made to drink large amounts of water, and vomiting should be induced (neither of these measures applies to unconscious victims, of course). Medical attention should be sought.

Massive or prolonged skin or eye contact with liquid ethylene glycol may cause irritation because of the chemical's dehydrating effect. If ethylene glycol is splashed in the eyes or on the skin, the standard procedure of rinsing with large amounts of water should be followed.

Although ethylene glycol is slow to evaporate, dangerous vapors could form in an enclosed space (such as a cargo tank) or if the commodity were heated. Ethylene glycol, like all central nervous system depressants, can be insidious. While it has a recognizable odor, the chemical can deaden the sense of smell. Lifelessness and dizziness can progress to unconsciousness; if an unconscious victim is not discovered and if he breathes a high enough concentration, he will be asphyxiated.

In cases of inhalation exposure, the victim should be moved to fresh air, and a physician should be consulted.

The best measures to take against these hazards are preventive ones. Persons handling ethylene glycol should avoid breathing the vapors or fumes which will result if the commodity is heated. If they enter a tank, they should wear a self-contained breathing apparatus. If splashing is likely to occur, they should wear chemical goggles or a full face shield. In any case, the wearing of rubber gloves, aprons and shoes is advisable. If clothing is contaminated, it should be removed and laundered before being worn again.

The U.S. Coast Guard regulates ethylene glycol as a Grade E combustible liquid. The regulations governing it can be found in Parts 30 - 40 of Title 46 of the Code of Federal Regulations (Subchapter D). The International Maritime Organization includes ethylene glycol in Chapter 7 of its Chemical Code, chemicals to which the Code does not apply. Ethylene glycol is not regulated by the U.S. Department of Transportation, nor is it included in the International Maritime Dangerous Goods (IMDG) Code.

Hazard Evaluation Branch
Marine Technical and
Hazardous Materials Division

Confined Spaces

Is your hose mask really "serviceable"?

From time to time we publish reminders of the folly of entering confined spaces or toxic atmospheres without taking the proper precautions or using the proper equipment. At least one article a year has appeared detailing the hazards. Often, as in the cases recounted in the May 1980 and January/February 1981 issues of the *Proceedings*, an incident has resulted in multiple fatalities. A feature in last month's issue ("Death by Asphyxiation") saw yet another case where someone died as the result of entering a cargo tank containing a toxic atmosphere.

The incident to be discussed this month began while a tanker was offloading kerosene. An apparent leak in the cargo piping resulted in an accumulation of one to two feet of product in one tank. The master donned the available breathing apparatus and entered the tank to effect the repairs. In this instance that equipment was a Type A hose mask supplied by a hand-operated blower--a breathing apparatus no longer approved for atmospheres immediately dangerous to life or health. On November 17, 1980, the Coast Guard issued Navigation and Vessel Inspection Circular No. 13-80, which states that Type A hose masks will no longer be approved either on new vessels or as replacements for equipment found no longer serviceable. Units in use, however, could continue to be used until they became unserviceable.

In addition to the hose mask, the master had a lifeline made of steel-wire rope. One crewman operated the blower, and three crewmen stood by in the vicinity of the cargo tank access.

The master stood on an 18-inch suction line to effect the repairs necessary to rid the tank of the remaining kerosene. After about ten minutes in the tank he fell approximately six feet to the bottom of the tank. The fall dislodged his mask. The victim got to his feet, but one of the crew members in attendance sensed that he was having difficulties and summoned a rescue squad by telephone. The master again collapsed to the bottom of the tank, where he remained until the rescue squad came and removed him. He was pronounced dead on arrival at a local hospital. The attending physician's statement lists the cause of death as "inhalation of kerosene vapors."

While we can only speculate as to whether a faulty mask caused the master to fall or whether the mask simply slipped off and allowed him to inhale kerosene when he fell, a more effective mask might have saved his life.

The crew members in this case acted prudently. When they discovered that their safety equipment was not adequate to permit anyone to reach the victim without undue risk to his own safety, they allowed the rescue squad to handle the removal. The rescue squad arrived very promptly. Had the crew members not recognized the limitations of their equipment, this could have been another multiple-fatality case. In those cases, bystanders rush to aid the victim without regard for their own situation and, as might be expected, compound the problem rather than alleviating it. ‡

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. Vessels are first regarded as being in sight of one another when

A. a sound signal is heard.
B. one can be seen by the other visually.
C. the vessels see one another on radar.
D. one has spoken to the other over radiotelephone.

REFERENCE: Commandant Instruction M16672.2

2. Under the IALA B buoyage system, spherical buoys may be

A. numbered.
B. lighted.
C. used to mark an obstruction.
D. none of the above.

REFERENCE: *Proceedings of the Marine Safety Council*, Vol. 39, No. 9, Sept./Oct. 1982

3. The immersion of the deck edge in a heavy roll will serve to

I. decrease the reserve buoyancy.
II. decrease the GZ.

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

REFERENCE: Merchant Marine Officers Handbook

4. Readings taken from an aneroid barometer should be corrected for which of the following factors?

I. Latitude of the vessel
II. Height above sea level

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

REFERENCE: Bowditch, 1977

5. In the master gyrocompass, the phantom element is maintained in alignment with the sensitive element by means of the

A. corrector gimbal.
B. transmitter.
C. azimuth motor.
D. rotor and rotor case.

REFERENCE: Mariner's Gyro-navigation Manual

ENGINEER

1. Which factor(s) has (have) a part in determining the effective temperature of air?

I. Humidity
II. Air motion

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

REFERENCE: Modern Refrigeration and Air Conditioning, Althouse

2. Which of the following is (are) true regarding oxygen indicators or their use aboard vessels?

A. The instruments are capable of providing an immediate, accurate reading of any space with no delay.
B. Prolonged exposure to gases such as CO_2 may affect the accuracy of an indicator.
C. A cotton filter placed at the end of the sampling tube prevents damage when the instrument is exposed to strongly acidic gases.
D. All of the above

REFERENCE: MarAd fire-fighting manual

3. The purpose of the air chamber on the discharge of an emergency boiler-feed steam-reciprocating pump is to

A. facilitate draining of the cylinder.
B. reduce pulsations in the feed line.
C. adjust the speed of the pump.
D. provide for addition of boiler compound.

...ERENCE: Naval Auxiliary Machinery, U.S. Naval Institute

... Which statement is true regarding mechanical seals?

A. They may be used in lieu of conventional packing glands for any service other than saltwater.
B. They are not suitable for use on fuel-oil transfer pumps.
C. They are normally lubricated and cooled by the fluid being pumped.
D. Leakage may be reduced by adjusting spring compression.

REFERENCE: Centrifugal Pumps, Karassik

... A lubricating oil's ability to resist viscosity changes during temperature changes is indicated by its

A. American Petroleum Institute number.
B. Viscosity Index number.
C. Seconds Saybolt Furol number.
D. Seconds Saybolt Universal number.

REFERENCE: Lubrication, Gunther

ANSWERS

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

New Edition of Text on Stability and Trim Published

A third edition of *Stability and Trim for the Ship's Officer* has been published by Cornell Maritime Press, Inc. The original book, by John La Dage and Lee Van Gemert, was published in 1946. A second edition appeared in 1956. The new edition was edited by William E. George.

The text has been enlarged to include the newest developments in cargo handling and their implications. Vast changes have taken place in the technological aspects of the maritime industry since the last revision. Also, a number of changes have been made in operating rules concerning stability requirements for bulk grain carriers and in U.S. Coast Guard licensing examinations.

Every chapter has been revised and rewritten. New chapters on longitudinal hull strength and movable bulk cargoes have been added. The chapter on computers has been revised to show the evolution of electronic computing techniques for establishing stability, trim, and longitudinal hull strength factors. In the chapter on metacentric height calculations, there is an explanation of the short-form stability method that is used aboard many container and barge-carrying vessels. The chapter on marine disasters illustrates loss of ship as a result of shifting bulk cargo and insufficiencies in reserve buoyancy, hull strength, and transverse stability. The appendices have been enlarged and updated.

The book has approximately 400 pages and is available from booksellers or from Cornell Maritime Press, Box 456, Centreville, Maryland 21617. The price is $15. Orders sent to Cornell Maritime Press should include $2 for postage and handling. ⚓

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

Topical Index to NVICs Offered

Navigation and Vessel Inspection Circulars (NVICs) are published by the Coast Guard to provide the public with guidelines on certain regulatory actions affecting commercial shipping. They are available through the Government Printing Office. A private organization has prepared a topical index which may be of assistance to those using NVICs and can be obtained at no cost by sending a stamped, self-addressed envelope to Captain Kirk Greiner, Maritime & Environmental Consultants, 3107 NE 160th Street, Ridgefield, Washington 98642. The index will be updated on January 1 and July 1. ⚓