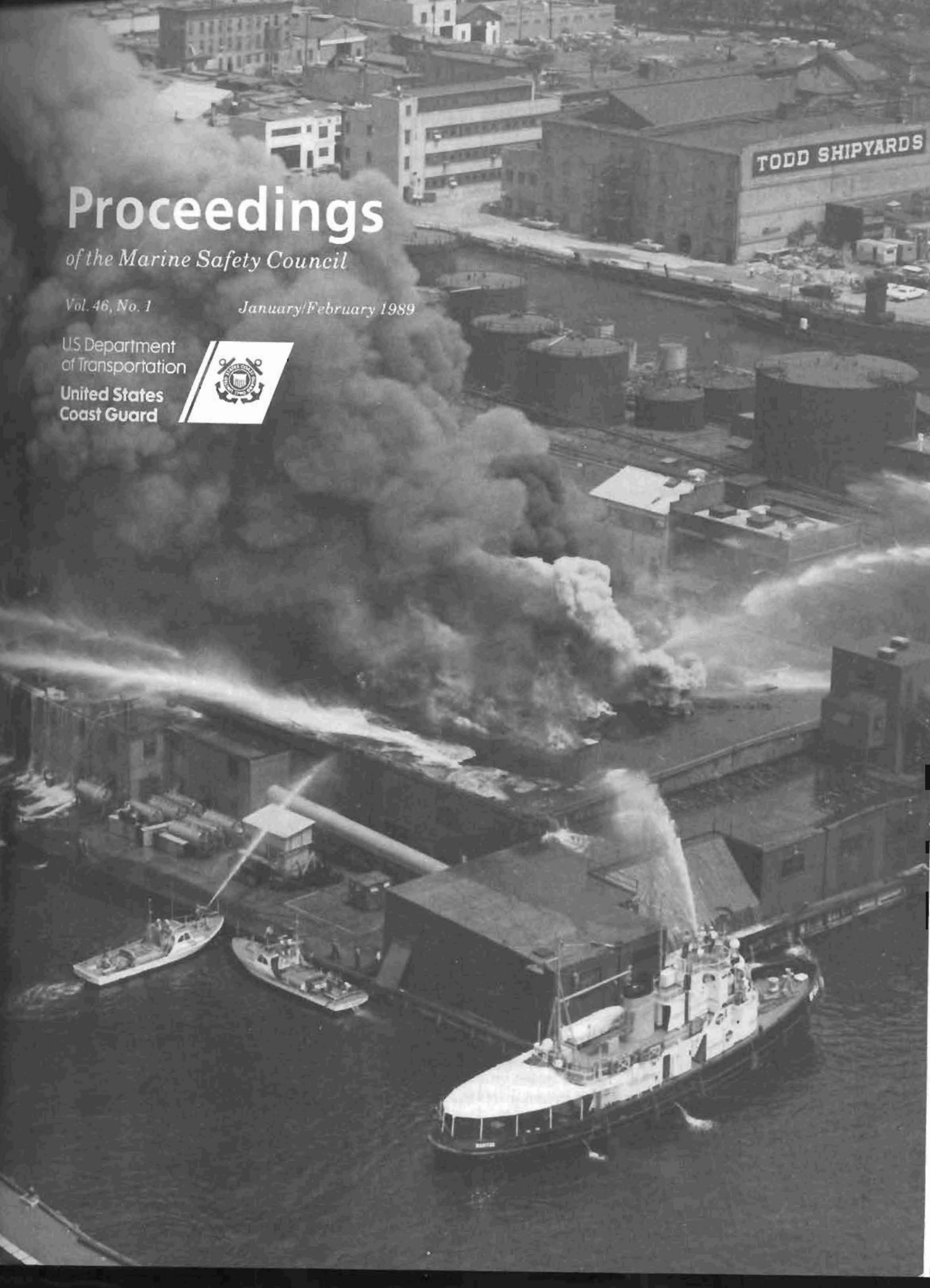

Proceedings

of the Marine Safety Council

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**United States
Coast Guard**

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Cover

U.S. Coast Guard vessels and New York City fireboats pour water into the blazing SuCrest Sugar Corp. warehouse at Erie Basin in Brooklyn. The eight-alarm fire raged out of control for more than 3 hours. (U.S. Coast Guard photo, 1966)

Explosive Vapors, Flammable Liquids, and Welding Never Mix

Thomas J. Pettin

When conducting welding operations around flammable liquids, you have to be particularly attentive not only to the task at hand, but also to the environment in which you are working. If you aren't, you just might "light up your life" in a way you never dreamed possible. Such was the case on August 17, 1984, when a welder's torch caused a serious fire aboard the production platform East Cameron Block 322, located off the western Louisiana coast.

An array of workmen were conducting general maintenance operations on the platform just before the fire occurred. Directly below the deck where welding operations were about to commence sat a small, rectangular, 120-gallon tank containing Emulsotron X-156, methanol and naptha solvents -- liquids all classified as highly flammable and explosive by the Department of Transportation and the Occupational Safety and Health Administration. [1]

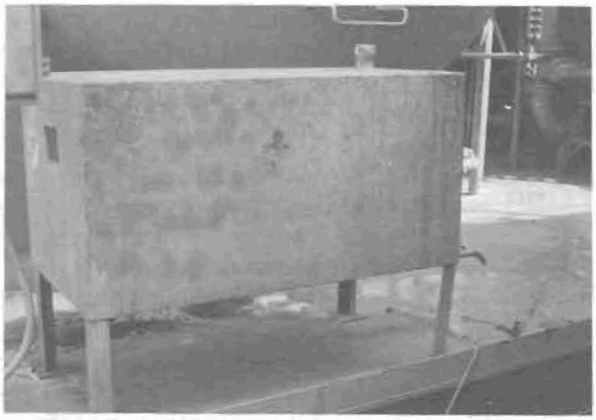
An explosion and raging fire occurred when sparks and slag, descending from the cutting operation one deck above, apparently ignited flammable vapors from the tank located directly below. Thirty-five minutes later the fire was extinguished, and what began as a routine work operation ended in tragedy for four men. The investigation that followed, conducted by the Department of Interior's Minerals Management Service, revealed that the tank was unshielded, and flame-cutting operations conducted so close to an unprotected tank of a flammable liquid was the probable cause of the fire. It was impossible to determine exactly how the ignition source met with the flammable substance. It was also impossible to determine whether a fill cap was in place on the tank. Had the tank been clearly labeled to the identity of the hazardous nature of its contents, or had the welder been aware of this dangerous situation, he might be alive today, and three other men would have avoided serious injuries. No fuels, gases, or other materials other than the chemicals in the tank made any significant contribution to the fire.

Mr. Pettin is a Program Analyst in the Coast Guard's Marine Safety Evaluation Branch.

[1] *U.S. Department of Interior, Minerals Management Service, Investigation of Aguust 1984 Fire, Lease OCS-G 2254, East Cameron Block 322 Gulf of Mexico, Off the Louisiana Coast, November 1985, p. 4.*

Safety Plans Ignored

A "Safe Welding and Burning Plan" had been approved by the Minerals Management Service (MMS). It described precautionary measures that should be taken to prevent the presence and/or ignition of combustible substances in instances like this. The plan directed that combustible substances be moved clear of cutting and welding operations and further directed that unmoveable combustible substances should be protected against sparks or slag. No action was taken to drain and inert the space inside the tank or to move the tank from the cutting operations. The tank wasn't even covered with a fireproof tarp, nor were the contents of the tank labeled as flammable. Unfortunately, neither is required by regulation. In this instance, a few precautionary steps taken in the name of safety would have gone a long way toward preventing tragedy from occurring. Because welding operations had previously been conducted in the vicinity of the tank, personnel in charge of operations believed that the tanks' contents posed no hazard. In the aftermath of the fire and explosion, the tank was completely destroyed, as were several pieces of production and firefighting equipment. Evacuation was not deemed necessary nor was there any report of pollution. Total damages were estimated at $114,700.



This chemical tank -- unused -- is similar to the one which exploded. Note this tank is marked as containing flammable liquid. *(Mineral Management Service photo)*

This Accident Might Have Been Prevented

The presence of the small tank and its contents were discussed in a safety meeting earlier in the day, but because the situation wasn't considered hazardous, the only precaution taken was to "sniff" the area for explosive vapors. The fact that this tank might be in the direct line of falling slag was in all probability never contemplated. If the "Safe Welding and Burning Plan" had been followed, precautions could have been taken that would have prevented this accident.

Safety plans and procedures provide no benefit if they aren't followed or adhered to. In this case, there was an apparent violation of safety regulation 30 CFR 250.80. This regulation deals with failure to comply with the provisions of an approved "Safe Welding and Burning Plan" (Sec. 5.4.1). The two employees who had been designated as fire watches were not in their designated areas when the fire ignited because they incorrectly assumed that welding personnel had gone to the galley for dinner. Both employees also alternated as part of the platform night crew and would periodically leave the welding area without a fire watch as they took care of other duties. Platform operators should schedule these assignments so that assigned duties don't override safety considerations.

Recommended Solutions

Operators of platforms should strive to maintain the highest standards of safety. Guidelines should be established and enforced which direct the amount of required protective gear to be worn during welding operations (gear should be worn by all personnel in a welding area). Gear that is defective should be replaced. Welding operations should be blocked off so sparks won't ignite materials in the vicinity, and welding operations should be performed only by qualified personnel. Such guidelines will lessen the risk of exposure from gases, fumes, electric shock, heat, and light radiation. Always ensure the work area and surrounding vicinity are *certified safe for hot work*. Welding is a specialized skill -- respect and guard against its hazards.∎

This article was based on the report of the Coast Guard Investigating Officer, Marine Safety Office, Port Arthur, Texas (report number MC 84912865, May 20, 1985) and on OCS Report MMS 85-0099, prepared by the Dept. of Interior's Minerals Management Service, November 1985. The author wishes to acknowledge both offices.

View of damaged chemical tank on deck of well bay area, showing (center foreground) small pump used for injecting chemical into production manifold. *(Minerals Management Service photo)*

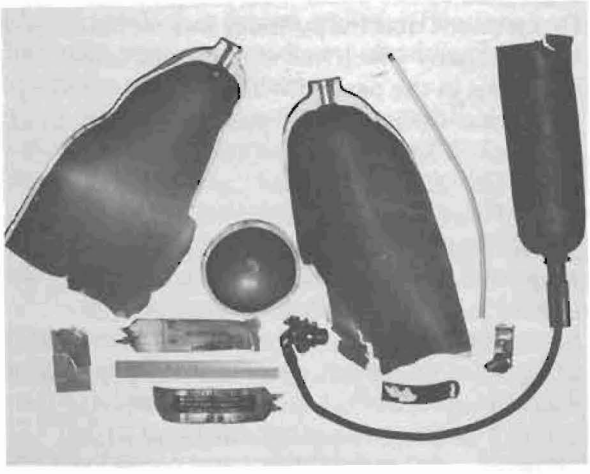
Barge Ballistics

LTJG Mark Dix

The tank barge **Smith Point** is an asphalt barge and because it carries oil products, it is inspected by the Coast Guard as required by Title 46 Code of Federal Regulations. **Smith Point** carries cargoes which require elevated temperatures for handling. In other words, the products carried on this vessel are so viscous that they must be heated to transform them into a more manageable fluid. Barges such as **Smith Point** are usually not as dramatic as a warship, sailing vessel, or large merchant ship when it comes to sea stories; however, this story is about a near tragedy on the **Smith Point** and how it almost became a dramatic sea story in itself.

The **Smith Point** was transiting the Chesapeake and Delaware (C & D) Canal in February 1988 under tow by the tug **Bay King**. The barge was loaded with asphalt and was enroute to Norfolk, Virginia. An unmanned barge, **Smith Point** has a small space on the port quarter where a tankerman can warm up, sip some coffee, and escape the chill when making his rounds in the winter. The warmest space, though, has to be the thermal fluid heater room on the starboard side where the cargo is heated to keep it in a free-flowing condition. Temperatures in this space routinely hover around 100° Farenheit in the winter. For safety reasons, company officials mandate that a fire extinguisher be kept in this space because of the two boilers housed there.

In mid-afternoon, while making way through the C & D Canal in Maryland, the tankerman on watch heard an explosion. The tankerman immediately began a search for the source. He found twisted and torn metal in the thermal fluid heater space. The aluminum cylinder fire extinguisher that was mounted on the forward bulkhead lay scattered about the deck in three pieces. A light switch was ripped off its foundation, a utility panel was pushed in, and two lockers were completely demolished. No other machinery was visibly damaged. Apparently, the fire extinguisher had exploded!



Remnants of the fire extinguisher. *(Photo by LTJG Donald Noviello)*

Upon docking in Norfolk, the barge company called Coast Guard Marine Safety Office Hampton Roads to alert the duty investigator and inspector. Since the **Smith Point** is an inspected barge, the inspector was interested in finding out if any Coast Guard inspected equipment was at fault. The investigator's concern was the "why" and "how" of the explosion. Understandably, the insurance companies and other parties involved were also interested in finding the answers.

The investigator and inspectors found that the bulkhead on which the cylinder was mounted was pushed out at least 2 inches. The cylinder itself was split longitudinally from the valve to the base. Deep gouges were noted in the cylinder fragments from where they had struck various objects during their ballistic flight. The remnants of one storage locker had been dragged out on the deck for closer inspection while the other locker was still wedged in place like a crumpled beer can.

Perplexing questions jumped to mind. What caused a fire extinguisher, a safety device, to explode as violently as a bomb? Was there the potential for other fire extinguishers on board to

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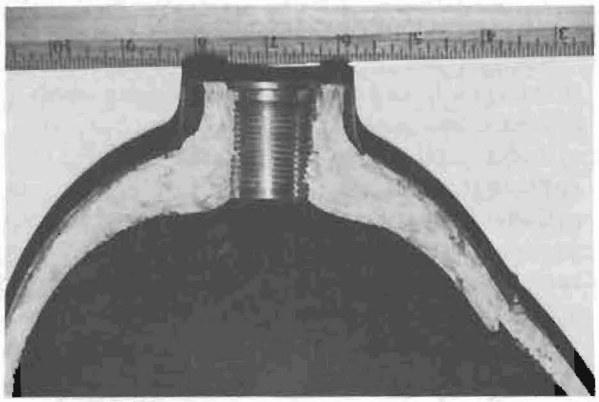
LTJG Dix is an Investigating Officer at the Coast Guard Marine Safety Office, Hampton Roads, Virginia.

explode? Did a nationwide recall for that make of extinguisher need to be implemented? One would never think that such a simple item as a fire extinguisher could present such a lethal hazard.

As examination of the evidence began, it was noted by the Coast Guard Inspections Department that the cylinder was manufactured by a company which had experienced some problems in the past with aluminum-lead alloy cylinders: the metal suffered hairline cracks at the neck. The cylinder had split into nearly equal halves along the neck, all the way to the base. However, the cylinder may not have been the problem. It was hydrostatically tested in May 1985 to a pressure of 1,800 pounds per square inch (psi). Instead of a bad cylinder failing at normal pressure, this might be a case of a good cylinder failing at extreme pressure. It was evident that the valve should be tested.

The barge company contacted a local laboratory in Norfolk that could test the valve to 5,000 psi using hydrostatic pressure. When it was fitted into the testing apparatus, the valve was in the same condition as when found following the explosion. The rupture disk -- a thin, metal wafer inserted into one of two exit ports on the valve -- was designed to burst at a particular pressure, in this case around 2,000 psi. The cylinder was rated to an even higher pressure of 4,500 psi. The valve was "strapped in," and the pressure was cranked up. It was not tested to failure as originally planned. Since the limit of the testing facility was 5,000 psi, the testing examiner aborted the test as the pressure neared 4,800 psi with the rupture disk still intact. The rupture disk withstood twice the pressure beyond which it should fail!



Detail of the fire extinguisher's neck. Note secondary crack below 3" tick mark. (Photo by LTJG Donald Noviello)

The culprit had been found, or so it seemed. The valve was now opened for the first time following the explosion, and a rupture disk which was unsuitable for that type of valve was found inside. It showed signs of deformation but it could not be concluded that this was a result of the test or the actual incident. The reason the valve did not blow when it should have was now known: an improper disk. One difficult question remained: what caused the pressure in the cylinder to exceed 4,800 psi?

The fire extinguisher had been serviced 2 days before the explosion; servicing consisted of merely recharging the CO_2 cylinder. Procedures for recharging are to completely discharge the bottle and then refill it with 15 pounds of CO_2. No company records existed to trace the origin of the disk in the valve or to determine whether the bottle was overfilled.

The explosion was linked directly to the presence of an unsuitable rupture disk in the valve assembly. Since no paper trail links the service company to overfilling the extinguisher or substituting a bad rupture disk, one can only speculate as to the contributing causes of the incident. These causes lay in keeping the extinguisher in a space where there were elevated temperatures and a *possible* overfill during the last servicing. Even a cylinder with a normal charge of CO_2 will experience an increase in pressure due to an elevated temperature.

Such an incident would have drawn a great deal more attention if someone had been injured or killed. The incident would have been placed under the microscope by the media, insurance companies, and the Coast Guard, and an in-depth report would be written on how to prevent recurrences. However, it is quite likely that someone did narrowly escape death or injury on the **Smith Point**, and the lesson may still be learned without having the expense of a full-scale investigation and lengthy report: treat pressurized cylinders, which include fire extinguishers, with care. Seek regular maintenance and reliable servicing for all firefighting equipment. Fire extinguishers can save lives or take lives. They are potential bombs when overpressurized.∎

An Open Letter to Proceedings Readers

The National Shipbuilding Research Program, with full concurrence by senior shipbuilding, ship operating, and government officials, recognized that a body of national shipbuilding standards is essential for the U.S. shipbuilding industry to be competitive.

Several initiatives are underway, including a standards development panel, SP-6, of the Society of Naval Architects and Marine Engineers and the Shipbuilding Committee, F-25, of the American Society for Testing and Materials. There have been successes, and the two groups are continuing to develop standards. Two recent examples of standards developed in response to recommended needs are (1) a standard for marine fiberglass pipe and (2) design and selection standards for shipboard incinerators.

SP-6 and F-25 are looking to the future to see what work initiatives should be undertaken. The original premise of the NSRP is still valid: common U.S. shipbuilding standards are needed if the United States is to be competitive. Standards will save money by providing design repetitiveness, will streamline bid preparation and response, and will reduce item cost by enlarging the sales base since each item would not be different for each ship operator or owners. Standards will also simplify ship design and specifications by having consensus agreement (producers and users) for shipboard items.

First, I invite and encourage all interested in standards development to participate actively in the F-25 technical subcommittee. A listing of Main Committee meetings, technical subcommittees, and their chairman follows this letter.

Second, I encourage all to make written recommendations on where standards are needed or where a change in standards would result in improvements in U.S. shipbuilding.

F-25 and SP-6 are at a stage where they are identifying new initiatives which will have a significant benefit to U.S. interests. Please write or call me. Each of us can make a difference.

D.A. Marangiello
Chairman, ASTM Committee F-25 on Shipbuilding
203 Cape Saint John Road
Annapolis, MD 21401
(301) 261-8021

ASTM F-25 Main Committee Meeting Schedule

May 8 - 10, 1989, Annapolis Ramada, Annapolis, Maryland

December 4 - 6, 1989, Hilton, Orlando, Florida

Tentative Schedule for 1990 and 1991

May 22 - 24, 1990
San Francisco, California

December 3 - 5, 1990
San Antonio, Texas

May 6 - 8, 1991
Atlantic City, New Jersey

December 2 - 4, 1991
San Diego, California

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(202) 692-0213

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F25.04 - Hull Structures

Norman Lemley
U.S. Coast Guard (G-MTH-2/12)
2100 Second St., SW
Washington, DC 20593
(202) 666-9487

F25.07 - General Requirements

Victor Burnett
JJH
Two Crystal Park, Suite 600
2121 Crystal Drive
Arlington, VA 22202
(703) 920-3435

F25.10 - Elect/Elex/Automation

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Naval Sea Systems Command
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Washington, DC 20362
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Pete Emerling
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4301 Poche Court West
New Orleans, LA 70127
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F25.11 - Machinery & Deck Machinery

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(202) 692-3279

F25.13 - Piping

Hector Ballester
901 Lake Summit Drive
Anaheim Hills, CA 92806
(714) 921-1039

National Recreational Boating Safety Program

The Coast Guard has fiscal year 1989 funds available to provide financial assistance to national nonprofit public service organizations to help them conduct boating safety activities. This announcement seeks proposals for all types of projects that will promote boating safety on a national level. Innovative approaches are welcome.

Specific information on organization eligibility, proposal requirements, award procedures, and application forms (SF 424) can be obtained by writing Commandant (G-NAB), U.S. Coast Guard, Washington, DC 20593, or by calling Mr. Ladd Hakes at (202) 267-0954.

Proposals must be received by April 1, 1989.∎

U.S. Coast Guard Safety Advisory

Steam and Static Electricity

How can steam cause the explosion and loss of a tank barge and injury of five tank-cleaning workers? By creating a static electricity discharge within a tank containing flammable vapors, that's how.

Asphalt residue was being removed from a barge's tanks by means of stripping lines led to a cleaning facility's vacuum manifold. Steam hoses were run from the facility to two butterworth machines attached to butterworth openings on top of the tank. As steam was being injected into the tank being cleaned, vacuum was applied to the stripping lines to suck softened cargo and water from condensed steam out of the tank. The manhole hatch covers were propped open during tank cleaning. Steam and suction had been applied to one cargo tank for not more than 45 minutes when the barge exploded, burst into flames, and sank. The force of the explosion, burning material thrown into the air, and smoke from the fire caused five workers from the adjoining facility to be hospitalized. Had anyone been aboard the tank barge at the time of the explosion, they most likely would have perished.

What caused this explosion? The most probable cause was ignition of an explosive mixture of hydrocarbon vapors and air by a static discharge from a steam cloud within the tank. The steam cleaning released cargo vapors while the suction action of the stripping piping drew oxygen laden air into the tank through the open manhole covers. With the atmosphere in the tank within the explosive range (between the upper and lower flammable limits), a spark with sufficient energy was all that was needed to cause the explosion.

The petrochemical industry has long recognized the potential for ignition of explosive vapor-air atmospheres by static electricity produced by steam jets, and a number of industry publications discuss this hazard. Wet steam or steam with entrained rust particles will generate a large static charge when exhausting from a nozzle. Electrical discharges between the nozzle and tank walls, or between charged steam clouds within the tank, will result in explosion if the spark energy is high enough.

ANSI/NFPA 77-1983, "Recommended Practice on Static Electricity," states, "If flammable vapor-air mixtures are likely to be present, steam jets should be avoided." This warning is repeated in the International Safety Guide for Oil Tankers and Terminals (ISGOTT), published by the International Chamber of Shipping, the Oil Companies International Marine Forum, and the International Association of Ports and Harbors, which advises ". . . steam should not be injected into cargo tanks where there is any risk of the presence of a flammable atmosphere." So how can tank steaming be carried out safely? ISGOTT indicates that steaming of cargo tanks can be conducted safely *only* in tanks which have been either inerted or water washed and gas freed with the concentration of flammable vapors not exceeding 10 percent of the lower flammable limit prior to steaming. The injection of steam into tanks containing uncontrolled flammable vapors or cargo residue which could release flammable vapors is *not safe*. The operations manuals of tank barge cleaning and gas freeing facilities should refer to the ISGOTT standards or include a similar discussion of safe tank steaming procedures.

Additional information on the hazards of static electricity in the handling of flammable or combustible liquids may be found in American Petroleum Institute Recommended Practice 2003, "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents," and the safety advisory "Static Electricity and Tank Barge Explosions," appearing in the October 1987 issue of this magazine.

Will the Stability Test Delay the Delivery of Your Vessel?

LCDR Glenn W. Anderson

A vital element in obtaining Certificates of Inspection and Load Line Certificates is Coast Guard approval of the stability calculations. The most time-critical step in getting those calculations approved is the completion of a stability test, which is often referred to as an inclining experiment. This inclining determines the vessel's displacement and center of gravity -- information necessary to determine if the vessel has adequate stability. Since the stability test must be done when the vessel is substantially complete, the owner's ability to employ his vessel as soon as possible depends on the completion of the stability test to the satisfaction of the Coast Guard. In certain cases described in Navigation and Vessel Inspection Circular (NVIC) No. 3-84, the American Bureau of Shipping (ABS) may act on the Coast Guard's behalf. The technical requirements are the same whether the Coast Guard or ABS approves the vessel's stability.

The stability regulations (46 CFR Part 170) detail the basic requirements for conducting a stability test. Probably the most important aspect for timely and proper conduct of a stability test is planning. The requirement for the submission of a "stability test procedure" at least 2 weeks prior to the test is to ensure that proper planning occurs.

Except when NVIC 3-84 is invoked, the USCG Marine Safety Center, located in Washington, DC, reviews the stability test procedure and the subsequent stability calculations. They also ensure the Coast Guard provides a witness for the stability test. Ideally, this witness is a representative from their office because this same person will normally review the stability calculations when the inclining test results are submitted for approval. Also, a witness from the Marine Safety Center ensures the presence of a naval architect who is experienced with Coast Guard technical requirements and who is trained to evaluate the cause and effect of any observed difficulties, therefore permitting immediate technical decisionmaking. Constraints on personnel and resources sometimes result in a Marine Inspector from the local Marine Safety Office serving as the Coast Guard's witness. Many Marine Inspectors have technical backgrounds and experience with inclining vessels.

It is of paramount importance to conduct a proper inclining. Sometimes owners do not appreciate the significance of this event, especially when it is all that stands in the way of the vessel's delivery. In most cases this test is routine and little goes awry. However, when things do go wrong, the problem usually lies in one or more of the areas discussed below. If these pitfalls can be avoided, the stability test should run smoothly and not cause late deliveries or less-than-capacity vessel operations.

The most likely problem area is the test supervisor's lack of familiarity with the Coast Guard's requirements for conducting the test. The test supervisor is usually a naval architect or engineer employed by the shipyard. Although technical competence is important, it alone is not sufficient to ensure an acceptable stability test. The supervisor is the owner's representative at the inclining experiment and is responsible for conducting the inclining experiment. The use of a naval architect normally expedites an inclining and minimizes misunderstandings.

NVIC 15-81 provides guidance to help ensure that an acceptable test is achieved without undue delay or complications, and the test supervisor should be familiar with it. The supervisor's familiarity with NVIC 15-81 is probably the single most important requirement

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LCDR Anderson is Chief of the Coast Guard's Stability and Subdivision Section, Naval Architecture Branch.

that should be considered to avoid untimely delivery. The Coast Guard believes it is of such importance that it has asked local Society of Naval Architects and Marine Engineers Sections to stress the importance of a stability test.

The second area which may result in problems is the vessel's not being in a "nearly completed" condition for the test. Often the test is scheduled with overly optimistic plans for completing construction. The vessel *must* be substantially complete at the time of the test. If it is not in this condition, the test may be postponed or even repeated after missing items are finally installed. A properly prepared stability test procedure and a line of communication with the Marine Safety Center and the local Marine Safety Office should result in the vessel's being ready when the test is performed. Of course, the owner and shipyard must understand the need to have the vessel substantially complete by the time of the test.

The Coast Guard recommends that owners consider including a provision in their contracts with shipyards requiring a stability test conducted in accordance with NVIC 15-81. This would help ensure proper details and should avoid last-minute arrangements as a vessel nears delivery. An excellent way to ensure the stability test runs smoothly is to perform a trial inclining prior to the arrival of the Coast Guard witness.

NVIC 15-81 can be ordered from the Marine Safety Center. Copies may also be available from organizations such as The Society of Naval Architects and Marine Engineers, the National Association of Passenger Vessel Owners, and the Offshore Marine Service Association.

Immediate operation may be possible upon conclusion of the stability test. A temporary stability authorization may be delivered immediately after the test, provided preliminary stability calculations are approved well in advance of the test and the test proves that the vessel has the same or better stability than the calculations assumed. This procedure has been used successfully in the past and is common for overseas inclining experiments where delays in approving final stability calculations, caused by correspondence time, can be considerable. Authorization for full passenger count or full cargo capacity may be delayed but the vessel may be put to work immediately. This procedure has the costs of extra and early submission of calculations and possibly finding that the vessel has less stability than assumed in the calculations. However, to many owners it has proved itself to be well worth the effort.▮

Photo Collection of Museum Available

The Maritime Industry Museum at the State University of New York (SUNY) Maritime College in The Bronx, New York, will begin making its photo collection available to the general public beginning in September 1989. The photos cover ships, places, events, and people as early as the turn of the century.

The College has developed an extensive collection of photos since its founding and has recently acquired several new collections. Among these are the Sailor's Snug Harbor Collection of early New York, the Prudential/Grace Line Collection, the Monroe Maritime Photo Collection, which includes original photos of the S.S. Morro Castle, and several collections from World War II.

The collection is currently being organized by the Museum's Photo Curator, Cadet Matthew Reynolds of Long Island City, New York. The cost for reproduction of the photos will be kept low to allow increased access by students and collectors. Information on photos available may be obtained by writing the Maritime Industry Museum, SUNY Maritime College, Fort Schuyler, Bronx, New York 10465.▮

Careful -- It's Loaded!

Sometimes reviewing the events of a casualty gives the reader a sense of slow motion: the build-up of a hazard waiting to happen, something like cocking a loaded shotgun or setting the spring of a bear trap. A recent example involves a lifeboat winch for which the investigating officer's report and the accident report given by the vessel's master reveal the following details:

At conclusion of fire and boat drill. . . while the #2 motor lifeboat was being handcranked into its resting place on the [davit arms]. . . the gear case apparently jammed. . . . While attempting to clear this condition. . . when the gear box inspection cover plate was removed, the pinion gear and the ring gear shifted out of alignment with the worm gear and the lifeboat free fell. . . to the water's edge and banged against the vessel's hull. . . . Exactly what caused the gears to jam cannot be determined. . . the most probable cause was the lack of lubrication.

There were no personnel injuries in the above; the lifeboat was cracked in three places along its gunwale, along with failures of a tricing pendant of one davit arm and a chain link of the lifeboat's forward gripe.

Figure 1 shows the mechanical parts of this winch. In this design, when the handbrake lever is on, the brake holds the load of the lifeboat and the davit arms in a stopped position by preventing rotation of the wire rope drums that pay out the falls. The handbrake is able to maintain its control of the wire rope drums because of its connection to the worm shaft (ab) which is in contact with the worm wheel - pinion shaft (cd) leading to the gears on the ends of the drums.

In this winch, the removable cover plate of the gear box contains, in a recess on its inside face, the support bearing for one end of the worm wheel - pinion shaft, the end marked "c." When the crew removed this cover plate to have a look inside the gear box, the "c" end of the worm wheel - pinion shaft lost its support so that the shaft dropped out of position, thereby eliminating both the handbrake and the centrifugal brake from their control of the wire rope drums. The drums, no longer restrained, then began to rotate so that the lifeboat and davit arms ran away, uncontrolled.

In this incident when the winch stopped operating and would neither hoist nor lower the lifeboat, the master of the vessel had to do something quickly: an unstowed lifeboat on an underway vessel is a breach of seamanship. And it is almost certain that no one onboard had sufficient knowledge of the winch to be aware of what would happen on removal of the gear box cover. The steps taken by the crew to open up the winch while the weights of the lifeboat and davit arms were exerting forces on the wire rope drums was comparable to repairing the brakes of a parked automobile on a hill. The potential energy produced by the lifeboat's weight and the davit arms, "parked" on the sloping trackways, was a hazard easily triggered, to use again the shotgun analogy.

At what point did things begin to go wrong? From the facts, it is clear that the safer course of action would first have been for the crew to tie off, secure, or immobilize the lifeboat and davit arms before opening the winch in an attempt to fix its mechanical stoppage. What steps could have been taken for this?

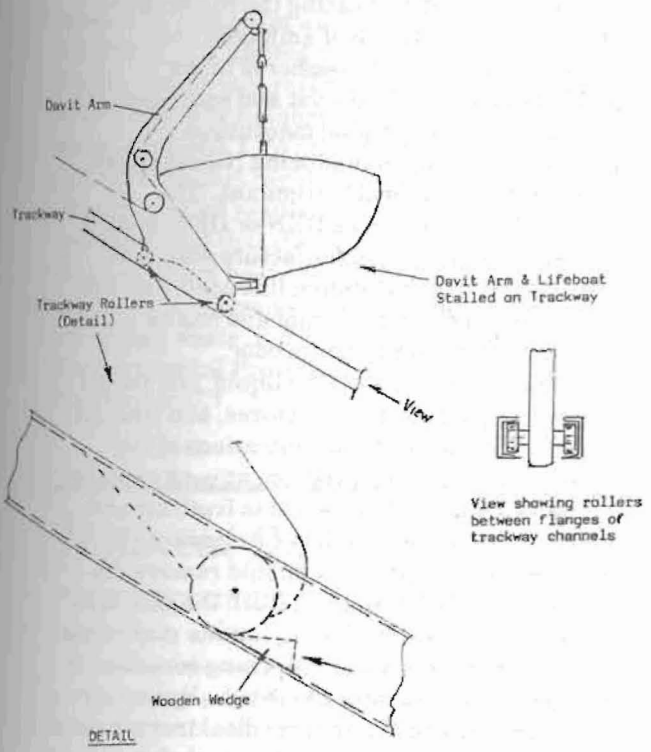
(1) Drive wooden wedges between the rollers of the davit arms and the contacting flanges of the trackways. This would stop any downward movement of the davit arms, but the strain of the lifeboat's weight would still be exerted on the falls; so

(2) Apply wire rope clips to the falls where the wires enter the fairlead sheaves on the trackways above the winch (see diagram). Then, if there was additional payout of the falls, the

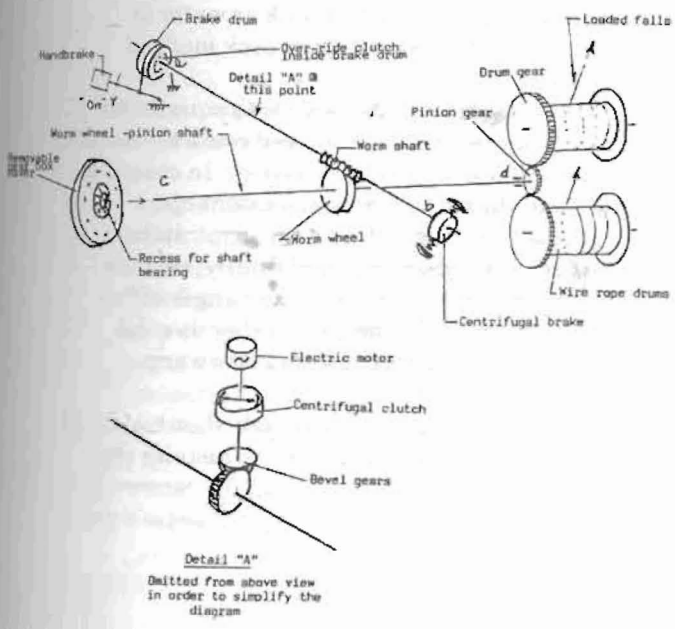
wire rope clips would jam against the fairleads and prevent the boat from moving; and finally

(3) Pass temporary gripes around the lifeboat to hold it fast against the davit arms.

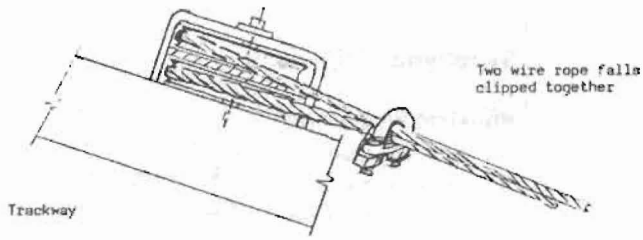
Shipboard personnel must be constantly alert to things going wrong when working with weight-handling machinery. The man-on-deck must do this instinctively. When working with winches, windlasses, hoists, power-operated folding hatches, etc., where forces exerted by wire rope cables move heavy weights, there is always a danger from the potential energy resulting from such hoisting and straining. In the vicinity of equipment holding a strain on a cable, the watchword must always be "Careful -- It's Loaded!"



View showing rollers between flanges of trackway channels



Omitted from above view in order to simplify the diagram



Showing use of a wire rope clip as a stopper adjacent to a double-sheaved fairlead bracket

For the fairlead of a single fall, where the second wire is missing, the extra clearance within the bend of the U-bolt will require filling with a scrap of wire so that the clip will not slip from the load carried by the fall when the clip jams against the fairlead bracket.

Chemical of the Month

Todd Chappell

Diethylamine

Chemical Name: Diethylamine

Formula: $(CH_3CH_2)_2NH$

Synonyms: DEN, DEA

Physical Properties
- boiling point: 132°F, 55.5°C
- freezing point: -57.6°F, -49.8°C
- vapor pressure: 0.7 psia
- threshold limit value: 10 ppm
- short-term inhalation limits: 100 ppm for 30 minutes

Flammability Limits in Air
- lower limit: 1.8%
- upper limit: 10.1%

Combusion Properties
- flash point: 5°F
- autoignition: 594°F

Densities
- vapor (air = 1): .0453 lb/ft^3
- specific gravity (at 20°C): 0.708
- density (at 18.3°C): 44.26 lb/ft^3

Identifiers
- U.N. Number: 1154
- Cargo Compatibility Group: Aliphatic Amine

Todd Chappell was a Fourth-Class Cadet at the U.S. Coast Guard Academy when he wrote this article for LCDR Kichner's hazardous materials transportation class.

Diethylamine $(CH_3CH_2)_2NH$, a primary amine, is created by heating the combination of an alcoholic solution of ammonia and acetaldehyde at 12 atmospheres in the presence of a nickel catalyst and hydrogen. It is frequently used in pharmaceutical processes, such as in producing Nikethamide, a respiratory and heart stimulant. The chemical, also known as DEN or DEA, is used to vulcanize rubber, manufacture soap, and tan leather. Diethylamine, like soap, floats on water. It is a colorless liquid and has an irritating fishy or ammonia odor.

When working with the liquid, one should use safety goggles, rubber gloves, and wear an apron. Because high concentrations of the vapor can cause asphyxiation, anyone exposed to the vapor should be moved to fresh air and given artificial respiration if necessary. If exposed to the liquid, one should remove the contaminated clothing and flush the skin area with plenty of water. Diethylamine may cause irritation to the skin, or a burning sensation to the eyes and respiratory systems. Eye exposure requires further medical treatment. If the chemical is swallowed, give the conscious victim plenty of milk or water to neutralize the chemical, then seek medical attention.

Diethylamine is dangerous to aquatic life even in low concentrations, and could be harmful if it enters water intakes. In case of a spill, one should first stop the discharge, evacuate the area and then try to minimize any fire ignition sources and finally, call the fire department. To reduce the danger of fire caused by the spill, one should stay upwind and use a water spray to knock down any vapor from the spill.

Diethylamine is extremely flammable, and vapors produced in a fire are heavier than

air and may travel a long distance to another source of ignition and flash back. In case of ignition, one should use dry chemicals, CO_2, alcohol foam, or carbon tetrachloride as a fire extinguisher, while continuing to cool any remaining diethylamine with a water bath. After the immediate danger has subsided, the local health and pollution control agencies should be notified.

When shipped, the chemical is considered a flammable liquid, and it is forbidden to be carried on passenger aircraft or trains. On cargo airplanes, it is limited to a 5-pint maximum. Diethylamine is covered under packaging group II and UN/DOT number 1154 with an IMO description of 3.1. When carried in bulk aboard a cargo ship, it is regulated under Department of Transportation regulations 46 CFR, and it is recommended that the chemical be kept on deck, and away from heat. For packaged commodities, regulations are contained in 49 CFR. Also, as a hazardous waste, it is regulated under the Environmental Protection Agency's 40 CFR Subchapter C.∎

Nautical Queries

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

Engineer

1. The main objection to the use of a dry chemical on an electrical fire is that _____.

A. extinguishing action is not as good as with soda acid
B. powder conducts electricity back to the firefighter
C. dry chemical leaves a powder residue which may render electrical equipment inoperative
D. extinguisher will need to be recharged

Reference: CG 329, *Firefighting Manual for Tank Vessels*

2. If a boiler is smoking, and increasing the excess air does not reduce the smoke, the cause can be _____.

A. forced draft fan failure
B. dirty atomizers
C. heavy soot on tubes
D. high ambient air temperature

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

3. Moisture in a typical R-12 refrigeration system will most likely _____.

A. boil in the condenser.
B. be removed by the liquid line strainers
C. cause sweating and frost on the evaporator coils
D. freeze in the expansion valve

Reference: Shulters, *Marine Air Conditioning & Refrigeration*

4. A direct connection or geared main propulsion diesel engine would be fitted with a/an _____ governor.

A. constant speed
B. variable speed
C. isochronous hunting
D. nutating disk

Reference: NAVPERS 16178-A, *Fundamentals of Diesel Engines*

5. Humming or buzzing electric contacts is a symptom of _____.

A. low voltage
B. power failure
C. a circuit ground
D. a circuit overload

Reference: Hubert, *Preventive Maintenance of Electrical Equipment*

Deck

1. Which of the following statements about the deck line is true?

A. The top of the deck line is marked on the side at the level of the highest point of the

freeboard deck, including camber, at the midships point.

B. A vessel with wooden planks on a steel deck will have the deck line marked at the intersection of the upper line of the wood sheathing with the side shell.

C. The deck edge is marked at the intersection of the freeboard deck with the side shell at the lowest point of sheer with the vessel at even trim.

D. On a vessel with a rounded stringer-sheer plate, the deck line is marked at the level where the stringer plate turns down from the plane of the deck line.

Reference: 46 CFR 42.13-20

2. On approaching the English Channel on course 080° T, you note the symbol YBY near a charted buoy. You must pass

A. northward of the buoy.
B. southward of the buoy.
C. eastward of the buoy.
D. westward of the buoy.

Reference: Bowditch, *American Practical Navigator*

3. You are on a LASH vessel. Which of the following statements concerning the stowage of the hazardous material in barges is true?

A. Barges with hazardous materials may only be stowed in locations where they can vent to the atmosphere.

B. The containment provided by the barges meets all segregation requirements except for cargoes of flammable liquids.

C. The hazardous cargo in the barge must be inspected every 24 hours after stowage is completed.

D. Each barge must be stowed to provide access to its cargo unless firefighting equipment capable of piercing and reaching the barge is available.

Reference: 49 CFR 176.69

4. Gross tonnage indicates the vessel's _____.

A. displacement in metric tons
B. total weight including cargo
C. volume in cubic feet
D. draft in feet

Reference: Hayler, *American Merchant Seaman's Manual*

5. You are in longitude 33 degrees west. The GHA of Aries is 29 degrees. The SHA of a star is 43 degrees. The LHA of the star is _____.

A. 9°
B. 14°
C. 39°
D 105°

Reference: Bowditch, *American Practical Navigator*

Answers

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

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

Keynotes

Final Rule

CGD 81-059, Licensing of Maritime Personnel (January 4)

The Coast Guard is amending the regulations concerning the licensing of maritime personnel and the manning of vessels. This rule modifies the regulations contained in Parts 10, 12, 15, 30, 31, 35, 151, and 185 of Title 46 Code of Federal Regulations and Part 155 of Title 33 CFR concerning the licensing of individuals, the registration of staff officers, and the manning of vessels. This final rule combines and modifies the regulations contained in rulemaking dockets CGD 81-059 and CGD 81-059b published as Interim Final Rules on October 16, 1987 (52 FR 38614 and 52 FR 38658 respectively). New limited tonnage licenses are added for Great Lakes and inland service. Provision is made for master and mate licenses with a river route. The renewal requirements are modified to allow license renewal by mariners who are not actively employed under the authority of their licenses. The license renewal requirement for a valid cardiopulmonary resuscitation course certificate has been withdrawn. The authority for masters and mates to act as tankermen, which appears throughout 46 CFR and in 33 CFR Part 155, is modified to reflect the broader use of the terms master and mate. The list of examination subjects for engineering licenses has been completely revised to more clearly indicate the material covered in each examination. Minor modifications to the topics for deck licenses have also been made.

These changes to the regulations are effective February 3, 1989. For further information, contact LCDR Gerald D. Jenkins, Project Manger, telephone (202) 267-0224.

Notice of Availability of Funds

CGD 89-001, The Boat Safety Account of the Aquatic Resources Trust Fund; Availability of Fiscal Year 1989 Financial Assistance (January 24)

Pursuant to Title 46 United States Code section 13103(c), the Coast Guard is seeking to enter into financial assistance agreements with national nonprofit public service organizations for national boating safety activities. The Coast Guard has fiscal year 1989 funds available to subsidize selected national boating safety activities. This announcement seeks proposals for all types of projects that will promote boating safety on a national level.

Proposals must be submitted by April 1, 1989, to Commandant (G-NAB-5), 2100 Second *Street, SW, Washington, DC 20593-0001.* Specific information on organization eligibility, proposal requirements, award procedures, financial administration procedures and application forms may be obtained from the same address.

For further information, contact Mr. Ladd Hakes, telephone (202) 267-0954.

Notice of Proposed Rulemaking

CGD 85-080, Small Passenger Vessel Inspection and Certification (January 30)

The Coast Guard is proposing to revise the regulations governing small passenger vessels which are in Title 46, Code of Federal Regulations, Parts 175 through 187 (Subchapter T). Subchapter T contains the regulations for the inspection and certification of small passenger vessels including requirements on construction, outfitting of lifesaving and fire protection equipment, machinery and electrical installations, and operations. The term "small passenger vessel" generally includes any vessel of less than 100 gross tons carrying more than six passengers.

The regulations in Subchapter T were initially developed in the late 1950s and early 1960s. Significant changes have occurred within the past 20 years affecting the small passenger vessel fleet including: Statutory changes, increases in physical vessel size and passenger capacity, increase in the services offered by the owners and managing operators of small passenger vessels, expansion of vessel

routes, and technological advances. Consequently, Subchapter T needs to be updated to reflect these changes.

Comments must be received on or before May 30, 1989. Written comments should be submitted to The Executive Secretary, Marine Safety Council (G-LRA-2/3600) (CGD 85-080), U.S. Coast Guard Headquarters, 2100 Second Street, SW, Washington, DC 20593-0001. Comments may be delivered to and will be available for inspection or copying, and the materials referenced in this notice will be available for examination and copying, at the Marine Safety Council (G-LRA-2), Room 3600, U.S. Coast Guard Headquarters, address above. This office will be open between 8:00 a.m. and 3:00 p.m. Monday through Friday, except holidays.

For further information, contact LCDR William P. Cummins, Project Manager, telephone (202) 267-1181.∎

Merchant Marine Industry Training

The U.S. Coast Guard celebrates its fortieth year of the Merchant Marine Industry Training Program, which affords the opportunity to select Coast Guard officers in the field of marine safety to work alongside some of the nation's largest companies in the marine industry.

The training program begain in 1948 with Texaco and two precedent Exxon companies. The program has graduated over 170 officers, including Vice Admiral William F. Rea, now retired, and Vice Admiral Clyde T. Lusk, current Vice Commandant. There are six programs, varying in length: Deep Sea Vessel, 12 months; Offshore Oil Industry, 12 months; American Waterways Operators, 4 months; Shipbuilders Council of America, 6 months; Lake Carriers' Association, 6 months; and a program established this year with the National Association of Passenger Vessel Owners, 4 months.

The training provides experience in the operation and management of the maritime industry. It focuses not only vessel movement and upkeep, but also on the impact of federal, state, and foreign regulatory bodies, and the problems associated with being a profitmaking enterprise. The program gives the Coast Guard officer a greater appreciation of the merchant marine and improves communications between the Coast Guard and industry.∎

L to R: VADM William F. Rea, USCG (ret.); Mr. William R. Cumming, President, Texaco Marine, Inc.; Mr. Wendell W. Dedman, Texaco Marine, Inc.; LT James G. Law, USCG; RADM Joel D. Sipes, USCG.

Now Hear This

Prolonged exposure to high noise levels causes hearing loss. That's a proven fact! Anyone who tells you differently doesn't have the facts.

Everyone prefers a future with sound, so read on.

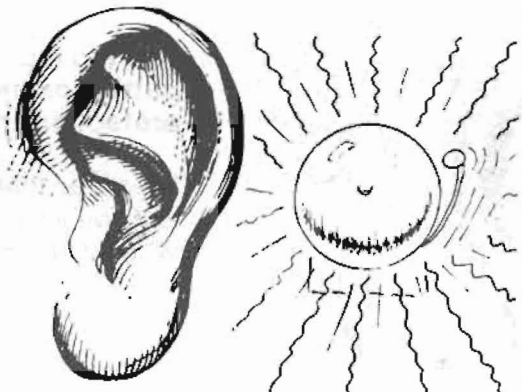
You can protect yourself against hearing loss from exposure to high noise levels by using hearing protection devices.

People make a lot of excuses for not wearing hearing protection. Here are some of the more common excuses and our comments:

Reprinted from
The Chevron Shipping
Company's *Safety Bulletin*,
January 1989 issue.

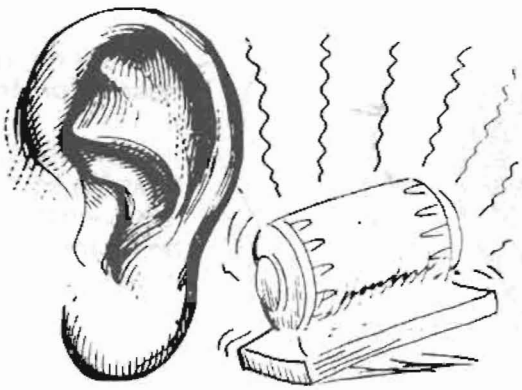
"My hearing's already bad."

Then, don't allow it to get worse! Permanent damage can't be corrected, but further damage can be prevented.



"I can't hear the alarms or bells when I'm wearing hearing protection."

Not correct. Hearing protection cuts down on the distracting noises and alarms are actually easier to hear.



"The hearing protection muffles the sound of the machinery and I can't tell when something's going bad."

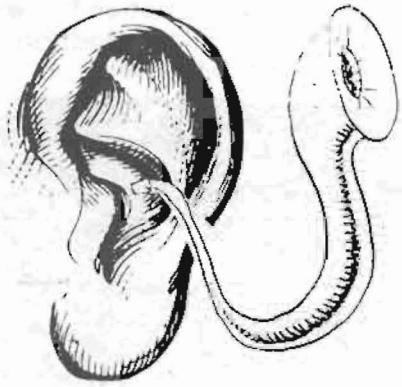
Hearing protection doesn't change the quality of the sound, only the quantity, and you quickly adjust to that. Also, most sound is caused by vibration, and you feel the changes as well as hear them. Hearing protection devices do not affect your ability to feel vibration.

"I have become used to the noise so it doesn't affect me."

This can happen — mainly because you are losing hearing sensitivity and the noise doesn't register anymore.

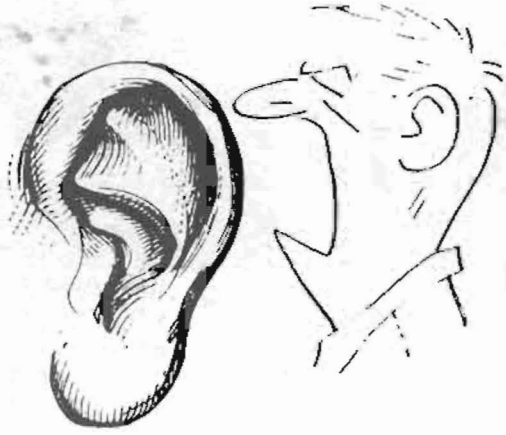
"Hearing protection is uncomfortable after I wear it for awhile."

Then try another type. There are earmuffs, earplugs, and disposable earplugs available on the ships. The only requirement is that the type of hearing protection used must have a specified minimum noise reduction capability. P.S. A cotton wad is not an acceptable earplug.



"It's too much of a bother to keep putting on and taking off hearing protection as you move around."

We agree that there is some bother. But you'll have a lot more bother when your hearing is gone.



"It's not noisy enough to need hearing protection."

If you have to raise your voice to be heard by someone less than an arm's length away, you should both be wearing hearing protection devices.