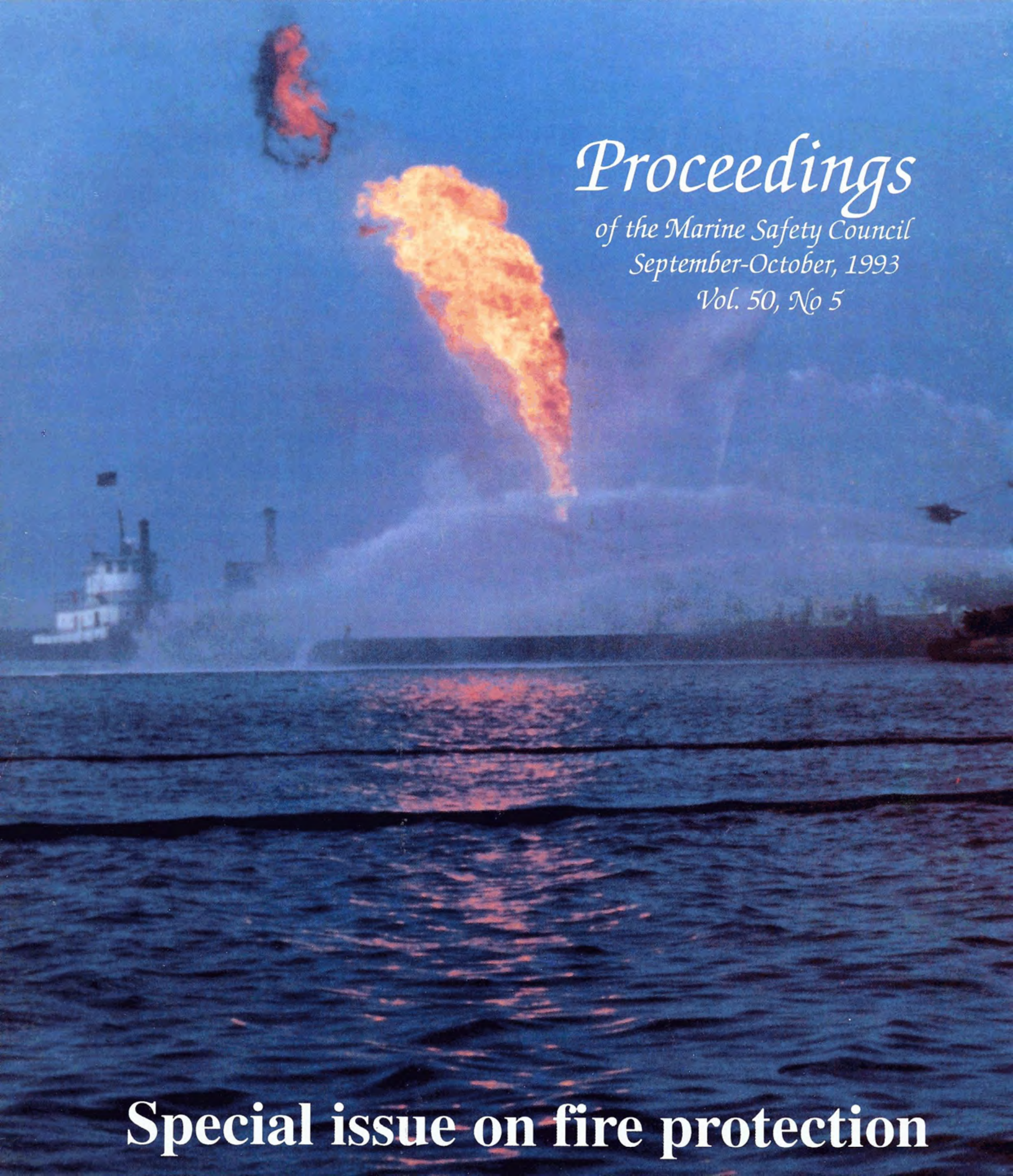
Proceedings

of the Marine Safety Council
September-October, 1993
Vol. 50, No 5



Special issue on fire protection

Proceedings

of the Marine Safety Council

September-October, 1993 *Vol. 50, No 5*

Special issue on fire protection

Proceedings is published bymonthly by the Coast Guard's Office of Marine Safety, Security and Environmental Protection, in the interest of safety at sea under the auspices of the Marine Safety Council. The Secretary of the Office of Transportation has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Special permission for republication, either in whole or in part, except for copyrighted material, is not required, provided credit is given to Proceedings. The views expressed are those of the authors and do not represent official Coast Guard policy. All requests for subscriptions must be in writing, addressed to: Editor, Proceedings Magazine, U.S. Coast Guard (G-MP-4), 2100 Second Street, S.W., Washington, D.C. 20593-0001; (202) 267-1408. Please include mailing label when changing an address.

DIST (SDL No. 131)
A: ac(2); ebfghijklmnopqrsuv(1).
B: nr(50); cefgipw(10); bklqshj(5); xdmou(2);vyz(1).
C: n(4); adek(3); blo(2); cfgijmpqrtuvwxyz(1).
D: ds(5); abcefghijklmnopqrtuvwyz(1).
E: kn(2). F: abcdehjkloqst(1).
List TCG-06.

Fire safety -- a proud history

By RADM A. E. "Gene" Henn

Fire aboard ship has been the greatest fear of sailors throughout history. Despite a limitless water supply, fighting a fire at sea is fraught with difficulty -- limited space to maneuver hoses and other fire-fighting equipment, rapidly spreading smoke filling narrow corridors, and the ever-present danger of being cut off from a safe escape route.

Seasoned sailors have profound respect for the potential power of even a small fire aboard ship. They know that the history books are replete with stories of drama, tragedy, bravery . . . and success in preventing fires at sea. It is the long history of success in fire protection at sea to which this issue of *Proceedings* is dedicated.

The United States Coast Guard has always taken a lead role in promoting fire safety for commercial ships: assuring that ships are built and operated in a safe manner so that people and goods are transported throughout the world without incident. We proudly uphold this tradition in our dealings with industry, technical land-based experts and international counterparts.

Background

We have a long and fruitful history, working with our domestic maritime industry in developing standards for fire safety. The Coast Guard has collaborated with the National Fire Protection Association (NFPA) since the mid-1930s, when we worked hand in hand to develop a standard test for fire resistant bulkheads. This exact same test serves as the world standard today.

In the late 1940s, our joint efforts with the National Institute of Standards and Technology (then the National Bureau of Standards) produced the standard test for noncombustible construction, which became part of our domestic regulations.

The Coast Guard still works closely with these and other organizations, welcoming their members in our delegations to the International Maritime Organization's (IMO's) Subcommittee on Fire Protection.

IMO and SOLAS

The IMO is the world body, solely responsible for establishing international rules for shipping safety and pollution prevention. The work of IMO committees and subcommittees deals with the most important and far reaching maritime issues of our time.

For more than 30 years, the Coast Guard has had a continuous leadership role at the IMO. We have been the key players in developing standards for fire safety in the International Convention for Safety of Life at Sea (SOLAS).

Continued on page 2

Continued from page 1

The United States standard for fire safety was established in 1938, after the passenger ship *Morro Castle* burned at sea, causing 124 fatalities. While the SOLAS conventions of 1929, 1948 and 1960 contained some fire safety requirements, they proved inadequate. In the 1960s, a series of fires aboard foreign passenger ships highlighted the problem. The IMO ultimately developed the 1974 SOLAS convention, which was largely based on United States regulations. In fact this convention surpassed our domestic standards by requiring all ships not only to be built of noncombustible materials, but also to have either detecting systems or automatic sprinklers installed.

SOLAS 1974 came into effect on May 25, 1980. There have been incremental design and construction upgrades to this convention in 1981, 1983, 1988, 1989, 1990, 1991 and, most recently, in 1992. Each of these amendments has served to improve the international standards to a higher level of safety. The 1992 amendments, however, are the most significant changes in the 20th century.

1992 amendments

In 1992, IMO adopted two sets of fire safety amendments to the SOLAS Convention for passenger ships. The first set, adopted in May 1992, applies to all existing passenger ships throughout the world. The other, adopted in December 1992, is applicable to every passenger ship to be built after 1994. The two sets of amendments exist because of real world differences between a ship that is already built and one that is still on the drawing board. For example, some construction features can be incorporated in an existing ship, and others, such as eliminating dead-end corridors, must be in the initial design.

The key requirements of both sets of amendments, nevertheless, are identical. All passenger ships will have to install the latest fire safety features applicable to a modern hotel: sprinkler systems, smoke detectors, improved methods for monitoring and reacting to a fire, and improved means to guide and protect passengers escaping to safety. The fire safety of passenger ships will match that of any hotel room ashore.

Ultimately, all existing ships must meet the latest fire safety requirements for new ships. "Grandfathering" will no longer create an incentive to retain ships built to outdated standards. Monumental construction changes will ultimately put some ships out of business, but will place those that remain on an international par. With the passage of these amendments by IMO, we have now put in place the passenger ship safety capstone.

Universal application

The Coast Guard's future leadership role in fire safety will not be to write more regulations. Rather, it will be to assure that all the regulations are applied throughout the world evenly and fairly.

We remain committed as a port state to expand our control verification examination program to assure compliance with the current standards in the convention. In keeping with our role as the conscience of the world, we will be striving to eliminate ambiguities in the convention so that everyone sings from the same song sheet when applying the requirements.

At the Coast Guard's request, the IMO has set a high priority on dealing with the role of the human element, and will continue to do so for some years to come. And we will be working through the IMO to ensure that the crews charged with responding to fires aboard ship will be properly trained to react most effectively during an emergency. At the same time, we will be supporting the development of maintenance standards for vital fire equipment.

And in our role as protectors of the environment, the Coast Guard will explore new ways to further minimize the risk of fire or explosion aboard tankers. We will work with industry, reviewing operational standards and guidelines, making sure that they are clearly understood by all who must follow them.

Throughout our history, we have been proud proponents of fire safety at sea. We have made marvelous progress in assuring that ships are designed, built and operated in a fire-safety conscious manner. But following every fire on board a ship, we are reminded that fire safety and awareness are paramount to Safety of Life at Sea. We cannot and will not let down our guard.

RADM A. E. "Gene" Henn is the chief of the Office of Marine Safety, Security and Environmental Protection.

Telephone: (202) 267-2200.

Human element . . .

halon . . .

uniformity . . .

are priority topics at IMO session

by Ms. Marjorie Murtagh

The 38th session of the International Maritime Organization's (IMO's) Subcommittee on Fire Protection was conducted in London, England, from June 28 to July 2, 1993. Among the pertinent issues discussed were the roles of the human element, halon alternatives and uniform interpretation of international regulations.

Uniformity

Flag and port states throughout the world can ensure maritime safety only when they are able to apply international regulations in the same clear, precise manner. Chapter II-2 of the Safety of Life at Sea (SOLAS) Convention of 1974 deals with the fire safety of all ship types, including passenger, cargo and tankships. It has been amended several times, yet still con-tains ambiguous language.

Vague expressions, such as regulations should be carried out "to the satisfaction of the administration," may be interpreted in as many different ways as there are different administrations. This does not advance the cause of safety.

The Subcommittee on Fire Protection concurred that the provision of uniform interpretations to such vague requirements in SOLAS Chapter II-2 is urgently needed. One of three working groups will address this issue next year and possibly propose new amendments to the convention.

Unified interpretations of IMO regulations should:

- minimize unsafe conditions due to misinterpretations;
- decrease differences between flag and port state requirements; and
- "level the playing fields" so that all ship owners, operators and builders follow the same requirements.

Fire protection regulations for paint lockers was the topic of one of many discussions concerning the importance of uniform interpretation. A new requirement for all ships was issued under chapter II-2/18.7 on February 1, 1992. It states that "paint lockers and flammable liquid lockers shall be protected by an appropriate fire-extinguishing arrangement approved by the administration."

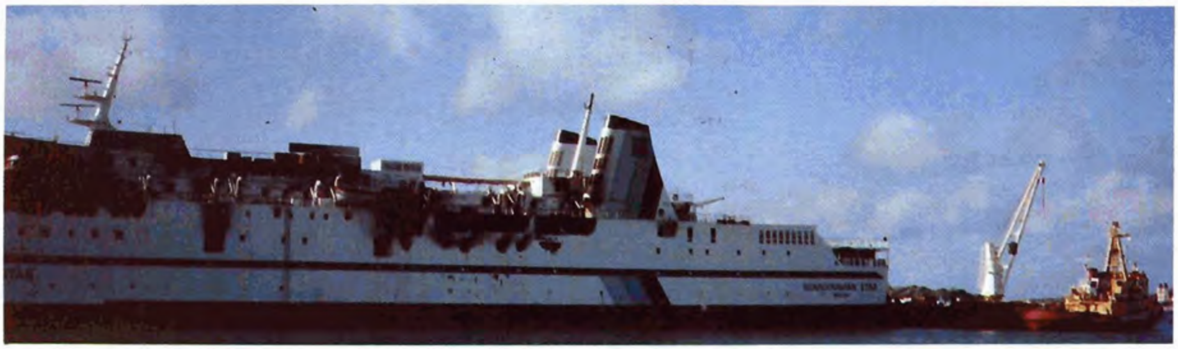
Recognizing that an "appropriate arrangement" was open to various interpretations, a subcommittee working group on fire-fighting systems prepared a draft of a universal interpretation to be discussed at the next subcommittee session in July 1994.

Continued on page 6




FIRE





and aftermath

Damages caused by fire on the passenger ship Scandinavian Star in April 1990.

The cruise ship Angelina Lauro was almost destroyed by a fire, which started in the crew galley on March 30, 1979, while it was docked at St. Thomas in the Caribbean.

Continued from page 3

Human element

A high priority was established by the subcommittee for developing a set of comprehensive operational guidelines for on-board fire protection activities, including the readiness of crews for fire-fighting emergencies and the main tenance of fire-fighting systems. Falling within the role of the human element, this is a critical item for future fire safety of ships. Despite the most careful requirements, there will always be shipboard fires. The reaction of the crews and the condition of their equipment will determine the outcomes.

Pre-boarding training is being deliberated extensively by the Subcommittee on Standards of Training and Watchkeeping. However, the training of crews on each individual ship regarding their maintenance and emergency duties, emergency stations, location of emergency equipment and other vital ship information is the province of the Subcommittee on Fire Protection.

Fire damage on the Angelina Lauro.

As a first step, a working group was assigned to prepare draft guidelines for the maintenance of fire-fighting systems and equipment, fire detection and alarm installations, and fire doors and dampers. This draft will be reviewed by members of industry over the next year and should be a high-priority topic at the 1994 IMO session.

Halon alternative

Because of the threat to the ozone layer, no new installations of halon will be permitted after October 1, 1994. Many ships are operating with existing halon installations, however, and the maritime industry is concerned about the availability of replacement halon or an alternative system when the current supply is exhausted. The Subcommittee on Fire Protection placed a high priority on this issue.

There have been several proposals for alternative water-based systems to replace gas (halon and CO_2) fire-fighting installations. The subcommittee assigned working groups to draft guidelines for the approval of such systems for machinery spaces and cargo pump rooms, and to prepare draft fire-test standards. These guidelines and test procedures will most likely be reviewed by all appropriate parties during next year.

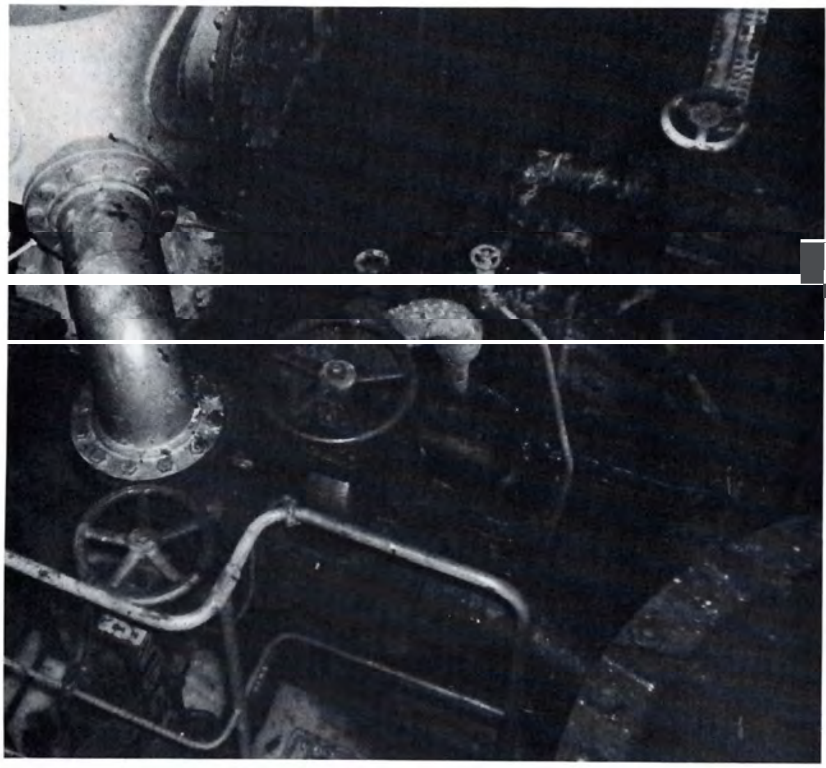
SOLAS working group

The deliberations of these and other issues at the 38th IMO session of the Subcommittee on Fire Protection will be discussed at an upcoming meeting of a United States SOLAS working group to be held at Coast Guard headquarters. The date of this meeting will be announced shortly in the *Federal Register*. All interested parties are invited to participate.

To be placed on the mailing list for this meeting, please contact:

Chairman
United States SOLAS Working
Group on Fire Protection
U.S. Coast Guard Headquarters
2100 Second Street, S.W.
Washington, D.C. 20593-0001

Ms. Marjorie Murtagh is the chairman of the IMO Subcommittee on Fire Protection and the United States SOLAS Working Group on Fire Protection. She is also the chief of the Fire Protection Section, Ship Design Branch, Marine Technical and Hazardous Materials Division.
Telephone: (202) 267-2997.



(Left) At the 2 o'clock position, the small valve is white from heat. This is the source of fuel. (Below) A similar valve shows epoxy bedding at its base, compensating for undersize threads.

Investigation uncovers source of fire aboard tankship *Skaufast*

By CWO2 Raymond J. Kennedy

Scenario

October 2, 1992 — 5 a.m.

The crew aboard the Norwegian tankship *Skaufast* are involved in their assigned tasks while Nigerian crude oil is transferred from the vessel to a shore-side facility in Baton Rouge, Louisiana. In the control room, two of the Filipino crew members and a safety monitor from the facility maintain a constant vigil, particularly over the rate of product flow displayed on the vessel control panel.

In minutes, the worst possible fear will materialize — a crude oil fire aboard a vessel moored at a refinery.

The ship's fire and control board alarms for the #1 pump go off, but the three watchstanders continue their idle conversation with no reaction. In fact, no one on board reacts.

Seconds later, the crew member watching the control panel flips a switch, extinguishing the signal light and silencing the alarm. He remarks, "Don't worry, it's just another false alarm. Excess steam leaking from the hot well sets it off." The rest of the crew aboard the *Skaufast* don't react because they don't know what the alarm means.

Somewhere during crew indoctrinations, the language barrier between Norwegian officers and the Filipino crew was not bridged successfully. On this ship, communication — a vital link in any operation — is critically impaired.

7:20 a.m.

The automatic shut-down for the #1 cargo pump activates. The control board watchstander reaches up to reset the relay, only to be stopped by the facility safety monitor who, this time, insists that someone go the pumproom and check the condition of the pump. A crew member is dispatched, and moments after he enters the pumproom, he races out, announcing that there is smoke coming from the lower deck where the pump is located.

The fire alarm sounds again. This time the ship's officers react and secure power and ventilation to the lower deck space. The chief engineer activates the foam system, directing the discharge to the pumproom. Instead of racing to the pumproom, hundreds of gallons of foam spew onto various decks around the ship from fire station valves left open and from the vent to the foam mixing chamber.

Continued on page 8

Continued from page 7

The *Skaufast* fire-fighting party begins to muster at the same time as volunteer fire fighters from the facility respond. Laying hose from the pier and tying into the shipboard system, the facility personnel hope to get the much needed fire hoses manned and charged.

However, the initial surge of pressure from the shore-side firemain ruptures many of the hoses laid out on deck. These hoses had come from various fire stations aboard the *Skaufast.* The condition of the rest of the fire equipment aboard the vessel is at best questionable, and time is too valuable to waste on setting up equipment which is likely to fail when used. Therefore, the fire party from the facility regroups and lays out its own hoses while the fire fighters get outfitted.

10:00 a.m.

Intense heat prevents the fire parties from entering the pumproom, so they concentrate on keeping all surrounding spaces cooled. The fire is believed to be out, probably smothered by foam and lack of oxygen.

11:00 a.m.

The facility fire team enters the pumproom and finds that the fire is out, but many hot spots still exist. The party cools them and desmokes the space.

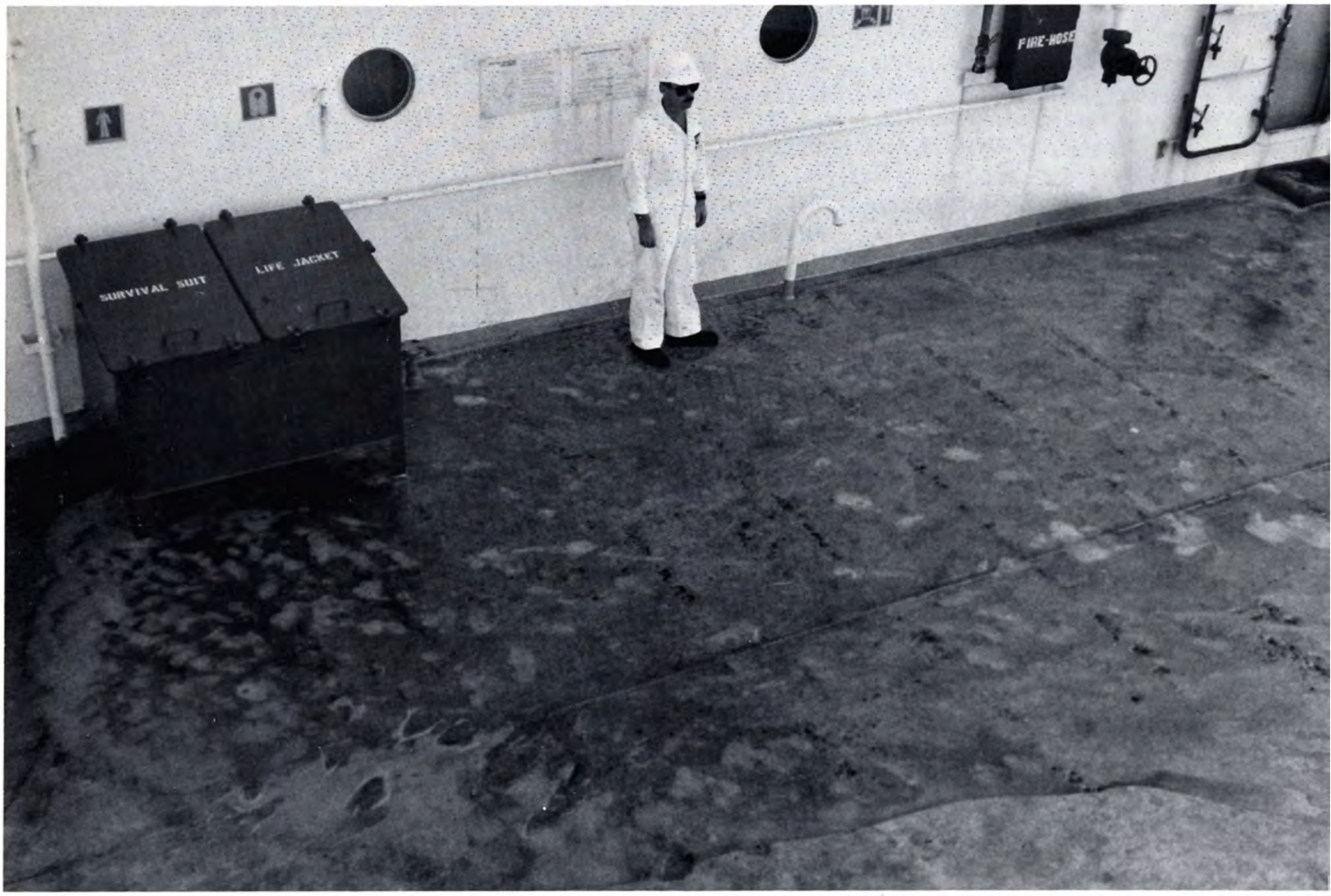
Coast Guard investigators enter the space once oxygen and toxic gas tests determine that it is safe. Oil is splattered onto bulkheads and platforms 20 feet above the #1 cargo pump. Charred, blistered paint points to a valve on top of the transfer pump casing as the hottest part of the fire.

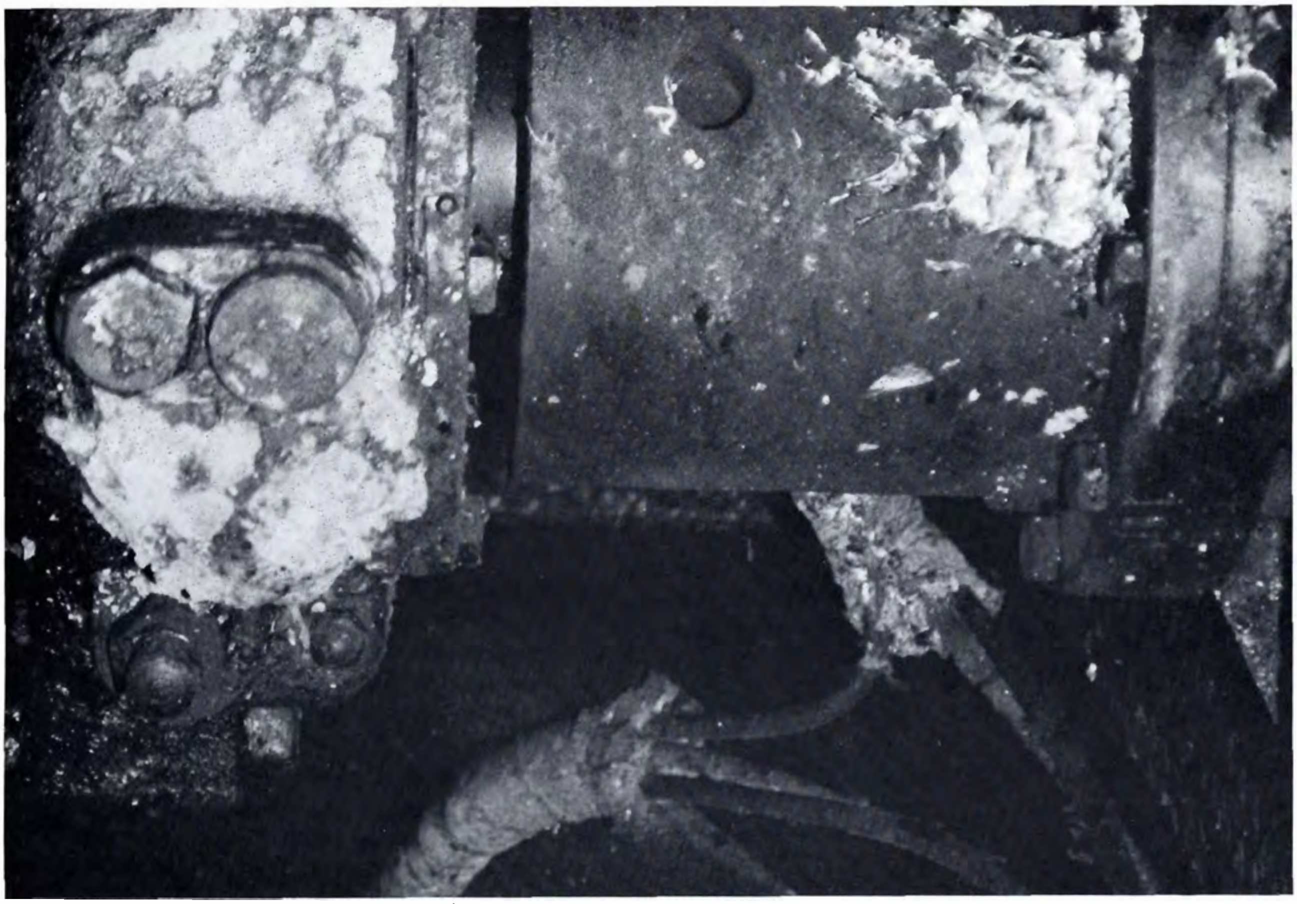
A mysterious fine powdery residue coats the base of the valve where it enters the pump casing. An examination of the area under the pump platform reveals that the foam discharge points were all well below the affected pump, indicating that little foam reached the fire. Most of the foam was lost on the weather decks.

Investigation

The darkness of the interior spaces and the black oily soot coating everything hampers the investigation. It is impossible to stand back and have an overall view of the accident scene.

Much of the foam which should have gone to fight the fire in the pumproom spilled out through vents and fire stations onto the weather decks.





The broken wire (lower right) in the pre-heater circuit provided the heat source for ignition. Pitting caused by electrical arcing is clearly visible on the surface of the exposed wires.

Only the flash from a camera seems to penetrate the darkness. More than 70 photographs were taken from every conceivable angle.

About a week later, the photographs reveal that another identical unaffected pump in the same space had repairs at the bottom of a valve corresponding to the "hotspot valve" on the #1 pump. Epoxy putty had been used as a filler between the valve threads and the pump casing.

The flash exposure had provided a good overall view of the affected pump, pointing to the fuel source or hot spot of the fire. Only one of the 70 photographs taken revealed the source of ignition. Illumination from the flash exposed a broken wire in a preheater coil below the pump casing. The wire had been hidden by the darkness and only luck had included it in the photograph. Pitting on the wire from electrical arcing was clearly visible.

The photographs were given to the chief arson investigators for New Orleans, who quickly confirmed the Coast Guard investigator's theory. The base of the valve on the #1 pump casing had received repairs similar to those of the unaffected pump. As the pump casing was warmed by the flow of the preheated oil, a small leak developed at the base of the valve. Under pressure from the pump, an oily mist sprayed from this base.

The oil collected and dripped down onto the spinning pump shaft, slinging leakage throughout the compartment. Slowly a concentration of explosive vapors grew in the space, allowing an arc of electricity from the preheater coil to ignite the mist. When this happened, the flames followed a course back to the fuel source — the base of the valve.

It appeared that the fire was extinguished only because all available oxygen in the space had been used up. Had the ventilation to the pumproom not been secured when it was, it is unlikely that the fire would have been contained.

Continued on page 10

(Above) Hose fittings are held loosely in place by corroded fasteners. (Below) Hoses are missing fittings.

Continued from page 9

Lessons learned

Fire is probably the most terrifying emergency that occurs aboard ship. Crews train for the day they hope will never arrive with regular shipboard fire-fighting drills. Unfortunately, in spite of efforts by shipboard personnel to maintain an effective fire prevention system, we sometimes become our own worst enemy.

Evidence left by fire does not age well, therefore the early phases of an accident investigation are critical. Weather conditions change, witnesses wander off and the physical aspects of a fire's signature changes. If established procedures are ignored, the problems will be compounded.

Investigators responding to a fire should always take a partner. One person can't see everything and talk to everyone. Get there as soon as possible and take lots of photographs. Talk to everyone you can.

Lines rupture, fittings leak and alarms fail to sound. All of this can be documented by collecting physical evidence, reviewing statements, taking photographs and, if necessary, by consulting with experts in fire investigation.

Tracing the course of a fire is a fairly rudimentary process. There are usually many factors involved. Only on rare occasions do accidents happen as a result of one incident.

To the shipboard personnel dreading fire drills, remember when the chips are down, there is nothing better than a well trained crew. Daily maintenance and housekeeping is an important aspect of fire prevention. The outcome of the fire on the *Skaufast* could have easily been catastrophic. Don't cut corners — do it right the first time. Your life and the lives of others may depend on it.

CWO2 Raymond J. Kennedy is an investigator with MSO New Orleans, Tidewater Building, 1440 Canal St., New Orleans, Louisiana 70112-2711. Telephone: (504) 589-6251.

Not all foam systems are created equal

By LT Hung M. Nguyen

Ocean-going tankships are often prevented from carrying particular cargoes because of their fire-fighting foam systems. A system may be of good quality, but if its ability to extinguish a fire of a certain cargo has not been tested, the vessel would not be authorized to carry that cargo.

Fires

A fire is a self-sustained flaming combustion with four essential components: heat, fuel, oxygen and chemical reaction. When any one of these components is missing, a fire cannot burn.

There are four distinct types of fire:

(1) **class A** (ordinary cellulose materials),
(2) **class B** (flammable or combustible liquids),
  (a) hydrocarbons and
  (b) polar solvents,
(3) **class C** (materials occurring in or originating from live electrical circuits), and
(4) **class D** (certain metals with unique chemical properties).

Fire-fighting foam

A fire extinguisher is effective if it can separate one component from the others. Foam extinguishes flammable or combustible liquid fires by:

(1) **smothering** the fire, preventing air from mixing with flammable vapors;
(2) **suppressing** flammable vapors, preventing their release;
(3) **separating** flames from the fuel surface; and
(4) **cooling** the fuel and adjacent surfaces.

The quality of foam is measured in terms of its drainage time, expansion, fire performance and burn back resistance.

The first fire-fighting foam was known as "chemical foam," and was used to combat coal oil fires. Formed from a chemical reaction, these foams are now obsolete. They were replaced by "air" or "mechanical" foams.

Air foam is made by mechanically mixing air with a foam solution (foam concentrate mixed with water). Surfactants (as in detergents) are the primary components of foam concentrate. A surfactant molecule has an unsymmetrical structure with a hydrophobic (water-fearing) and a hydrophilic (water-loving) part. This unique feature is responsible for the foam's stability and resistance. If a flammable liquid can displace or extract the stabilizing surfactant molecules, the foam will be destroyed.

There is a variety of air foams available: regular (protein), fluoroprotein, aqueous film-forming (AFFF), high expansion and alcohol. They vary in their effectiveness. Regular, fluoroprotein and AFFF (non-polar-solvent) foams are effective on hydrocarbon (non-water-mixing) fuels only. Alcohol (polar-solvent) foams are generally used against fires involving polar (water-mixing) solvents, such as alcohols and ketones.

While polar solvent foams are usually effective on hydrocarbon fires, non-polar solvent foams are **generally** not effective on polar solvents. This is because polar solvents have a high affinity for water and may render non-polar solvent foam ineffective by draining water from it. This should not discourage anyone from testing the effectiveness of non-polar-solvent foams against polar solvents. (The Coast Guard recently approved a non-polar solvent foam for use against a polar solvent: Chubb National Foam XL-3 for methyl tertbutyl ether.)

Regulations

The requirements of a fire-fighting foam system for self-propelled tankships and manned non-self-propelled tankships are outlined in 46 CFR parts 34.20 and 153.460, the IMO's International Codes for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code chapter 11 and BCH Code chapter III.E), and regulation 61 of the IMO's International Convention for the Safety of Life at Sea (SOLAS). Further guidance on foam systems for polar solvents is in Navigation and Vessel Inspection Circular (NVIC) 11-82.

Plan review and approval

Fire protection requirements for various flammable or combustible liquids can be found in table 1 of 46 CFR part 153, IMO's IBC Code chapter 17 and IMO's BCH Code chapter VI.

A requester should first check with the system manufacturer to see if it has been approved by the Coast Guard for the cargo in question. If not, the requester should work with the foam manufacturer to obtain approval from the Survival Systems Branch, Merchant Vessel Inspection and Documentation Division.

LT Hung M. Nguyen is a chemical engineer with the Cargo Division of the Marine Safety Center, 400 7th Street, S.W., Washington, D.C. 20590.
Telephone: (202) 366-6441.

How static charges set fires

By LT Rondal B. Litterell

On February 9, 1993, a fire was reported on fuel barge *TS-85*. At the time, gasoline was being loaded aboard the barge, owned by Mapco Petroleum in Memphis, Tennessee.

The fire started when a tankerman was lifting a flame screen from the ullage to check the level of fuel in the #3 starboard cargo tank. The temperature was around 70 degrees and the relative humidity approximately 60 percent, with no wind. Due to these conditions and the volatility of the gasoline, a high vapor content formed around the opening of the tank.

As the tankerman grabbed the flame screen of the tank, he felt a slight prick on his finger and heard a distinctive snap. The vapors ignited, causing him to dislodge the flame screen from the #3 starboard ullage. The adjacent ullage opening on the #3 port tank also ignited, but a flame screen prevented flames from entering the tank.

What prevented an explosion in the tank without the flame screen was the pressure from the loading operation, which pushed the vapors above the ullage opening, and the fact that the vapors were above flammable limits. Also, the tank was nearly full when the fire started.

Quick action by nearby personnel and handy portable fire extinguishers brought a rapid end to the fire. Both dry chemicals and CO2 were used. CO2 was sprayed directly into the cargo hatch opening of the tank with the dislodged screen, which depleted the oxygen and put out the fire. Dry chemical was used to extinguish flames above the adjacent tank's flame screen. (Closing the hatch cover would have done the same.)

The cause

Initially, it was believed that there was an electrostatic buildup in the fuel being loaded. However, the conductivity of this fuel was 190 picoSiemens/meter, and fuel is considered safe from electrostatic hazards if it has a conductivity of 25 to 50 picoSiemens/meter or higher, which ruled out this as the cause.

It was recalled that just before the fire, the tankerman had noted that a polypropylene mooring line was slack, and he pulled on it, letting it slide between his hands. He then grabbed the flame screen from the ullage of the #3 starboard tank. It was thought that the static buildup on his hands from working with the line created an incendiary discharge spark, igniting the vapors, which were within flammable limits.

A test was conducted to demonstrate the validity of this theory. A worker slid his hands over the same type of mooring line and then reached for a metal chain. Three times, this caused a static discharge.

Static electricity

Chapter 19 of the International Safety Guide for Oil Tankers and Terminals addresses the relation of static electricity to loading and discharging cargo, and tank cleaning operations. Certain activities cause a buildup of electric charges, which may be released with enough energy to ignite flammable hydrocarbon gas/air mixtures.

There are three basic steps leading up to a static hazard: change separation, change accumulation and an elecrostatic discharge. They all must take place to cause ignition. Whenever two different materials

Closing the hatch would have put out the flames much more easily.

come into contact, change separation occurs. The contact may be between two solids and a liquid, or between two nonmixable liquids. These charges can be widely separated by many processes, including:

A) flow of liquids (such as petroleum or mixtures of petroleum and water) through pipes or small filters;

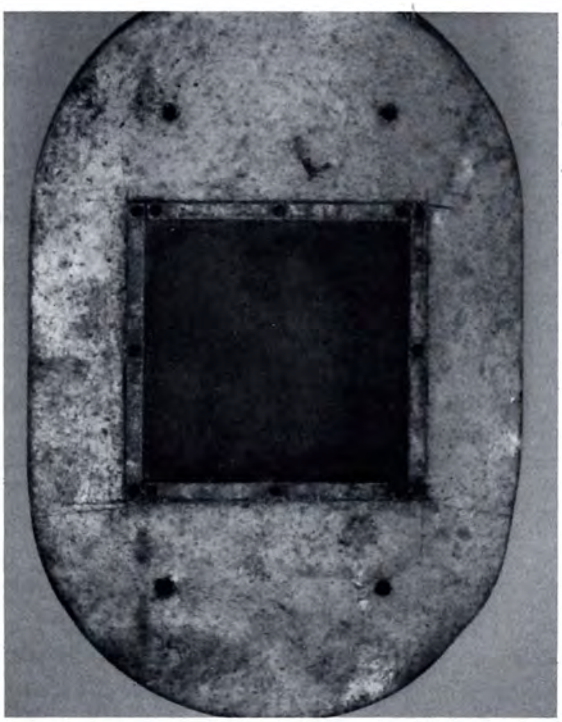
B) splashing or agitation of a liquid against a solid surface (such as washing operations or the initial stages of filling a petroleum tank);

C) settling of a solid or nonmixable liquid in a liquid (such as rust or water in petroleum);

D) ejections of particles or droplets from a nozzle (such as steam operations); and

E) vigorous rubbing together and separation from certain synthetic polymers like polypropylene.

Discoloration on screen came from flames burning above it.



Prevention

The most effective measure to prevent electrostatic hazards is to bond all metal objects together, grounding them. This is done aboard ship by connecting all metal objects to the metal hull, which is naturally grounded through the water.

In the case of barge *TS-85*, the direct grounding of the vessel and equipment did not prevent this hazard. The tankerman's rubber-soled boots insulated him from the barge, allowing a static charge to build up on his hands.

Dire result

The barge fire was minor in that there were no lives lost, injuries or property damage. There have been far worse results of electrostatic charges, particularly those involving empty tanks with high volumes of explosive vapors.

In 1984, a massive explosion occurred in a cargo tank of the *SS American Eagle*. It was caused by an accumulation of electrostatic charges on an ungrounded air mover with a plastic sleeve, which was used while cleaning the tank. When steam was introduced in the tank, a static discharge ignited the hydrocarbon vapors.

The explosion killed three crew members and injured four others. The vessel sank due to major structural damage. It is interesting to note that when the explosion occurred, there was no additional fire involved, according to a survivor.

Conclusion

When people take things for granted, accidents happen. When was the last time you slid across your car seat and reached for the door handle? ZAP - an electrostatic discharge! If there had been hydrocarbon vapors present, you would be a statistic.

Make sure all metal objects aboard ship are grounded - and don't wear rubber soles!

LT Rondal B. Litterell is chief of marine inspections at MSO Memphis, 200 Jefferson Avenue, Memphis, Tennessee 38103-2300.
Telephone: (901) 544-3941.

Halon use limited t

By Mr. Morgan J. Hurley

For years, halons (halogenated hydrocarbons) have been used to extinguish fires on shipboard and on land. They have been popular because of their low toxicity (compared to carbon dioxide), electrical non-conductivity, and non-corrosive qualities. The latter attributes are advantageous around electrical and computer equipment.

Recently, however, it has been determined that halons have a significant detrimental effect on the ozone layer. For this reason, steps have been taken both nationally and internationally to limit their use.

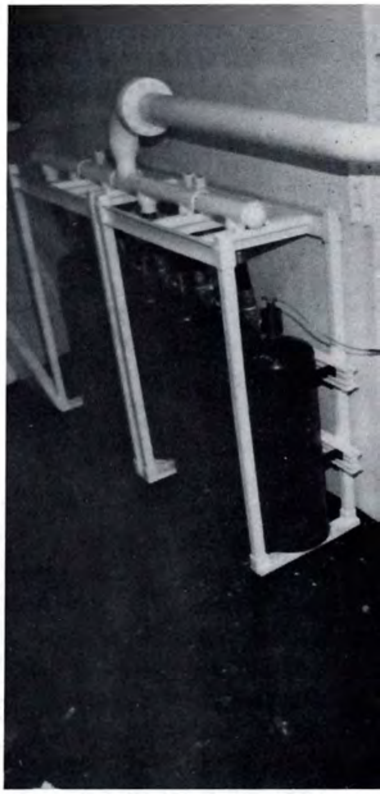
Initiatives

In 1987, representatives of 23 countries including the United States met in Montreal, Canada, to reach an agreement on how to prevent the destruction of the ozone layer by man-made chemicals. They developed the "Montreal Protocol," calling for a 50 percent reduction of ozone-depleting chemical production by 1998.

In November 1992, the Montreal Protocol was revised by the United States and 94 other nations to halt the production of halons by January 1, 1994.

The United States has also taken steps to limit the domestic production of halons and other ozone-depleting chemicals. The Clean Air Act Amendments of 1990 call for stopping the production of halons by the year 2000. In early 1992, President George Bush announced that the United States would phase out the production of many ozone-depleting substances, including halons by December 31, 1995. A proposed rulemaking by the Environmental Protection Agency (EPA) would accelerate this deadline to coincide with that of the Montreal Protocol.

The parties to the Montreal Protocol determined that before any new halon systems could be installed, it must be demonstrated that they are essential for adequate fire protection. At the 37th session of the Subcommittee on Fire Protection of the IMO, members could not identify any situations where the use of halon would be essential. Subsequently, the IMO Maritime Safety Committee passed an amendment to the International Convention for the Safety of Life at Sea (SOLAS), 1974, stating that new installations of halogenated hydrocarbon systems shall be prohibited on all ships. This amendment will take effect on October 1, 1994.



In the future, the Subcommittee on Fire Protection will consider setting a date for the removal of existing halon extinguishing systems from ships. The group also recognized that commercial conditions would most likely dictate the future of existing systems, because recycled halon from systems that have gone out of service will increase in cost when halon production stops.

Initiative effects

As of now, any ship with a SOLAS certificate may not install a new halon system after October 1, 1994. Existing halon installations on SOLAS vessels are not affected by present regulations. However, these installations may have to be removed at a future date.

Vessels without SOLAS certificates are not prohibited from installing new halon systems, and are not required to remove existing systems. The Coast Guard, however, is considering initiatives to limit or prohibit new systems from being installed aboard United States flag vessels.

protect ozone layer

Alternative systems

Carbon dioxide; high, medium and low expansion foam; and fixed-water spray extinguishing systems are all approved for use aboard ships. They all share some of the benefits of halon, but also have disadvantages. For example, carbon dioxide is noncorrosive, but lethal in extinguishing concentrations.

A typical halon installation

Emerging technologies which are not yet approved for use aboard United States flag ships include water mist systems, inert gas total flooding systems and halon-like substitutes. Water mist systems inject a fine spray of water into a protected space. Inert gas systems operate on the same principle as carbon dioxide, displacing oxygen from protected spaces, thus decreasing its concentration in the air to below combustion levels. Halon-like substitutes inhibit combustion, but do not deplete the ozone layer.

Halon disposition

After halon production ends, the cost of purchasing recycled products will rise, and they also will be taxed in the United States. Also, recycled halon may be difficult to obtain due to limited availability and high demand, particularly by the airlines and the military.

Therefore, two halon banking agencies endorsed by the EPA have started brokering the transfer of halons between former users whose systems are removed and who have excesses, and those in demand of the product. They are the Defense Logistics Agency under the Department of Defense and the Halon Recycling Corporation, a non-profit organization. The latter functions as a clearing house, brokering the sales of halon between buyers and sellers.

Summary

Ever since it was recognized that halons threaten the ozone layer, domestic and international regulatory action has rapidly taken place. The internationally-agreed on date for stopping the production of Halon has moved closer. Also those wishing to maintain existing Halon systems are trying to guarantee a supply after production ceases.

For information on buying or selling recycled halon, contact the EPA's ozone hotline at (800) 296-1996.

Mr. Morgan J. Hurley is an engineer with the Fire Protection Section of the Ship Design Branch. Telephone: (202) 267-2997.

Shipboard fire-fighting plan takes shape in Juneau, Alaska

By LT Scott J. Ferguson and LTJG A. E. Tucci

The Marine Safety Office in Juneau, Alaska, (MSO Juneau) is working to develop a model shipboard fire-fighting program and spread the awareness of its value among the maritime community in southeast Alaska. . . and beyond.

On August 18, 1992, in cooperation with the city of Juneau and Holland America Line Westours, Inc., the MSO conducted a fire-fighting exercise in Juneau harbor aboard the passenger vessel *M. S. Westerdam.* This was the first step in a comprehensive examination and perfection of a final contingency marine fire-fighting plan, expected to be in place by January 1994. This plan could have far-reaching effects way beyond the state of Alaska.

Control verification exams

The Coast Guard performs safety inspections called control verification examinations on foreign passenger vessels operating in United States waters under title 46 U.S.C. 3033. These exams include fire-fighting evaluations based on demonstrations of the vessel's fixed fire-fighting and detection systems, inspection of the structural fire-protection material, and testing the crew's response to a shipboard fire.

Each COTP must maintain a marine fire-fighting contingency plan for dealing with shipboard and waterfront fires within their geographical area of responsibility. (MSO Juneau's area is southeast Alaska.)

Southeast Alaska

During summer months, 20 of the largest cruise ships in the world visit southeast Alaska, making more than 300 port calls. The port areas range in population from 30,000 in Juneau down to 1,000 in Skagway. The Glacier Bay area has less than 500 inhabitants.

The possibility of fire is a major concern in the area which has limited emergency service capabilities. Marine fire fighting is conducted by volunteers under the supervision of a handful of professional fire fighters and emergency medical personnel.

What would happen in the event of a major cruise ship fire in ports with such limited resources as Glacier Bay and Skagway? To come to grips with this awful threat, MSO Juneau decided to first test the "Ports of Southeast Alaska Marine Fire-Fighting Contingency Plan" with the *M. S. Westerdam* exercise.

Approximately 100 people took part in the two-hour, "hands-on," realistic response to a simulated fire on board the *M. S. Westerdam*, a 53,872-gross ton 1,773-passenger vessel. The exercise was designed to encourage unrehearsed spontaneous actions on the part of participating individuals.

The following recommendations were developed from observations of exercise evaluators, including representatives from the Coast Guard, fire department, emergency medical facilities and industry.

Recommendations

A) The "Ports of Southeast Alaska Marine Fire-Fighting Contingency Plan" should be amended to include:

(1) a more detailed communications section including points of contact, notification procedures, radio frequencies, telephone and fax numbers;

(2) a plan for the disposition of a large number of evacuated passengers, including their lodging, meals, medical care, telephone access and transportation;

(3) a plan for the disposition of an "act of God" situation where the vessel master brings a burning ship into southeast Alaska waters or ports unimpeded; and

(4) separate, where appropriate, procedures for cargo ship, fishing vessel and cruise ship fires.

Continued on page 18

Coast Guard Cutter Liberty and a rescue boat stand by to transport personnel to the 800-foot M.S. Westerdam.

Continued from page 17

B) The southeast Alaska fire departments should conduct vessel surveys using a pre-survey guide attached to the National Fire Protection Association, Inc., publication, *"NFPA 1405 - Guide for Land-Based Fire Fighters Who Respond to Marine Vessel Fires."* Special attention should be paid to vessel internal and external communications systems.

Fire fighters should accompany MSO Juneau inspectors on cruise ship examinations to get acquainted with unique ship construction and safety features. They should also receive training in shipboard fire fighting and participate in annual cruise ship fire-fighting exercises.

Blindfolded, as if he was in a smoke-filled compartment, a crew member searches for personnel.

C) Passenger vessels should develop medical response plans to deal with emergencies. The plans should specify the following:

(1) information to provide shoreside medical support facilities that respond to an emergency;

(2) treatment areas for mass casualties;

(3) staging areas for briefing shoreside medical support personnel;

(4) visual identification (special vests, hats or insignias) of on board medical personnel to reduce confusion;

(5) medical tags for patients;

(6) carbon monoxide detection devices (air monitoring instruments) to provide warnings in staging and treatment areas;

(7) means of internal portable communications; and

(8) availability of portable medical supplies for treatment areas. (This equipment should be stored away from the ship's hospital which could become inaccessible in an emergency.)

D) Passenger ships should develop fire contingency plans in addition to fire control plans which would provide for:

(1) internal and external notification requirements;

(2) a communications section with procedures for dedicating emergency radio procedures and external phone capabilities;

(3) internal and external joint command structure;

(4) fire-fighting procedures for sea and in port;

(5) duties of bridge watch officer, vessel fire patrol, fire squads and rescue teams at sea and in port;

(6) drill procedures (specifying frequency and whether they are announced or unannounced);

(7) medical support issues;

(8) shoreside muster procedures for passengers;

(9) search procedures, including master key control, for staterooms and crews' quarters;

(10) shoreside support items, including staging and debriefing areas, identifying clothing for fire-fighting leaders, guides and accountability procedures for all personnel;

(11) public relations issues; and

(12) crew, including hotel and medical staff, training.

E) Local fire departments and passenger vessels should obtain cascade air systems to recharge self-contained breathing apparatus (SCBA) air bottles for fire fighters.

F) The Coast Guard should reevaluate and streamline fire incident notification/communication procedures throughout the area.

Workshop topics

Marine fire-fighting workshops were held in Juneau on March 8 and 9, and May 26, 1993. The attendants included representatives of the Coast Guard, local fire departments, cruise ship industry, local harbormasters and emergency response agencies. They identified nine crucial elements for fire fighting on board cruise ships, ferries or other large commercial vessels in southeast Alaska. They are:

1. **command structure and jurisdiction;**
2. **trained manpower;**
3. **isolated fire logistics;**
4. **interagency communications;**
5. **standardized pre-fire plans;**
6. **accountability for passengers, crew and rescue personnel;**
7. **replenishment of SCBA air, foam and other fire-fighting equipment;**
8. **financial responsibility and legal liability; and**
9. **media and public affairs.**

Command structure and jurisdiction

When fire breaks out on a cruise ship, the master directs the crew's initial response efforts and notifies the Coast Guard and vessel agent, and, if the vessel is in port, the local fire department.

In southeast Alaska, the master retains command of the vessel with responsibility for the overall safety of all aboard even after local fire fighters come on board. Fire-fighting efforts are coordinated jointly by the master, the fire department chief and the Coast Guard COTP, who each maintain individual authority over their own people.

Primary and secondary centers would be established on the vessel with a fall-back command center ashore. Overall jurisdictional relationships would have to be worked out.

Continued on page 20

Continued from page 19

Trained manpower

Among the large cruise ship crews, it is usually only the operations and engineering members who receive extensive fire-fighting training. It is proposed that hotel staff and entertainers receive routine fire-fighting training, focusing on personnel/passenger safety and notification procedures.

Isolated fire logistics

Cruise ships in southeast Alaska normally visit isolated areas where moving fire-fighting personnel and equipment to the scene is a logistics nightmare. First it should be determined what equipment and personnel is needed, and where it would be best to set up a remote command post.

An inventory of available equipment in each port is needed. Mutual aid and purchase order agreements are also necessary for speedy transportation of personnel and equipment to the scene of the fire.

Interagency communications

Interagency communications are frequently frustrated by the different types of radios used by various organizations involved in the same fire fight. Moreover, the Coast Guard and local fire fighters typically use VHF radios, whose signals are often blocked by metal ship bulkheads.

Some cruise ships are equipped with internal UHF radio-repeater systems, which work well for internal communications. However, ships may not have spare radios for shore-based fire fighters.

Predesignated working frequencies should be identified for the following:

- *local fire fighters,*
- *ambulance/medical units,*
- *Coast Guard rescue and evacuation units,*
- *Coast Guard marine safety and fire-fighting personnel,*
- *ship's fire-fighting personnel,*
- *ship's medical personnel,*
- *ships evacuation personnel, and*
- *liaison between bridge and shore-based command post.*

Standardized pre-fire plans

Cruise ship fire-control plans currently do not address action by outside agencies such as the Coast Guard or local fire departments. The cruise companies should develop fire contingency plans to address a catastrophic event when shore-based fire fighters and support personnel would augment the vessel's crew during a fire fight.

Medical contingency plans should also be developed by cruise ship companies. Such plans should consider the capabilities and limitations of local emergency service systems.

Accountability for passengers, crew and rescue personnel

If evacuation is necessary when a vessel is moored at a pier, abandon ship procedures should be followed with passengers and crew mustering ashore. The ship's stewards conduct a room-to-room search for missing individuals. To help in this process, cruise ship companies should maintain accurate sailing lists of all passengers and crew, both on ship and at home offices.

Accounting for all personnel is complicated during an evacuation when passengers are touring or shopping ashore. Often passengers are on their own, not listed on any ship-sponsored tour. It is then the responsibility of the ship's captain to request local radio station assistance to notify passengers of the emergency and direct them to a staging area for accountability. Local shipping agents play a large role in this situation, as well as arranging for hotel accommodations and transportation for evacuated personnel.

Fire fighters and rescue personnel use established departmental methods to account for individuals who enter a burning ship or other dangerous area.

A staging site should be identified at each port of call to collect passengers and to serve as a backup command post. A full evacuation of a large cruise ship may well exceed the capacity of any single building.

Local emergency medical services could be quickly overwhelmed by the large number of casualties expected from a catastrophic fire. In that event, the Alaska Department of Emergency Services, the American Red Cross and the Alaska Army National Guard would be asked to assist.

Coast Guard observer evaluates crew performance rushing injured woman through a hatch.

Replenishment of SCBA air, foam and other fire-fighting equipment

Both compressed air for SCBA equipment and fire-fighting foam are expected to be in short supply during a catastrophic cruise ship or ferry fire fight.

Some cruise ships have low-pressure cascade systems for refilling compressed air tanks and/or carry extra air bottles. Most do not have high-pressure cascade systems to rapidly refill spent air bottles.

Portable systems are needed from shore facilities to support ongoing fire-fighting efforts aboard ship, especially when the vessel's air bottles and/or compressors are damaged or inaccessible. Local fire departments should consider purchasing portable high-pressure cascade systems. Dive shops and salvage operators use compressed air and could provide this kind of support.

Different systems may be incompatible with one another without special adapters. Cruise ship companies should make sure that their SCBA equipment includes the necessary adapters.

Possible sources of foam, including commercial vendors, airports and other vessels, should be researched and incorporated into the plan.

A data base of fire-fighting equipment in southeast Alaska is needed, along with mutual aid agreements between local fire departments. The data base should include non-government sources such as dive shops and salvage operators.

Continued on page 22

Continued from page 21

Financial responsibility and legal liability

Cruise ship companies should be financially responsible for any expenses incurred on their behalf.

Under the Oil Pollution Act of 1990 (OPA 90), the Coast Guard has access to a fund to use in response to actual and potential pollution incidents, such as a large vessel fire.

The Alaska state troopers can issue case numbers to volunteer and local professional emergency services which provide them limited funding as well as liability insurance. Such case numbers are part of the state's search and rescue system.

Media and public affairs

A centralized public affairs office should be set up and all press releases should be published jointly.

Radios and cellular telephones are more or less accessible to the public. When possible, sensitive issues should be discussed on land-line telephones or other secure devices.

The cruise ship company is responsible for responding to queries about passengers. This can be handled easily by setting up an 800 number at the office.

Airport contingency plan methods of dealing with the public during casualties are useful to adopt.

Conclusion

On June 8, 1993, in cooperation with the cities of Douglas and Juneau, and Princess Cruise Lines, another fire-fighting exercise was held on board the passenger vessel, *M. S. Sky Princess*. These exercises and workshops turned out to be excellent training. They also provided extremely useful material and a forum for improving the region's contingency plan to better deal with a major cruise ship fire in southeast Alaska. Moreover, it may prove beneficial to other ports throughout the United States.

All photos accompanying this article are by PO Erik Kristin Lott, Public Affairs Specialist, 17th Coast Guard District.

LT Scott J. Ferguson, chief of inspections, and LTJG Andy E. Tucci, asssigned to port operations, at MSO Juneau, 2760 Sherwood Lane, Suite 2A, Juneau, Alaska 99801-8545.

Telephone: (907) 463-2450.

A casualty is transported to safety under the direction of a crew member aboard the M. S. Westerdam.

Decreasing machinery space fires

by ENS Pamela Zearfoss

More than one-third of all shipboard fires are caused by failures of flammable equipment, such as fuel, lubricating and hydraulic oil systems, according to casualty reports. Such failures are generally the result of improper installation, maintenance or design of piping systems. Failures are also caused by stress from vibrations and abrasions due to improper use of piping for hand and footholds.

Piping system failures have caused flammable fuel to spray onto hot surfaces and ignite in machinery spaces. Such fires are extremely dangerous because they flow freely and spread rapidly over large areas, often resulting in extensive damage and loss of life.

Jacketing fuel lines

One of the most effective ways to reduce machinery space fires is to jacket high pressure diesel engine fuel piping. Enclosing fuel lines between the cylinder pump and injection nozzles outside the engine provides 100 percent protection from atomized fuel spraying out of failed high pressure lines.

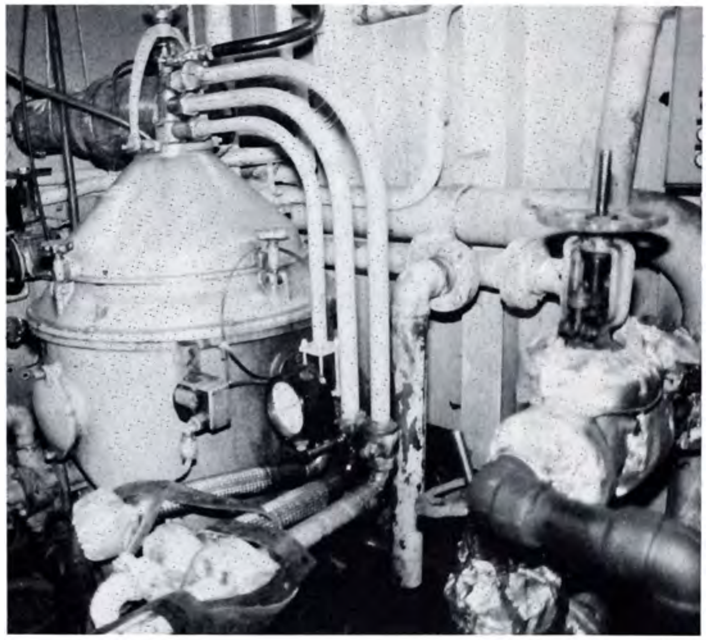
Jacketing entails inserting high pressure fuel pipes in outer pipes, forming a permanent assembly. Each system must have a means to collect leakage accumulating between the inner and outer pipes, and an alarm must be installed to warn of failure. The jacket encloses the leak at its origin, preventing fuel from spreading to hot surfaces.

Shielding connections

Shielding of all flammable piping system connections is another way to minimize the chances of fire. Spray shields are meant to be used around pressurized flange connections to prevent flammable liquids from spraying or leaking onto ignition sources, including engine exhaust manifolds, turbochargers, heat exchangers, switchboards, instrument panels, bench boards and electrical controllers.

Insulating hot surfaces

The risk of fire is also reduced by insulating hot surfaces, including steam piping, heat exchangers, hotwells and other piping components. Besides eliminating ignition sources, insulation also minimizes the chances of skin burns, helps control machinery space temperatures, reduces heat stress and conserves thermal energy.



Spray shields cover flanges in oil centrifuge piping.

The IMO will soon require all surfaces to be insulated if their temperatures exceed 220°C (430°F).

IMO regulations

In April 1992, the IMO approved amendments to Regulation II/2-15 of the 1974 SOLAS Convention to include these safety measures. These amendments will be applicable to existing and new SOLAS ships no later than the year 2000. (A SOLAS ship is any international ocean-going vessel over 500 gross tons flagged in a SOLAS signatory nation.)

IMO is also developing a circular of extensive guidelines for designers, shipyard personnel, vessel operators and maintenance crews to reduce risks of machinery space fires.

When these safety measures are carefully followed by all SOLAS ships, machinery space fires will decrease accordingly.

ENS Pamela Zearfoss is a staff member of the Engineering Branch of the Marine Technical and Hazardous Materials Division.
Telephone: (202) 267-2206.

FIRE on Russian trawler

By ENS Dennis O'Mara

On the morning of October 25, 1992, the Russian trawler/ processor Sotrudnichestvo entered Iliuliuk Bay, Dutch Harbor, Alaska, located on the Aleutian Island chain about 800 miles southwest of Anchorage. The Sotrudnichestvo had been having engine trouble with its propulsion reduced to nearly 50 percent power.

The vessel, which is home ported in Vladivostok, Russia, set anchor between Rocky Point and Spit Head at the entrance to Dutch Harbor, the largest fishing port in the United States. At about noon, Coast Guard personnel from the marine safety detail at Unalaska from MSO Anchorage, overheard a radio conversation between the master of the Sotrudnichestvo and the local harbor master.

The ship's master was reporting a fire on the second deck in the fish processing compartment, and requesting assistance from the local fire department. The fire-fighting capability of the trawler's 77-member crew was extremely limited.

This unplanned visit to Dutch Harbor turned out to be a memorable port call for the crew. Fortunately, a trust fund established by the Oil Pollution Act of 1990 (OPA 90) turned out to be life- and ship-saving.

The Sotrudnichestvo

OPA 90 to the rescue

October 25

The local fire department arrived and began fighting the blaze with one and one-half inch hoses from the tug *Padilla*. The fire source was stored flats of wax-coated boxes in a second deck compartment located directly over the engine room. The approximately 2,700-square-foot compartment, the largest space on the vessel, was reported to be nearly three-fourths full of the blazing boxes.

The fire was believed to be contained in the compartment, but was burning out of control. The local fire chief decided that his resources were insufficient to effectively fight the fire, so he pulled his team out. The ship's crew assumed a fire watch outside the compartment, but did not try to tackle the blaze. The owners of the *Sotrudnichestvo* didn't try to seek outside help to fight the fire.

The trawler was carrying volatile substances and pollutants including 35,280 gallons of diesel fuel, 44,100 gallons of heavy fuel oil and 11,760 gallons of hydraulic oil. The latter was stored in two tanks directly above the inferno. Also on board were 2,940 gallons of ammonia for the refrigeration system.

The oil posed an obvious threat to the environmentally-sensitive area. Fish-breeding streams and bird rookeries surround the port. Several seafood processing plants draw water from the harbor. A large oil spill this close to shore would have catastrophic effects on these economically important facilities. And with memories of the 1989 *Exxon Valdez* oil spill etched deeply in the minds of Alaskans, this threat was not taken lightly.

The possibility of an ammonia leak compounded the seriousness of the situation. The entire port area was endangered, including the inhabitants of Dutch Harbor and the neighboring village of Unalaska. Swift action was imperative.

The Coast Guard cutter *Storis*, underway on an Alaska patrol in the Bering Sea, was diverted to the scene to assist the stricken trawler. Assuming that two fire-fighting teams would have to sustain efforts for up to 24 hours, the *Storis* requested additional equipment: 600 oxygen breathing apparatus (OBA) canisters, ten cans of aqueous film forming foam (AFFF), two P-250 pumps with hoses, a portable generator and a thermal imager. This equipment was obtained by MSO Anchorage and sent to Dutch Harbor by Coast Guard C-130 aircraft. In the early hours of October 26, the *Storis* arrived on scene to assist MSO Anchorage personnel.

Continued on page 26

Continued from page 25

October 26

The fire was still contained in the compartment, but was burning out of control, threatening to spread. Before dispatching a rescue and assistance team to the *Sotrudnichestvo, Storis* personnel went aboard the *F/V Solidarnost*, a sister ship of the stricken trawler, to familiarize themselves with the layout of the ship. This allowed them to develop an effective plan of attack and identify potentially dangerous areas for fire-fighting team members.

Weather conditions worsened, increasing the risk of an oil spill from the *Sotrudnichestvo*. The 40-knot winds and 12-foot waves rocked the vessel. Heavy rain began to fall, typical October weather in the area. The rescue and assistance team from the *Storis* boarded the trawler under these conditions.

The team found the affected space cluttered with fish processing equipment, conveyor belts, refrigeration units, shelving and the burning boxes. There was little room for fire fighters to operate effectively.

Smoke and electrical damage was extensive around the affected space. Refrigeration lines carrying the deadly ammonia passed through the space intact. Smoke had spread throughout the vessel.

The Russian crew had left water on the deck of the compartment which had to be removed by the team from the *Storis* via a bucket brigade. When they began to fight the fire, it reflashed forcing them to evacuate. The compartment was closed and a fire watch posted.

October 27

The following day, the tug *Fidalgo* was loaded with 1,000 feet of containment boom and ordered alongside the *Sotrudnichestvo* in case of an oil discharge. Two other tugs, the *Sea Hawk* and the *Raven* were contacted to ensure their availability for emergency towing if the fire grew out of control or the vessel dragged anchor.

The Coast Guard Captain of the Port (COTP) decided that professional fire fighters were needed to extinguish the fire and minimize the pollution threat. Shortly thereafter, Williams Firefighting in Port Neches, Texas, was contracted to undertake the fire-fighting efforts. Equipment and personnel were quickly flown to Alaska, arriving within 24 hours of contact.

October 31

The professional fire fighters cut several six-inch holes in the overhead of the affected compartment to allow AFFF to be applied. Foam was applied to one or two areas at a time with the space being dewatered as necessary. This process began on the evening of October 31, six full days after the fire was first reported.

The unpredictable Aleutian Islands weather insisted on playing a part in the scenario. Driving winds and pounding seas continued to pummel the vessel. With the *Sotrudnichestvo*'s main engines, bow thruster and rudder inoperative, the vessel began to drag anchor.

The decision to maintain a tug alongside and reserve two others paid off. With the *Raven* and *Sea Hawk* enroute, the *Fidalgo* put a line on the drifting trawler. The *Fidalgo* was only able to hold the ship for a short time until the line parted. The other two tugs arrived just in time to stabilize the *Sotrudnichestvo*. If they had not been standing by, the situation would certainly have deteriorated and led to a major pollution incident.

The application of AFFF continued. A one percent foam solution was released at about 250 gallons a minute. Three foam applications were completed in all with an hour wait between them. The ship's bilge pump was able to pump excess water into the forward ballast tank.

November 3

The compartment was allowed to cool for about 18 hours after the final application of foam. On the morning of November 3, the space was reentered.

To the astonishment of the fire fighters, the fire reflashed, and once again attempts to control it were abandoned. The compartment was secured and foam applied.

November 4 and 5

After the space cooled for another 24 hours, the team went in again. On November 4, the fire continued to smolder. Minor hot spots were reported, but the fire team was able to remove some of the debris. The hot spots were extinguished with water and the rest of the debris was removed by the ship's crew.

Finally, on November 5, 12 days after the fire was first reported, the blaze was completely out.

AFFF containers, foam applicators and blowers litter the well deck of the Sotrudnichestvo.

Fire fighters aboard the Sotrudnichestvo plan their attack.

OPA 90 funds

Section 1012 of the Oil Pollution Act of 1990 (OPA 90) permits the use of the Oil Spill Liability Trust Fund to pay costs incurred in preventing, minimizing or mitigating the threat of a pollution incident. Due to the seriousness of the threat posed by the fire on the *Sotrudnichestvo*, the COTP quickly accessed the fund.

Conclusion

The estimated cost for all the fire-fighting efforts and equipment was $1.1 million. Not a single drop of oil entered the water. No ammonia was released. No wildlife was harmed. There was no adverse effect on local businesses. Most importantly, no fire fighters were injured.

Without access to the trust fund under OPA 90, the outcome probably would have been different.

ENS Dennis O'Mara is assigned to the Marine Safety Division of the 17th Coast Guard District, P.O. Box 25517, Juneau, Alaska 99802-5517. Telephone: (907) 463-2211.

Keep SCBA bottles filled with *cascade air systems*

By Mr. Morgan J. Hurley

At about 2:30 p.m. on April 15, 1993, fire broke out in the crew's galley aboard the cruise ship <u>Regent Sun</u> in the Caribbean Sea. In 30 minutes, the crew was able to extinguish the fire, which had spread to other areas of the vessel. However, all 22 self-contained breathing apparatus (SCBA) bottles were exhausted in the attempt, without any means of filling them on board. Fortunately, there was no further need for the bottles before they could be refilled at a dive shop on a nearby island. (See page 37 for details on this fire.)

Amendments to the International Convention for Safety of Life at Sea (SOLAS), 1974, required an increase in the number of spare SCBA charges for passenger ships. These amendments were passed, in part, because of casualties where the quantity of spare charges was not enough for continued fire fighting.

Leakage rate

Current regulations and recommended practices governing SCBA design do not stipulate a maximum permissible leakage rate from SCBA bottles when not in use. Thus, it would be possible for a stored SCBA bottle, which fully complies with applicable design standards, to have leaked badly and be nearly empty when needed. This is recognized by manufacturers and standards which recommend SCBA bottle pressure inspection at least weekly.

For a vessel at sea, it would be impossible to top-off SCBA bottles which have leaked, unless the ship has a means of refilling them, such as the cascade air system.

Cascade air system

Used for years by land-based fire departments and dive shops as a cheap, convenient means of filling low or empty SCBA and SCUBA (self-contained underwater breathing apparatus) bottles, the cascade air refill system usually consists of the following:

- **a bank of three to six storage cylinders of compressed breathing air,**
- **a pressure regulator set to the service pressure of the bottle to be filled, and**
- **a flexible fill hose equipped with shut-off and pressure-bleeder valves.**

An optional compressor may be included to fill the system storage cylinders. For vessel systems, storage cylinders must comply with 49 CFR 173.34. Connecting tubing and fittings must meet the requirements of 46 CFR part 56. Breathing air for these systems should meet requirements of the Compressed Gas Association commodity specification 6-7.1 for grade D air. Only fresh air should be supplied to compressors.

The refill system operates as follows:

(1) a low or empty SCBA bottle is connected to the fill hose;

(2) the cascade cylinder with the lowest pressure is opened, and the valve in the fill hose is opened until the bottle reaches the same pressure as the open cylinder;

(3) the valve in the fill hose is closed;

(4) the procedure in steps 2 and 3 is repeated with the cylinder with the next lowest pressure, and so on until the bottle is full; and

(5) the pressure in the fill hose is bled off, and the hose removed.

When a cascade air refill system cylinder gets low, it is filled by a compressor or replaced. However, all cylinders may not need to be replaced at once if they contain sufficient air pressure. Cylinders may be filled at shore-based facilities. Several distributors have contract options to transport full cylinders to docked customers and retrieve empty ones.

Maintenance and costs

The systems require very little maintenance, but should be inspected regularly to check for adequate cylinder pressure, especially if there is no compressor. System compressors require factory-recommended maintenance.

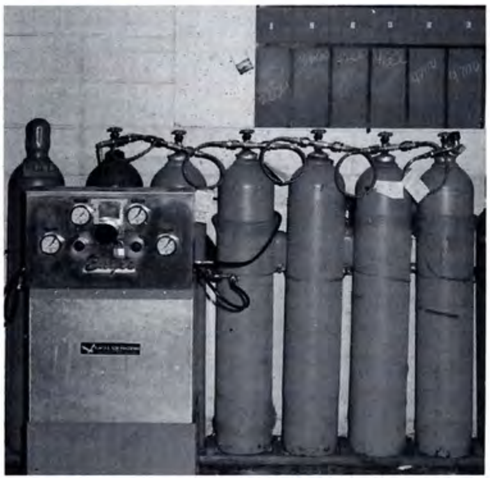
Costs for a cascade air refill system from a typical East Coast distributor (without a compressor) range from $300 to $1000, depending on pressure and the number of cylinders. Typical cylinder refill costs range from $25 to $100, again depending upon system pressure.

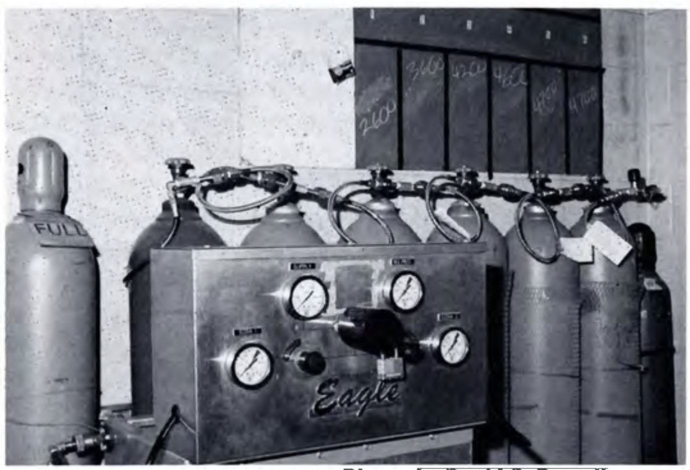
Refill systems with a compressor typically range from $23,000 to $35,000, which includes two storage cylinders, shipping, installation and training. Additional cylinders cost about $2,000 each.

Conclusion

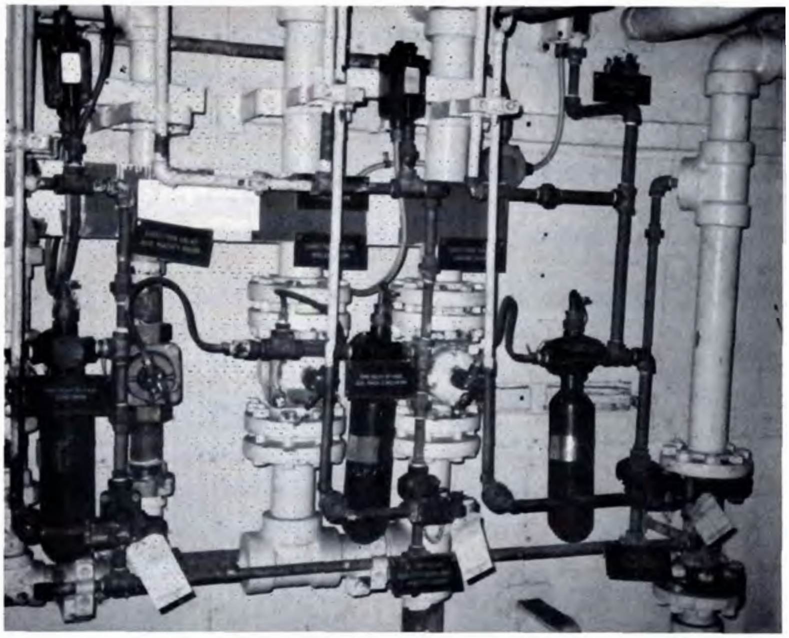
A cascade air system is a safe, economical way to keep SCBA bottles filled, to ensure that there will be enough air in the event of extended fire-fighting operations at sea.

Mr. Morgan J. Hurley is an engineer with the Fire Protection Section of the Ship Design Branch. Telephone: (202) 267-2997.





Cascade air systems *Photos by David S. Purcell.*



Check CO_2 systems

By LCDR Richard Wells and LT Andy Fordham

Fixed fire-fighting systems can extinguish engineering space fires far more effectively than water hoses or portable systems. There are three types of fixed systems: high-pressure CO_2 (carbon dioxide), low-pressure CO_2 and halon. They all put out fires by disrupting the combustion process. The most commonly used is the high-pressure system, which does not require refrigeration as does the low-pressure system, and is not as expensive as halon. (The latter is a suspected ozone depleter and is restricted in use.)

However, the same properties that allow CO_2 to effectively extinguish fires can extinguish human life. When the discharge of CO_2 into a space causes the oxygen level to drop below 12 percent, all occupants will instantly lose consciousness. Without rapid assistance, they will die.

Fixed fire-fighting systems will kill anyone trapped inside a compartment filled with their inert gases. These systems have malfunctions, but there are ways to check them out.

From 1981 to 1991, there were many incidents each year of operating failures and unplanned discharges of fixed fire-fighting systems on both merchant and military vessels. They frequently involved multiple fatalities.

These systems can be safe and reliable with normal care during testing or servicing.

Case study

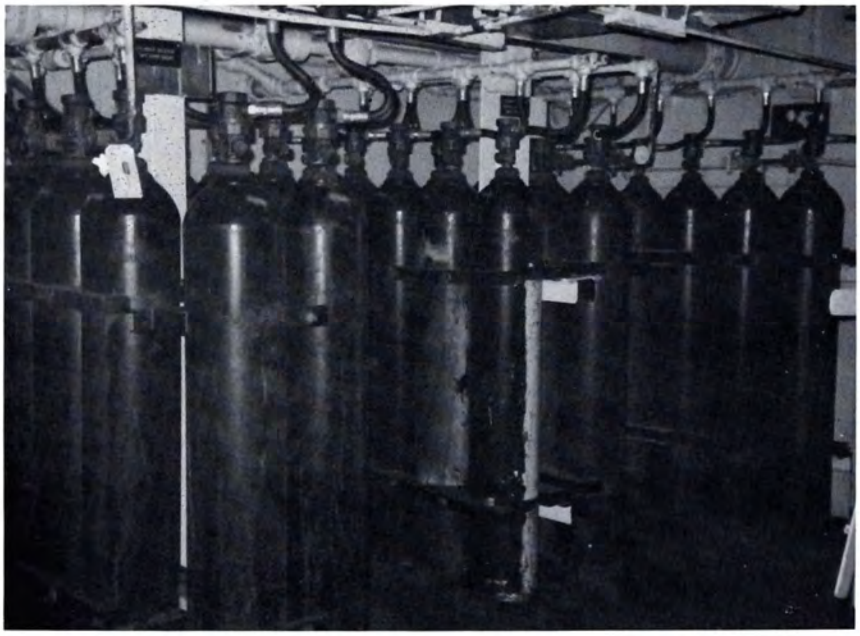
The following case is under investigation by the Coast Guard in New Orleans, Louisiana, and Mobile, Alabama.

3:15 p.m., February 26, 1993

An older tankship was on the Caribbean Sea en route to New Orleans for cargo, when the chief engineer heard a loud bang from the deck beneath his cabin. In an instant he realized that the noise came from the space containing fixed CO_2 fire-fighting system cylinders.

The chief engineer called the master who, in turn, notified the chief mate. The three officers immediately raced to the space, where one glance confirmed their fears. The room was filled with a light fog and the heads of many of the CO_2 cylinders were coated with ice. This was the result of rapid cooling as the carbon dioxide expanded from liquid to gas.

The officers quickly realized that their CO_2 system had accidentally activated. Knowing that the carbon dioxide discharge could have lowered the oxygen levels in the space to fatal levels, they first secured the entrance. The master then donned a self-contained breathing apparatus (SCBA) and entered the space to find out what happened.



Carefully - Frequently

The master discovered that 23 of the 62 cylinders in the system had discharged. The system was designed so that a release of carbon dioxide from one cylinder triggered the release of the 22 other bottles in its bank. Check valves separated these cylinders from two other banks containing the remaining 39 bottles.

The fire-fighting system was designed to protect three spaces: the engine room, which required all 62 bottles; the combined boiler and auxiliary machinery space, which also needed all the cylinders; and the pump room, which used 23 bottles. Only the main stop valve prevented this pressurized gas from being vented into these engineering spaces.

The master feared that the remaining valves could fail at any time. If the check valves isolating the 39 cylinders failed, they would also discharge. This would leave the ship without a vital defense against an engine room fire. On the other hand, if the check valve failed, the CO_2 would flood the engine room, threatening the lives of the watchstanders on duty.

The master then ordered the pump room cleared of all crew members and sealed. He then broke the seal on the directional valve to route the carbon dioxide to the pump room. This relieved the pressure in the fire-fighting system. For safety, the master kept the pump room secured until the ship arrived at port and the space was properly ventilated.

Finally, and just as important, the master sealed the CO_2 room to prevent tampering with the system or other relevant evidence. He also obtained statements from witnesses to the incident.

Second time

Overall, the crew's response to this incident was nearly flawless. This was admirable, though not surprising, in view of the fact that this was the second time in three months that it happened.

Just before Thanksgiving in 1992, the fixed fire-fighting CO_2 system completely discharged in the same ship. This time, an alert watchstander heard gas hissing in the CO_2 room. Shortly after his report, another crew member discovered "fog" leaking from the CO_2 discharge pipes and ice on the discharge heads.

Again, senior officers manually directed the carbon dioxide to the evacuated pump room. In this case, however, when the system was serviced, all 62 bottles were found empty and the stop valve to the engineering spaces was partially open because of grease and trash on its seat and face. Unfortunately, the CO_2 room was NOT sealed and the Coast Guard was NOT notified before the system was serviced. Thus, the cause of the first discharge is not known. However, the reason is believed to be the same as the second.

Continued on page 32

Continued from page 31

Fortunately, due to slow leakage past the partially open valve and alert watchstanding, no injuries or fatalities resulted from these two incidents on the tank ship. However, two people lost their lives the following week when a low-pressure CO_2 system discharged during a Coast Guard inspection of a freight ship in Hampton Roads, Virginia.

Analysis

The actions of the tankship master immediately following the second incident in February demonstrated a proper awareness of relevant safety issues. He first ensured the safety of the crew by preventing anyone from entering the contaminated spaces without a breathing apparatus.

The master then took appropriate action to preserve the remaining fire-fighting capability of the system. He also connected hoses to the ship's foam system for additional fire-fighting protection.

Finally, aware of the danger to crew members if other CO_2 valves should fail, he correctly relieved the pressure on these valves by venting the gases into the evacuated pump room.

A survey of the CO_2 room after this incident revealed poor workmanship, improper installation and defective materials in the cylinder valve heads. There was evidence that 25 percent of the cylinder heads were not completely overhauled after the first discharge in November. Moreover, many of the cylinder heads appeared to have been over tightened, causing damage which could have resulted in leaks.

Marine surveyors and Coast Guard inspectors discovered leaks in 11 of the 39 remaining cylinders. Given time, these leaks could have triggered the release of the other two banks of cylinders.

Prevention

There are multiple levels of oversight to prevent poor workmanship from going unnoticed. They include:

1- manufacturers only permitting vendors with properly trained and equipped personnel to work on their systems;

2- manufacturers providing detailed procedures and mandates that only approved replacement parts be used in servicing;

3- servicing companies providing reports to ship masters and Coast Guard inspectors of findings and recommendations after servicing CO_2 systems;

4- Coast Guard inspectors observing testing of time delays and warning sirens as well as the flexible hose connections and CO_2 bottles during annual vessel exams; and

5- licensed engineers on vessel crews observing and/or spot-checking system servicers during and after their work.

In both incidents on the tankship, one or more of these checks were not conducted properly. Since the inspection seals on the heads and valves of the failed cylinders were intact, the discharge was not the result of crew tampering. It was only after the incident, when the cylinder heads were taken apart that the deficient installation and workmanship was discovered.

Also, although some bottles were obviously leaking when the Coast Guard inspectors boarded the tankship in New Orleans, the servicing company or ship's crew had failed to notice anything amiss. It is likely that the bottles did not start leaking immediately after servicing. The delayed or increased leaking after installation would explain the fact that it went unnoticed until months later.

Questions to answer

When was the last time you were in your ship's CO_2 room?

Do you know where the control valves are for each part of your CO_2 system?

Do your watchstanders check your CO_2 room regularly?

Does everyone entering the CO_2 room know the hazards of carbon dioxide and the location of SCBA's?

Do all persons always latch the door to the CO_2 room at a fully open position while inside?

Do you want to be an accident statistic or safety aware?

LCDR Richard Wells is the senior investigating officer at MSO Mobile, 150 North Royal Street, Mobile, Alabama 36652.

Telephone: (205) 441-5207.

LT Andy Fordham is a marine investigator at MSO New Orleans, Tidewater Building, 1440 Canal Street, New Orleans, Louisiana 70112.

Telephone: (504) 589-6251-2711.

Photo courtesy of Factory Mutual Engineering Corp. (Copyright 1993)

Automatic sprinklers *afford excellent fire protection*

By Mr. Matthew T. Gustafson

"There's a fire in the storeroom on the third deck!"

Words like this strike fear into all aboard. Once fire has broken out, however, the most effective means of averting a major casualty is an automatic system that will detect, then control or extinguish the fire.

Automatic sprinkler systems fill this bill.

Continued on page 34

This fire-damaged passenger ship lounge was fitted with heat detectors, but no automatic sprinklers.

Continued from page 33

Background

Fire sprinkler systems have been an important feature of marine safety for decades. Early systems were often open head deluge or "drencher" types used to protect ammunition magazines, vehicle storage decks or special hazards with high fire risks.

A typical early system consisted of an empty piping network fitted with open sprinkler heads. A manually-operated valve or heat-actuated pneumatic sensor admitted water into the piping network.

Modern systems

The piping for modern automatic sprinklers is constantly filled with pressurized water. The sprinkler heads are normally closed and open individually in the event of a fire underneath. Each head has an orifice capped by a small disc which holds back water pressure. The disc is held in place by a glass bulb or fusible solder element that is released when a certain high temperature is reached. Modern quick response sprinkler heads are designed to provide immediate fire control and prevent temperatures in the area of the fire from becoming dangerously high.

Typically, sprinkler heads are positioned 12 feet apart and flow from 20 to 30 gallons per minute (gpm) when activated. In that the heads are only activated when directly over a fire, there is a significant reduction in water damage and free surface runoff. To illustrate this point, a fire located between two sprinkler heads may actuate both, which together would flow about 50 gpm. This is a lot less than that of a fire party, which typically flows 100 to 200 gpm per hose team.

Most importantly, sprinklers perform virtually all of the fire fighting automatically. This controls the fire and minimizes the dangers of fire and smoke exposure.

Marine sprinkler systems are normally filled with fresh water in pressurized tanks. When a fire occurs and one or more sprinkler heads open, water is expelled from the tank. If the tank pressure should drop to a preset level, a dedicated sprinkler pump turns on and pressurizes the system with sea water. As a back up, pumps supplying fire mains can be manually connected to the sprinkler system.

Flow sensors are fitted in each sprinkler zone and send an alarm when water moves in the piping. Sensors detecting abnormal conditions in the system also emit signals. All alarms and signals are transmitted to the bridge to alert the ships crew to either a fire as indicated by a water-flow alarm or an abnormal condition.

Water flow signals are very reliable fire alarms. They enable sprinkler systems to serve as fire detectors.

Modern conditions

Years ago, passenger vessels were primarily a means of long distance transportation. Today many of them are designed for leisure activities such as luxury cruises or gambling casinos. These vessels are often fitted with plush furnishings and ornate finishes like those in large hotels, night clubs, lounges and casinos.

These new luxurious surroundings create the potential for a rapidly spreading fire and an accumulation of vast amounts of smoke. Automatic sprinkler systems have proven to be the most effective means of protection under these conditions.

SOLAS requirements

All passenger ships constructed after 1994 will be required to have automatic sprinkler protection under SOLAS. Existing vessels must be retrofitted with sprinklers over a phased period. Older vessels must install sprinklers by 1997 and newer ships have as long as 15 years.

Installation requirements are in SOLAS regulation II-2/12. Sprinkler system requirements for United States flag passenger vessels are in 46 CFR, with updated alternatives provided in NVIC 3-93.

Maintenance and inspection

Automatic sprinklers have an impressive performance record on land, suppressing most fires with four heads or less with minimal fire damage. Performance on board ship has not yet been documented, but with proper design and maintenance, it will most likely mirror that of systems on land.

All fire protection systems require regular maintenance and inspection to ensure readiness. Guidance is found in the National Fire Protection Association's (NFPA) standard #25.

Basic measures include verifying that all valves are secured in the fully open position, that sea suctions are open, and that piping and hydropneumatic tanks are filled and pressurized. Also, make sure that sprinkler heads are not obstructed and sprinkler pump controllers are energized. Conduct operational tests to ensure that sprinkler pumps develop proper running pressure. Water should emanate from test connections, and water flow alarms should be received. Electronic sensors and alarm monitoring equipment should be tested according to NFPA standard #72.

All system tests and impairments should be recorded in a log book, which will bear valuable witness to a vessel's commitment to safety.

Burned finishes and soot along the top of this corridor show what can occur during a fire at sea. The vessel had fire detectors, but no automatic sprinkler system.

Summary

Automatic sprinkler systems provide a safe, highly effective means of fire protection by virtue of their simple and efficient principles of operation and their use of water, the most abundantly available shipboard fire extinguisher. The systems have an excellent performance record in shore facilities and can perform equally well at sea.

Mr. Matthew T. Gustafson is an engineer with the Fire Protection Section of the Marine Technical and Hazardous Materials Division.

Telephone: (202) 267-2997.

New automatic sprinkler standards

By LT Peter Coxon

Modern vessels have become dependent upon automatic sprinkler systems to ensure the safety of passengers and crews. The only regulations governing the design of these systems are contained in 46 CFR 76.25. These regulations set forth very specific construction requirements which do not permit designers to take advantage of new technological advancements that can reduce system cost and weight, while at the same time increase reliability and performance.

To acquire standards with up-to-date technology, the Coast Guard has turned to the time-tested industry standards of the National Fire Protection Code, which is developed and published by the National Fire Protection Association (NFPA).

Recently, the Coast Guard adopted the NFPA 13 Code, *"Installation of Sprinkler Systems,"* through a Navigation and Vessel Inspection Circular (NVIC). This NVIC incorporates most of the provisions of the code, with some modifications reflecting unique shipboard applications. Automatic sprinkler systems can now be custom designed for specific vessels in the most cost-effective manner possible.

The sprinkler systems addressed by the NVIC include:

Wet system

The piping of a wet automatic system is filled with water and pressurized to ensure immediate delivery after a sprinkler head actuates. This system is the most commonly used.

Dry system

The piping of a dry system is filled with pressurized air only. It is activated when a sprinkler head opens and allows air to escape. The reduction in pressure then opens a specially designed valve, which lets water into the system. The problems with this system are that it takes time for the water to reach the fire and the special valve may not operate.

Preaction system

The preaction is similar to a dry system in that its piping is normally empty. A fire detection device such as a smoke or heat detector activates the water supply valve.

Deluge system

The deluge automatic system differs from all other types in that each of its sprinkler heads are open at all times instead of opening individually. (An automatic sprinkler head is sealed with a device that opens at a preset high temperature and sprays water.) The water valve of a deluge system is usually operated with detection devices, similar to those on preaction systems. The deluge type is less popular because of the possibility of greater water damage.

Benefits

The new standards in the NVIC afford benefits, including:

- the use of plastic piping materials in some areas,
- additional flexibility in sprinkler head layout with design choices,
- reduction of water tank, pump and pipe sizes through water supply calculations,
- reduction of minimum sprinkler operating pressure to 10 pounds per square inch (psi),
- the use of different sprinkler head types and sizes, and
- the use of wet, dry, preaction, deluge and combined dry-preaction system types.

There are many potential advantages to be gained by following this NVIC. For now, its use in place of current regulations is, in most cases, voluntary. However, this NVIC must be followed on high-density passenger vessels where effective, reliable automatic sprinkler systems are critical to passenger safety.

LT Peter Coxon is a naval architect and mechanical engineer in the National Fire Protection Policy and Implementation Section of the Ship Design Branch.

Telephone: (202) 267- 2997.

FIRE

in crew's galley

The Regent Sun in New York Harbor. ***Photo courtesy of Regency Cruises.***

By LCDR Randell B. Sharpe

The fire started in a deep fat fryer in the crew's galley at approximately 2:30 p.m. on April 15, 1993, aboard the Regent Sun on the Caribbean Sea. About 700 passengers were cruising the Virgin Islands aboard the Bahamian-flag vessel when this potential disaster occurred. Built in 1964 under the 1960 SOLAS convention's structural fire protection standards, the vessel was constructed with some combustible materials and is fitted with an automatic sprinkler system throughout the accommodation spaces.

The Regent Sun was located about 200 miles east/southeast of Puerto Rico near the island of St. Kitts, when the fryer was left uncovered on the highest power setting in the unoccupied galley after lunch.

Continued on page 38

Crew galley

(Above right) Deep fat fryer.

(Right) Looking forward.

(Below) Behind partition.

Continued from page 37

FIRE

The fire spread very quickly into exhaust vent ducts over the deep fat fryer. Although the intake vent dampers closed on fusible links, the fire had already entered the ducts, spreading up to the #14 fan room. The fire burned through canvas vibration dampening joints connecting the galley exhaust fans to the duct system. The fan room only suffered local damage due to the limited amount of combustible material near the two fan motors.

The fire passed through fan room #8 with only blistered paint on the duct and burned insulation on an adjacent chilled water pipe. There are no vibration dampening joints in this space on the affected duct.

The fire continued up the duct to fan room #4, where the crew's galley exhaust duct merges with that of the main galley. Flames proceeded down the main galley's duct to its exhaust fans in fan room #4. Fortunately, fire dampers at the inlet to these fans were closed and the fire did not burn any further toward the main galley. However, it again spread into the fan room after burning through the canvas vibration dampening joints.

(Bottom left) Back-to-back deep fat fryers.

(Left) Exhaust hood and filter arrangement.

(Bottom right) Galley door and access door open to ducting.

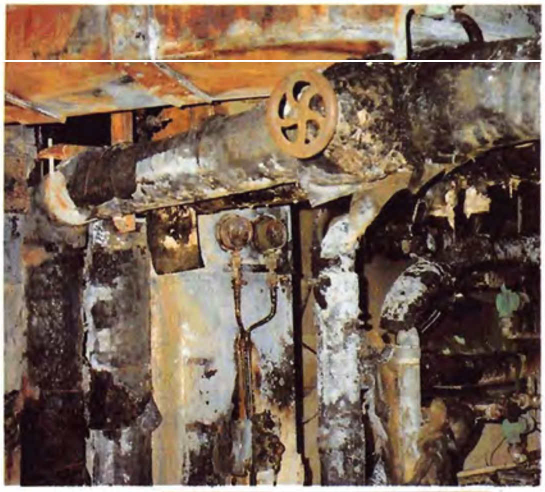
(Below) Galley exhaust duct with access open.

The fan rooms are arranged above one another, serving as a common air intake plenum. Each fan room has large deck grates with fire dampers to convey fresh air to those underneath. These dampers were closed by the A/C engineer when the fire was discovered, preventing its spread from #14 and #4 fan rooms into #8.

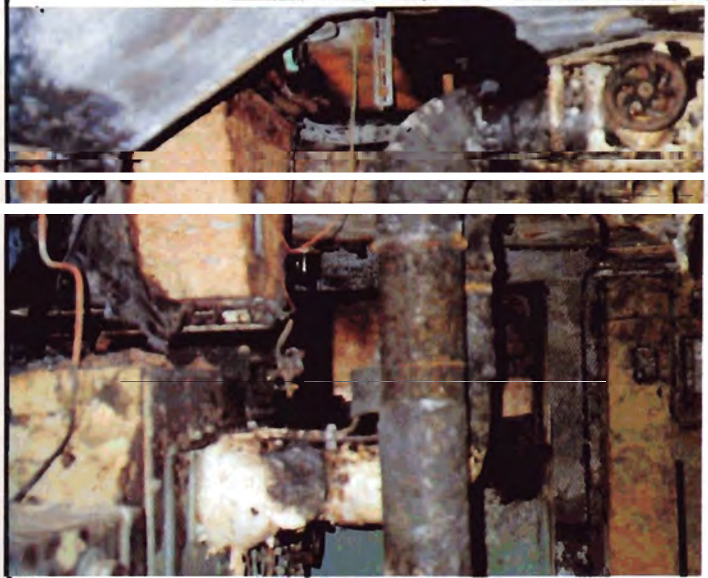
The #4 fan room sustained the most damage. A class A fire broke out on a metal storage shelf containing vent filters that burned very hot. The shelves warped and collapsed, and a duct above also warped. Some wire cable runs were destroyed in this space, affecting other vessel systems.

Continued on page 42

Fan room

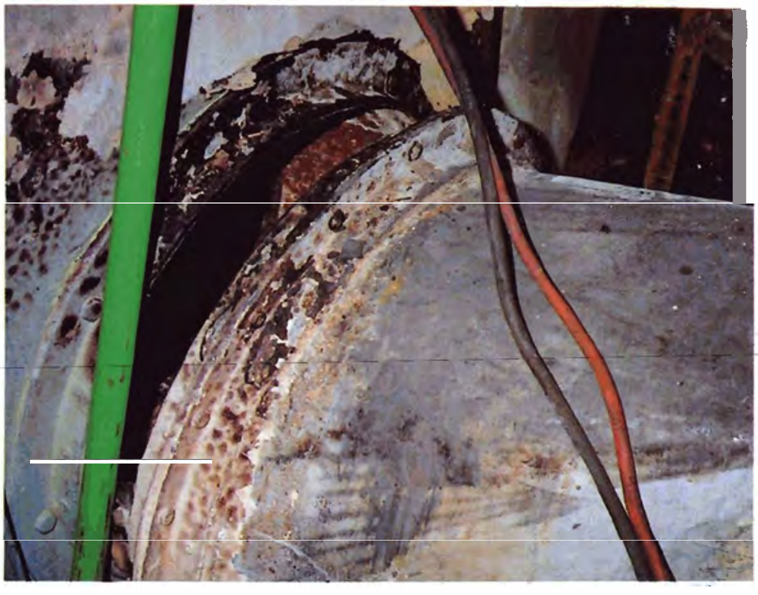


Shelving.



Air conditioning system.

Canvas ducting burnt away.

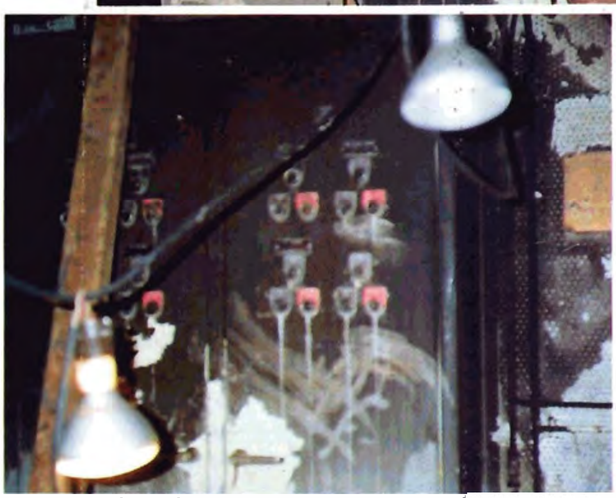


Canvas ducting burnt away.

Supply trunk looking from base of mast down into fan room #4.

4 fire damage

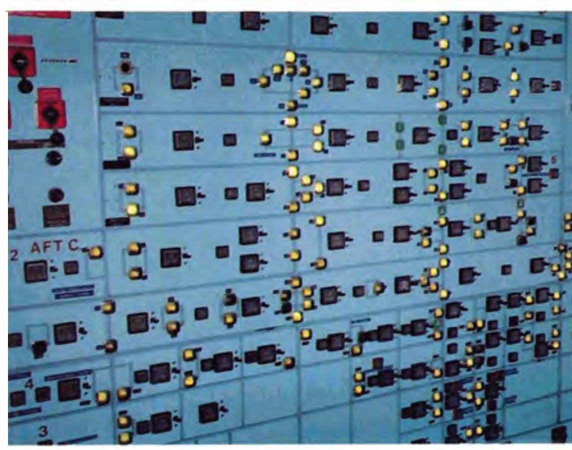
Starboard cable tray.



Forward end.

Fire extinguisher adjacent to braising pans.

Foam fire-fighting system for crew galley lower duct.



Bridge fire door panel. Fault shows all doors closed after fire.

Fan room #14 Damage

Burnt insulation.

Canvas ducting burnt.

Canvas anti-vibration duct burnt away.

Motor and fan impeller removed.

Continued from page 39

Response

The crew's response to the fire was extremely professional. Immediately upon discovery of the fire, two manual alarm call buttons were sounded and the automatic sprinkler system alarm was received on the bridge. The ventilation was secured from the bridge and locally. The power was secured from the engine room and locally. The vent dampers were secured from the engine room after an attempt to secure them locally failed due to smoke in the fan room.

The crew alarm sounded from the bridge and fire parties secured fire doors locally as needed to contain the fire and smoke. Initially, the fire was fought with a nearby semi-portable, 100-pound CO_2 extinguisher, and then with hoses and foam by fire teams.

An installed galley vent foam system was released by the officer in charge of the first fire party. The sprinkler system functioned well in the crew galley, with the four heads around the deep fat fryer setting off and the alarm sounding on the bridge.

(Left) Insulation is removed from deck above #4 fan room.

(Below) Deck above #4 fan room after removal of carpet.

The galley fire was put out in about 15 minutes, with just minor smoke damage to adjacent spaces. However, it had already spread to the vent ducts and on into the two fan rooms.

The crew maintained fire boundaries with lots of water to cool the decks and bulkheads around the two fan rooms. There was only one area where the fire spread into an adjoining space by burning through the carpet in a corridor above the #4 fan room. This was a smoldering fire and was immediately extinguished with continuous cooling from water hoses. (The water collected on the lower deck to about two feet at one point. A bucket brigade removed it successfully with little vessel listing.)

The two fan room fires were fought by hose teams. Water and then foam were injected from the upper bridge into an access in the vent ducts. The fire was under control within 30 minutes. Cooling continued until midnight and reflash watches were maintained until the vessel returned to port in San Juan, Puerto Rico, at 11 p.m. on April 16.

Aftermath

The passengers had been moved into two aft lounges shortly after the fire started. They were kept informed of the fire fighting progress by the hotel staff crew and given a complete report by the ship's master when the emergency was over. There were no passenger or crew injuries from the fire.

The *Regent Sun* exhausted all of its 22 breathing-apparatus air bottles and had no way of recharging the tanks on board. The master of the vessel stopped off at St. Kitts at 8 p.m. and had the tanks recharged by a cascade air system in a dive shop to be prepared for any reflashes.

A joint investigation of the incident was conducted by the Coast Guard, an independent surveyor representing the flag state and a representative of the vessel's owner.

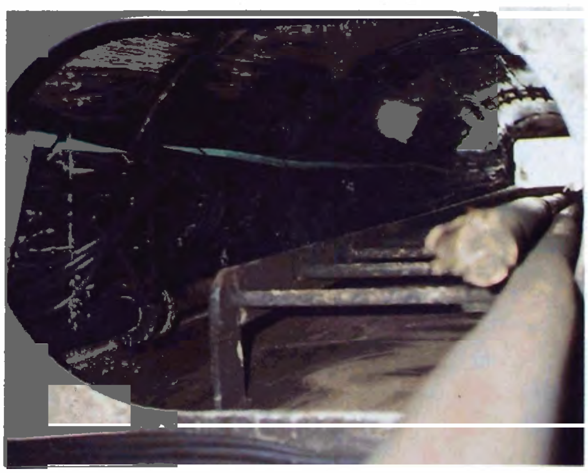
Continued on page 44

Aft end of mast with galley exhausts.
(Below) Internal ladder from base to top of mast.

Continued from page 43

Lessons learned

The quick, professional response of the crew and their knowledge of the vessel's safety systems helped avert more extensive damage. Had crew members been unfamiliar with the ventilation system and not secured the power and dampers, the fire could have easily spread to the main galley and beyond.



The real weak link in the system was the combustible material used for the vibration dampening joints in the ventilation system. This allowed the fire in the vent ducts to cause considerable damage in the two fan rooms in which they were located. The vessel immediately began replacing all canvas vibration dampening joints with non combustible materials.

The 1992 fire safety amendments to SOLAS require all vessels to be retro-fitted with grease traps or other grease-removal systems in galley range exhaust ducts where grease or fat is likely to accumulate. The amendments also require the installation of a permanent extinguishing system. Had these measures been taken aboard the *Regent Sun*, the duct fire would have been far less intense.

It was also determined that the vessel's supply of 22 SCBA air bottles was barely adequate for this relatively short fire, and there was no way to refill the bottles on board. The same 1992 SOLAS amendments require additional SCBA air bottles on board passenger vessels. The *Regent Sun* is presently required to carry eight SCBAs with no set number of spare bottles. By October 1994, the vessel must carry 12 SCBAs plus 24 spare bottles, totaling 36.

However, operators should already carry more than the minimum amount, and should provide the means to quickly recharge bottles on board.

The bottom line in this incident is that the safety systems worked as intended, with the exception of the combustible vibration dampening joints in the ventilation system. Otherwise, the fire was contained in the boundaries of the spaces in which it originated, except for the adjacent fan rooms.

The *Regent Sun* was returned to service once the fire-damaged electrical systems were repaired. It must be noted that additional SCBA bottles were placed on board when it left port.

LCDR Randell B. Sharpe is chief of the inspection department at MSO San Juan, Box 3666, San Juan, Puerto Rico 00902-3666.

Telephone: (809) 729-6800.

New hose standards help prevent fires

By ENS Pamela Zearfoss

Recently a malfunctioning hose was used to refuel a vessel. Gasoline spilled around the hose, and when the motor was started, the vessel exploded.

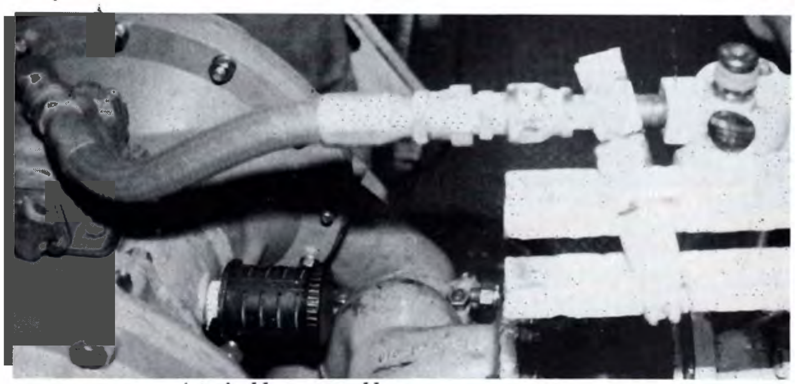
Numerous shipboard fires and explosions have been caused by faulty hoses, often resulting in loss of life.

Standards

Over the years, the Coast Guard has guarded against the use of faulty hoses through developing and enforcing standards and regulations. Recently, the Society of Automotive Engineers (SAE) joined in a cooperative effort to produce a new, more comprehensive set of standards for nonmetallic hoses.

The new standards were adopted by the Coast Guard on August 28, 1991, as SAE J1942, "Hose and hose assemblies for marine applications." They replaced all existing Coast Guard regulations, and eliminated the need for industry to submit test reports and other technical documentation to obtain approval for hoses. This reduces the overall cost, paperwork and staff hours for both government and industry, while providing a better method of ensuring compliance with Coast Guard regulations.

SAE J1942 contains specific construction and performance-level requirements for nonmetallic hoses and hose assemblies installed in piping systems aboard commercial vessels inspected by the Coast Guard. The society maintains a list of hoses which meet these standards.



A typical hose assembly.

Tests

Heading the list of qualification tests required by SAE J1942 are those involving flame resistance and fire.

The requirements for the flame resistance test are the same as those in title 30 of the Code of Federal Regulations part 18.65. The test, which is also mandated by the Mine Safety Health Administration, entails exposing a hose to an open flame for a specified time. The length of burn is measured after the hose is removed from the flame. If the hose is determined to be flame resistant, it is marked, "Flame resistant, UAMSHA No. XXX."

A hose must also pass a fire test in which it is subjected to two and one-half minutes of exposure to flames. Water is then turned on and the hose is pressurized. If a hose leaks during exposure to the fire or when under pressure, it fails the test.

Conclusion

The adoption of SAE J1942 is a good example of the Coast Guard's effort to use industry standards wherever possible in the spirit of the Office of Management and Budget circular 119. The acceptance of industry concensus standards reduces the government's regulatory role and the cost of compliances with the regulations. The end result is a quicker, more efficient response to industry demands.

ENS Pamela Zearfoss is a staff member of the Engineering Branch of the Marine Technical and Hazardous Materials Division.

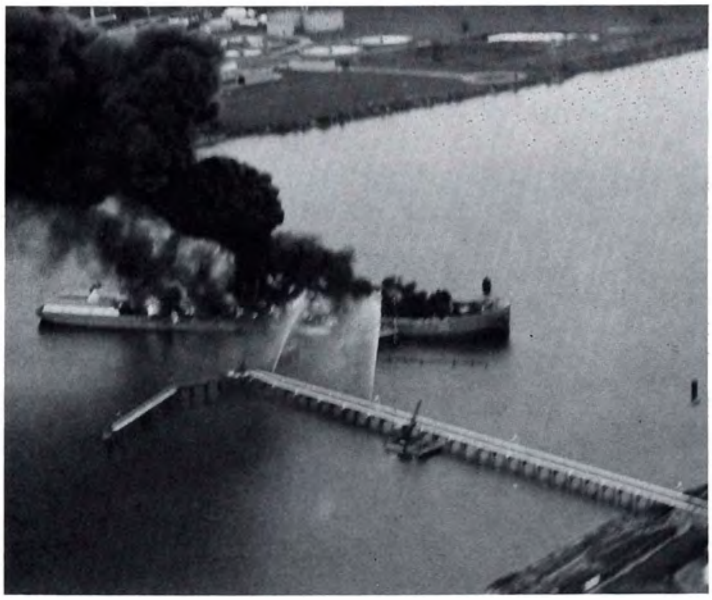
Telephone: (202) 267-2206.

The A B C's

of effective fire control

By Mr. Christopher E. Krusa

On September 16, 1990, the 635-foot bulk carrier Buffalo passed the 392-foot tankship Jupiter on the Saginaw River off Bay City, Michigan. The Jupiter, which was discharging its cargo of unleaded gasoline at the pier, broke away from its berth and its stern swung out into the river, rupturing the discharge hose.



The Jupiter fire.

Gasoline spilled on the pier and onto the deck of the Jupiter. The electrical cables to two motor-operated valves that closed off the pipelines at the end of the pier were torn apart, causing sparks. Fire spread to the deck of the tankship and soon flames engulfed the entire midships area.

The third mate and another seaman ran to the bow telephone to report the fire when an explosion occurred, followed by a loud roar of fire from the burning gasoline. "Let's get out of here," exclaimed the third mate. Without taking time to don lifejackets stowed forward or even to grab a ring buoy hanging in the forward bulwarks, both men jumped overboard.

Tragically, the other seaman drowned, but not without heroic efforts by the third mate to keep him afloat. He was the only fatality of the entire disaster.

Of all the threats to life and property, fire is probably the most dreaded. Unlike some natural phenomena, the ultimate outcome of a fire, particularly aboard ship, is often determined by the crew's reaction immediately after discovery. If appropriate precautions are taken beforehand and the right control methods are used, a fire can often be extinguished with little or no property damage and without any casualties. If not, the situation can become drastic.

To ensure that the response to a shipboard fire is appropriate, a well-rounded training program is required. There is a universal consensus that the primary elements in an effective marine fire-protection program should be:

1) awareness of the causes of fire in ships and preventive measures to take;

2) substantive knowledge of operating and maintenance procedures of the fire-fighting equipment and breathing apparatus aboard ship;

3) experience with live fire situations in a controlled environment; and

4) sufficient skill in the use of fixed and stationary fire-fighting equipment, breathing apparatus, and rescue and first aid equipment.

Shore vs shipboard

Shipboard fire fighting presents unique problems not typically encountered with shore-based fires. First and foremost is the fact that steel is used throughout ships for bulkheads, decks, superstructure, berthing spaces etc. Sizable fires in steel structures are usually very hot, smoky and stubborn, requiring fire-fighting teams to rotate frequently.

Many types of combustibles are found in ship's interior spaces and in most cargoes.

Fire fighting is not the day-to-day work of ship crews. It is an auxiliary duty, which is not pursued with anywhere near the intensity required of shore-based volunteer fire fighters. And a marine fire presents a serious challenge to the most seasoned professional fire fighters.

Ventilation

Another important issue to consider during a fire-fighting operation is ventilation. Limiting the supply of oxygen through ventilation controls the fire, avoiding its spread. The concern is to absolutely avoid a "backdraft" situation. This can occur when temperatures in a compartment reach the superheated stage (1500 to 1800 degrees Fahrenheit), and unburned combustion products cannot be exhausted. If a door is opened for attack, fresh, cool, oxygenated air will enter. Instantaneous combustion may result in an explosion.

The supply of air to the affected compartment should be cut off to reduce oxygen to smother the fire. It may also be appropriate to turn on the exhaust ventilation, thus removing the super-heated gases to the outside via exhaust ducting. However, exhausting the

Fire-fighting students participate in all purpose nozzle team training.

Priorities

When a shipboard fire is discovered, it is imperative that an evaluation be made on scene immediately by responsible crew members. Merchant marine officers and vessel operators must be aware of the fact that controlling and extinguishing live fire involves leadership in more difficult areas than simply mustering the crew and making hose assignments.

A typical protocol for fire management follows these priorities:

1- locate the fire,
2- determine exposures from all sides,
3- direct the first fire team attack,
4- control the fire parties,
5- confine the fire,
6- extinguish the fire, and
7- overhaul the fire.

hot gases may extend the fire to other locations in the vessel, depending on the routing of the exhaust ventilation duct and the ability to control associated exposures. On the other hand, assuming the fire will smother without exhausting the hot gases away, the fire team may be lulled into a false sense of security and be tempted to enter the compartment prematurely.

The decision to turn on exhaust ventilation must be made intelligently. The key to a correct decision is flexibility and preplanning ship-specific techniques for all areas incorporating the location and routing of exhaust ducting.

Fat fryer fires

Fires in deep fat fryers are common, and can be extremely difficult to put out, even for experienced fire fighters. When fog water is applied to a container of deep fat at an ignition temperature of 510 degrees

Continued on page 48

Students apply fog in team training.

Continued from page 47

Fahrenheit, a small explosion is likely to occur, splashing the fat around the galley, thus spreading the fire.

A good technique is to put out the fire with a dry chemical extinguishing agent such as PKP. When the fire is out, a four-foot applicator can be activated and held up high so that light water fog can drift slowly over the container, cooling the fat to below ignition temperature.

Fire severity

The size, intensity, location and type of fire dictates the type of attack. For example, a fire fueled by spilled flammable liquid igniting in a machinery space requires significantly different tactics than a moderate fire in a berthing compartment. In the first instance, AFFF foam should be applied immediately. However, if the fire gets out of control, personnel must evacuate the spaces and the vessel's fixed fire system should be activated at once.

On the other hand, a moderate fire in a berthing compartment could be tackled by a fire party with a hose charged with water, but with the nozzle in the OFF position until the fire is reached. Then the hose is turned on and the fire extinguished. This allows the team to enter the affected space without disturbing the thermal layers of heat and smoke. Visibility is improved, and the risk of injury to fire-team members is minimized. For an inexperienced fire team, the safest approach is a must.

Practical steps

There are many things for a fire fighter to recall when confronted with a shipboard fire. The following list of practical action items should be memorized, practiced and followed:

1. **locate, size-up and determine all exposures;**
2. **establish communications with the fire team and master/operator;**
3. **fix a staging area and obtain gear including breathing apparatus and fire suits;**
4. **team leader and a backup should keep track of fire team personnel entering and leaving the scene;**
5. **cut off fire energy sources, such as electricity and flammable liquids;**
6. **consider carrying hoses uncharged to save energy;**
7. **do not open a compartment door to a fire until an assessment has been conducted; and**
8. **keep low to allow heat and gases to pass over head.**

Fire prevention

History has proven time and time again that the best fire-fighting technique is a well executed prevention program. To be successful, a fire-prevention program must be carefully planned and structured. The details should be tailored to the ship for which the program has been developed. All crew members must accept and internalize fire prevention as a critical part of shipboard life. And it is important that the master/operator and chief engineer set the example.

Students check for reflash.

All shipboard fire-prevention programs should include:

1. **formal and informal training, and drills;**
2. **frequent full-ship inspections;**
3. **preventive maintenance and repair;**
4. **recognition of individual and team efforts; and**
5. **pre-fire planning.**

Training

The *Esso Brussels/Sea Witch* disaster in New York Harbor in June 1973 spurred federal funding for marine fire-fighting training. A formal curriculum, text and hands-on training facilities were funded in the late 1970s. Effective in late 1990, virtually all applicants for merchant marine licenses now must present certificates of completion from a Coast Guard-approved fire-fighting course of instruction. All courses must meet requirements based on the International Maritime Organization's (IMO) resolution A.437 (XI) "Training of Crews in Fire Fighting." This provides a good foundation, but it is not enough.

Fire-fighting skills begin to get rusty after the initial training. Just because the Coast Guard requires only this training, it doesn't mean it should stop there. The best way to maintain fire-fighting skills is to take a full refresher course at an approved hands-on school at least once every five years. This must be backed up with frequent drills and material review while aboard ship. In addition, all seafaring professionals should promote an attitude of fire safety to help nip fire hazards in the bud as they are discovered.

A list of basic and advanced Coast Guard-approved training courses begins on page 56. The Maritime Administration (MARAD) sponsors basic and advanced marine fire-fighting training at its school near Toledo, Ohio, a joint MARAD/Navy fire school at Earle, New Jersey and a Navy fire school at Treasure Island, San Francisco, California. MARAD instructors are available to provide information and guidance from the school in Earle at (908) 938-5190 and the one in Toledo at (419) 259-6362.

A MARAD text entitled, *"Marine Prevention, Fire Fighting and Fire Safety,"* can be purchased through the Government Printing Office for $18. The GPO stock number is #003-007-00099-5.

Conclusion

The effectiveness of marine fire control is primarily dependent on the individuals who operate ships.

Ship's crews must seriously practice and apply their fire knowledge and skill to reduce this risk to such a point that the vessel is fire safe.

The human element continues to be important in limiting and controlling shipboard fires and explosions.

The training photographs accompanying this article were taken by Mr. Michael Romstadt and Mr. Steven Parsons, MARAD fire instructors, Toledo, Ohio.

Mr. Christopher E. Krusa is the marine training specialist with the Maritime Administration, 400 Seventh Street, S.W., Washington, D.C. 20590. Telephone: (202) 366-5755.

Butylamine

Butylamine is an important commercial hydrocarbon derivative with the molecular formula $C_4H_9NH_2$. It is a colorless liquid with a strong fishy, ammonia-like odor. It is used as an intermediate for rubber-processing chemicals and pesticides, in pharmaceuticals, dyes, emulsifying agents, photography and desizing agents for textiles.

The chemical mixes, but does not react with water, but may corrode some metals in the presence of water. Butylamine is incompatible with strong oxidizers and acids, and reaction with either could cause ignition.

It is in reactivity group 7, which is the Coast Guard compatibility class, aliphatic amines. Labeled as a class 3 flammable liquid, butylamine is relatively stable during transport. The IMO/United Nations designation is 3.2/1125, respectively.

Hazards -- physical

Butylamine vapor is poisonous if inhaled or comes in contact with the skin. Inhalation irritates the respiratory system and causes nausea and vomiting. Contact of the liquid with eyes, skin, mouth and stomach brings about severe irritation and burns. Absorption through skin may cause nausea, vomiting and shock.

All exposures require **immediate** medical attention. If swallowed, do **not** induce vomiting. Have the victim rinse the contaminated mouth cavity several times with water. Immediately after rinsing, give the victim an eight-ounce glass of water and no more. Do not permit the victim to drink milk or carbonated beverages.

Flush contaminated eyes and skin gently with plenty of water. Remove all contaminated clothing. If inhaled, get victim to fresh air. Give oxygen if breathing is difficult.

Personnel handling butylamine should wear appropriate clothing, including air-supplied mask, rubber gloves, apron coveralls and chemical goggles or face shield.

Hazards -- environmental

Discharge of butylamine results in fire and health hazards, and possible water pollution. Access into areas where the chemical is contained should be restricted. Accidental discharges should be absorbed with sand or other noncombustible absorbant material, and placed in a covered container for disposal. The chemical may also be covered with sodium bisulfate, and flushed into a sewer with water.

Hazards -- fire

Butylamine is easily ignited by heat, and vapors can explode in an enclosed area. There may be flashbacks along the vapor trail. Toxic nitrogen oxides may form in the combustion.

Containers should be kept cool with water. If a tank car ignites, it should be isolated within a half mile radius.

Fire fighters should wear goggles, self-contained breathing apparatus and rubber outer garments. A small butylamine fire can be put out with dry chemicals and carbon dioxide. Larger fires require alcohol foam. A water spray can "knock down" vapors.

Regulations

Coast Guard bulk shipment regulations are in 46 CFR, subchapter O. Department of Transportation regulations for other modes of transportation are found in 49 CFR, subchapter C. EPA hazardous substances regulations are found in 40 CFR, subchapter D.

Butylamine

Chemical name:	Butylamine
Formula:	$C_4H_9NH_2$
Synonyms:	1-aminobutane, mono-n-butylamine, norvalamine
Description:	Colorless liquid with strong fishy, ammonia-like odor

Physical properties:	
Boiling point:	77.4°C
Freezing point:	-49°C
Vapor pressure:	
20°C:	82 mm Hg
100°F:	1.39 psia
Threshold limit values:	
Time-weighted average:	Ceiling limit, 5 ppm (15 mg/m^3)/skin
Short-term exposure limit:	Unassigned
Flammability limits in air:	
Lower flammability limit:	1.7%
Upper flammability limit:	9.8%
Combustion properties:	
Flashpoint:	10°F (-12°C) (closed cup)
Flashpoint:	30°F (-1.1°C) (open cup)
Autoignition temperature:	594°F (312°C)
Densities:	
Vapor (Air=1):	2.5
Specific gravity at 20°C:	0.74
Identifiers:	
CHRIS code:	BAM
Cargo compatibility group:	7 (Aliphatic amines)
CAS registry number:	109-73-9
U.N. number:	1125
U.N. class:	3, Flammable liquid

Julie Mehta was a first class cadet at the Coast Guard Academy when this article was written as a special chemistry project for LCDR Thomas Chuba.

This article was reviewed by the Hazardous Materials Branch of the Marine Technical and Hazardous Materials Division of the Office of Safety, Security and Environmental Protection.
Telephone: (202) 267-1577.

The following items are examples of questions included in the third assistant engineer through chief engineer examinations and the third mate through master examinations.

ENGINEER

1. When testing for blown fuses in a three-phase motor circuit, you should first ____________

A. apply the voltage tester across the tops of the line fuses

B. apply an ammeter diagonally across the top of the first line fuse and the bottom of the third line fuse

C. apply the voltage tester across the bottoms of the line fuses

D. ensure the circuit is de-energized, and then use a continuity tester

2. A two-element feedwater regulator reacts to changes in the steam drum water level and the_______.

A. steam flow from the boiler

B. main feed pump speed

C. water flow to the boiler

D. signal from the flame scanner

3. What is indicated when the lubricating oil of a diesel engine turns dark after a few hours of use?

A. The oil should be purified.

B. The lubricating quality of the oil has dangerously deteriorated.

C. The oil is functioning normally.

D. Normal engine operating temperatures have been exceeded.

4. In accordance with Coast Guard regulations (46 CFR subchapter J), a circuit breaker in the machinery space and installed in a 440V AC system must__.

A. be dependent upon mechanical cooling to operate within its rating

B. have a long-term delay trip element set above the continuous current rating of the trip element or the circuit breaker frame

C. have an interrupting rating sufficient to interrupt the maximum asymmetrical short-circuit current available at the point of application

D. all of the above

5. A guardian valve in a boiler bottom blow line prevents ____________

A. loss of steam and water from a steaming boiler due to a leaking bottom blow valve

B. leakage from the blow line back to an idle boiler

C. entry of seawater into idle boilers due to leaking skin and bottom blow valves

D. all of the above

6. Steam baffles are used in the steam drum of a water-tube boiler to____________

A. direct the flow of steam to the desuper-heater inlet

B. reduce the possibilities of carry-over

C. prevent water return

D. increase the velocity of the steam and water mixture

7. Which class of fire is one involving electrical equipment?

A. Class A.

B. Class B.

C. Class C.

D. Class D.

8. If there is a sudden drop in the capacity of a reciprocating air compressor, you should check for_ .

A. broken compressor valves

B. worn piston rings or cylinder liners

C. excessive compressor speed

D. a defective pressure switch or pilot valve

9. The most accurate method of setting an inside caliper is to use a/an____________

A. thread micrometer

B. outside micrometer

C. engineer's scale

D. dial indicator

10. Each emergency light on a MODU must be marked with ____________

A. the letter "E"

B. an arrow pointing to the nearest exit

C. a no smoking symbol

D. the word "DANGER"

DECK

1. When preparing to hoist anchor, first_________

A. engage the wildcat
B. put the brake in the off position
C. take off the chain stopper
D. take the riding pawl off the chain

2. Segregation of cargoes refers to_____________

separating cargoes so that one cannot damage the other because of its inherent characteristics
B. separating cargoes by destination
C. classification of cargoes according to their toxicity
D. listing of cargoes in order of flammability

3. The wind circulation around a high pressure center in the northern hemisphere is _______________

A. counterclockwise and moving towards the high
B. counterclockwise and moving outward from the high
C. clockwise and moving towards the high
D. clockwise and moving outward from the high

4. A disk with a horizontal line through its center, equivalent to the summer load line, is called the ___.

A: deadrise mark
B: maximum allowable draft mark
C. plimsol mark
D. tonnage mark

5. A V-shaped ripple with the point of the V pointing upstream in a river indicates a _______________.

A. submerged rock, not dangerous to navigation
B. sunken wreck, not dangerous to navigation
C. towed-under buoy
D. all of the above

6. INTERNATIONAL ONLY -- When two vessels are meeting, a two-blast whistle signal by either vessel indicates _______________

A. "I intend to alter course to port"
B. "I desire to pass starboard to starboard"
C. "I desire to pass port to port"
D. "I am altering course to port"

7. If you hear air escaping from a liferaft just after it has inflated, you should_______________

A. quickly hunt for the hole before the raft deflates
B. check the sea anchor line for a tear if the seas are rough
C. check the painter line attachment for a tear caused by the initial opening
D. not panic since the safety valves allow excess pressure to escape

8. BOTH INTERNATIONAL AND INLAND -- What dayshape must be shown by a vessel 25 meters in length aground during daylight hours?

A. One black ball.
B. Two black balls.
C. Three black balls.
D. Four black balls.

9. When chopping rust on a vessel, the most important piece of safety gear is _______________

A. a hard hat
B. gloves
C. goggles
D. a long sleeve shirt

10. The position accuracy of Loran-C degrades with increasing distance from the transmitting stations as _______________

A: gains are made over the signal path
B: a result of variation in propagation conditions
C. the frequency of the pulses increases
D. the stations shift pulses

ANSWERS

Engineer

1-D, 2-A, 3-C, 4-C, 5-D, 6-B, 7-C, 8-A, 9-B, 10-A.

Deck

1-A, 2-A, 3-D, 4-C, 5-C, 6-D, 7-D, 8-C, 9-C, 10-B.

If you have any questions concerning "Nautical Queries," please contact the Coast Guard (G-MVP-5), 2100 Second Street, S.W., Washington, D.C. 20593-0001.

Telephone: (202) 267-2705.

Notice of renewal

CGD 93-034, Chemical Transportation Advisory Committee renewal (June 9).

The secretary of transportation has approved the renewal of the Chemical Transportation Advisory Committee. The purpose of the committee is to provide expertise on regulatory requirements for promoting safety in the transportation of hazardous materials on vessels and the transfer of these materials between vessels and waterfront activities. The committee shall act solely in an advisory capacity to the Coast Guard.

For further information, contact: CDR Kevin J. Eldridge or Mr. Frank K. Thompson at Coast Guard headquarters (G-MTH-1), 2100 Second St., S.W., Washington, D.C. 20593-0001. Telephone: (202) 267-6227.

Notice

CGD 92-035, Discontinuance of Navy Western Pacific Composite Fleet/General Morse Telegraphy Broadcast (June 21).

The Coast Guard has discontinued the Navy Western Pacific composite fleet/general Morse telegraphy broadcast of NAVAREA XII and meteorological information, designator GCMP, operated from Coast Guard Communication Station Guam in the high frequency radiotelegraphy band, effective June 1, 1993.

For further information, contact: LT Bob Salmon, Telecommunications Management Division (G-TTM), Office of Command Control and Communications, Coast Guard headquarters. Telephone: (202) 267-4106.

Normal office hours are between 7 a.m. and 3:30 p.m., Monday through Friday, except holidays.

Final rule

partial suspension of effectiveness

CGD 91-203, 91-204, 91-222, Navigation underway; tankers; partial suspension of effectiveness (33 CFR part 164) RIN 2115-AE00, AE03, AE12 (July 6).

The Coast Guard is partially suspending the effectiveness of the provisions of the rule governing the use of autopilot equipment in United States navigable waters. The portion affected would have allowed expanded use of autopilots in integrated navigation systems. The provisions are being suspended because of the lack of necessary technology to implement them.

Effective date: July 8, 1993.

Addresses: Comments may be mailed to the executive secretary, Marine Safety Council (G-LRA/3406) (CGD 91-204), Coast Guard headquarters, or may be delivered to room 3406 between 8 a.m. and 3 p.m., Monday through Friday, except for federal holidays. Telephone: (202) 267-1477.

For further information, contact: Ms. Margie G. Hegy, Short Range Aids to Navigation Division (G-NSR-3). Telephone: (202) 267-0415.

Notice

CGD 93-042, Testing of American underpressure oil spill prevention system (July 7).

The Coast Guard seeks comments from the public on the extent, methodology and cost of conducting a full-scale test of the "American underpressure system" to reduce oil spills from tankers. The Coast Guard also specifically seeks indications of potential financial support for such a test from the private and public sectors.

Date: Comments must be received by September 7, 1993.

Addresses: Comments may be mailed to chief, Marine Technical and Hazardous Materials Division (G-MTH), Coast Guard headquarters.

For further information, contact: Mr. Zbigniew J. Karaszewski, technical advisor G-MTH). Telephone: (202) 267-6481.

Local notice to mariners study

CGD 93-033, Local notice to mariners study (July 7)

This notice announces a Coast Guard study on issues relating to the Coast Guard's dissemination of marine navigation safety information through the Local Notice to Mariners (LNM) publication.

Date: Comments must have been received by August 16, 1993.

For further information, contact: Mr. Frank Parker at (202) 267-0358.

Notice of public hearing request for comments

CGD 89-037, Stability design and operational regulations (46 CFR part 170) RIN 2115-AD33 (July 8).

On December 10, 1992, at 57 FR 58406, the Coast Guard indefinitely suspended the effective date of 46 CFR 170.210 in the stability design and operational regulations published on September 11, 1992, at 57 FR 41812. This notice requests specific comments to allow further investigation of the application of, and costs associated with, the performance of the periodic lightweight survey requirements in 46 CFR 170.210.

Dates: Comments must be received by November 5, 1993. A public hearing was scheduled for August 5.

Addresses: Comments should be submitted in writing to the executive secretary, Marine Safety Council (G-LRA/3406) (CGD 89-037), room 3604, Coast Guard headquarters. The comments and materials referenced here will be available for examination and copying in room 3406 between 8 a.m. and 4 p.m., Monday through Friday, except for federal holidays. Telephone: (202) 267-1477.

For further information, contact: Ms. P.S. Carrigan, Marine Technical and Hazardous Materials Division. Telephone: (202) 267-2988.

Notice of proposed rulemaking

CGD 92-061, Federal pilotage requirement for foreign trade vessels (46 CFR part 15) RIN 2115-AE28 (July 9).

The Coast Guard is proposing to require federal pilots for foreign trade vessels navigating at certain offshore marine oil terminals located within the United States navigable waters of the states of California and Hawaii, or while making intra-port transits within certain designated waters of the states of New York and New Jersey, or while transiting certain designated waters of the state of Massachusetts. This action is necessary to ensure that vessels are navigated by competent, qualified individuals, skilled and knowledgable about the area. The Coast Guard believes this requirement will promote navigational safety and reduce the risk of an accident and the discharge of oil or other hazardous substances into these waters.

Date: Comments must be received by September 7, 1993.

Addresses: Comments may be mailed to the executive secretary, Marine Safety Council (G-LRA/3406) (CGD 92-061), Coast Guard headquarters, or may be delivered to room 3406 between 8 a.m. and 3 p.m., Monday through Friday, except for federal holidays. Telephone: (202) 267-1477.

The executive secretary maintains the public docket for this rulemaking. Comments will become part of this docket for this rulemaking, and will be available for inspection or copying at room 3406.

Notice of availability

CGD 91-005, Preliminary regulatory impact analysis for financial responsibility for water pollution (Vessels) (33 CFR parts 130, 131, 132 and 137) RIN 2115-AD76 (July 21).

The Coast Guard has prepared a preliminary regulatory impact analysis which addresses the possible impacts on vessel owners and operators, as well as consequential impacts on the economy, of proposed financial responsibility regulations to implement section 1016 of the Oil Pollution Act of 1990 (OPA 90) and section 108 of the Comprehensive Environmental Response Compensation and Liability Act. The Coast Guard solicits comments on the preliminary analysis.

Date: Comments must be received by September 20, 1993.

Addresses: Comments may be mailed to the executive secretary, Marine Safety Council (G-LRA/3406) (CGD 91-005) Coast Guard headquarters, or may be delivered to room 3406 between 8 a.m. and 3 p.m., Monday tthrough Friday, except for federal holidays. Telephone: (202) 267-1477. Comments may be faxed to the executive secretary at (202) 267-4163).

The executive secretary maintains the public docket for this rulemaking. Comments will become part of this docket for this rulemaking, and will be available for inspection or copying at room 3406.

Copies of the preliminary analysis are available for inspection in room 3406 or may be obtained by contacting Mr. Ernest L. Wordan, economist, National Pollution Funds Center at (703) 235-4793.

For further information, contact: Mr. Ernest Wordan.

Notice

CGD 90-051, Double hull standards for vessels carrying oil in bulk; United States position on international standards for tank vessel design - RIN 2115-AD61 (July 21).

International standards for new and existing tank vessel designs were developed and adopted by the IMO in March 1992. The United States has taken a position with the IMO that the express approval of the

Continued on page 56

Continued from page 55

United States government would be necessary before these international tank vessel design standards will be enforced by the United States. This is due to technical differences with the mandated requirements of OPA 90 and IMO's adopted international tank vessel design standards.

For further information, contact: Mr. Robert M. Guavin, project manager, Merchant Vessel Inspection and Documentation Division (G-MVI-2). Telephone: (202) 267-1181.

Final rule

CGD 92-045, Recreational Boating Safety Equipment Requirements (33 CFR parts 175 and 181, 46 CFR part 160) RIN 2115-AE26 (August 4).

The Coast Guard is changing a number of federal requirements and exemptions for carriage of personal flotation devices on recreational vessels. The designs and uses of recreational vessels and safety equipment have changed since the rules were first issued or last revised, and some of the requirements and exemptions are no longer appropriate. This rule provides the recreational boating public with clearer and more appropriate requirements for carrying personal flotation devices and promotes a safer recreational boating environment. The rule also provides for necessary temporary exemptions from certain personal flotation device carriage, labeling and information pamphlet requirements affected by this rulemaking.

Date: This rule will be effective on September 3, 1993.

Addresses: Unless otherwise indicated, documents in the preamble are available for inspection or copying at the office of the executive secretary, Marine Safety Council (G-LRA/3406), Coast Guard headquarters, room 3406, between 8 a.m. and 3 p.m., Monday through Friday, except for federal holidays. Telephone: (202) 267-1477.

For further information, contact: Mr. Carlton Perry, Auxiliary, Boating and Consumer Affairs Division. Telephone: (202) 267-0979. A copy of this final rule may be obtained by calling the Coast Guard's toll-free boating safety hotline, 1-800-368-5647. In Washington, D.C., call 267-0780.

Advisory committee meetings

TSAC

The Towing Safety Advisory Committee (TSAC) is scheduled to meet Thursday and Friday, November 18 and 19, in room 2415 at Coast Guard headquarters. This committee acts solely in an advisory capacity to the secretary of transportation on matters relating to shallow-draft inland and coastal waterway navigation and towing safety. The meetings are open to the public. For information, contact LCDR Roger Dent (G-MTH) at (202) 267-0178.

NOSAC

The National Offshore Safety Advisory Committee (NOSAC) is scheduled to meet on Wednesday, December 1, in New Orleans, Louisiana. NOSAC advises the commandant on activities directly involved with or in support of the exploration of offshore mineral and energy resources, insofar as they relate to matters within Coast Guard jurisdiction. The meeting is open to the public. For further information, contact, CDR Adan Guerrero (G-MVI) at (202) 267-0178.

Ship Structures Symposium '93

The Coast Guard's Ship Structure Committee (SSC) and the Society of Naval Architects and Marine Engineers (SNAME) will sponsor "Ship Structure Symposium '93" at the Sheraton National Hotel in Arlington, Virginia. The symposium, which is held every three years, should be of interest to all naval architects and marine engineers, whether they be owners, operators, designers, regulators or surveyors. This year, it will cover the overall state of the art for ship structures from the designers prospective, and will be dedicated to Michael Ochi and the late Ned Lewis for their work on statistical loads development.

Among the topics of papers to be presented are state of the art research in hydrodynamic loads, fatigue analysis and design methods, inspection methods, reliability and probabilistic methods. The aspect of the research varies from the work on inspection methods giving a new look at an old craft to the reliability methods opening a whole new realm of design methods. Also, the American Bureau of Shipping will discuss their new Rules 2000.

The costs will be $300 for early registration, $350 for late registration, and $50 to full-time graduate or undergraduate students. Interested persons may contact CDR Stephen E. Sharpe, executive director, Ship Structure Committee, Coast Guard headquarters.

Merchant mariners of the 90s

lean mean FIRE-fighting machines

By Mr. Robert Spears

Imagine, hundreds of miles from a fire station, a structure catches fire. It goes up in flames as it yaws to and fro, rolls left and right, and, at the same time, pitches up and down. A handful of amateur fire fighters try to control the blaze, aware that applying too much water too fast could cause dangerous flooding and stability problems.

This nightmarish scene has occurred too many times aboard ship at sea. Now it is played over and over again for students at maritime schools as part of their marine fire-fighting training. These schools prepare their students to face all sorts of marine disasters with Coast Guard-approved courses.

Consisting of lectures, demonstrations, hands-on exercise and tests, these fire-fighting courses conform with IMO standards as applied by the Coast Guard's Merchant Vessel Personnel Division and the Maritime Administration's Office of Maritime Labor and Training.

Students

The Coast Guard requires all holders of merchant marine licenses demonstrate their knowledge of fire prevention, fighting and safety in written examinations. Also, all licensed engineers, holders of deck licenses for service on vessels over 200 gross tons, ocean-going masters of vessels under 200 gross tons and operators of ocean-going uninspected towing vessels are required to complete Coast Guard-approved training in basic and advanced marine fire fighting.

It is important to note that anyone who can document having satisfactorily completed a Coast Guard-approved fire-fighting training course (basic or combined basic and advanced — not tankerman or barge courses) before December 1, 1989, does not have to attend fire-fighting training again. This is because, at present, fire-fighting training is a one-time only requirement.

Continued on page 58

Continued from page 57

Requirement changes

When new regulations on certification of tankermen are finalized in the near future, it may be necessary for candidates to attend approved training and demonstrate proficiency in fire fighting before receiving their tankerman endorsements.

"Ship on shore" mock up at MARAD's fire training center in Swanton, Ohio.

The Coast Guard also may amend part 12 (certification of unlicensed seamen) to require basic fire-fighting training for all mariners obtaining qualified ratings on their merchant mariner's documents.

United States Navy fire-fighting training courses are being reviewed to determine if they are at least equivalent to Coast Guard-approved model courses. A favorable finding would allow those with appropriate proof of course completion to satisfy the relevant qualification requirements without additional training.

Presently, there is no requirement for periodic recertification or recurrent fire-fighting training.

Necessity for training

With the increase in automation, there will be fewer and fewer able bodies at sea. Smaller crews must be able to fight fires more efficiently than their predecessors. This will come about only through enhanced training.

"Practice makes perfect" is an old, but appropriate adage in the case of fighting fires at sea. Therefore, the best marine fire-fighting schools exceed minimum standards, continually striving to improve their programs.

The dynamic, often hostile, marine environment places extraordinary burdens on novice fire fighters. Those operating in relative isolation are allowed very little tolerance for error. And facing the consequences of inadequate fire responses with no reasonable expectation of rescue or relief is a frightening prospect.

Good mental preparation along with quality hands-on exercises and debriefings can make all the difference between success and failure. Crews should board their vessels with confidence in their abilities based on excellent training, and be convinced of the need to practice their fire-fighting skills to maintain their readiness levels.

Further information on Coast Guard-approved marine fire-fighting training may be obtained by contacting G-MVP-3 at Coast Guard headquarters, 2100 Second Street, S.W., Washington, D.C. 20593-0001. Telephone: (202) 267-0224.

Mr. Robert Spears is an instructional systems specialist with the Personnel Qualifications Branch of the Merchant Vessel Personnel Division.
Telephone: (202) 267-0224.

Facilities with Coast Guard-approved *combined basic and advanced fire-fighting training

Alaska Department of Public Safety
Fire Service Training
P.O. Box 111200
Juneau, AK 99811-1200
(907) 465-3117

Biloxi Marine Training Services
CLASSROOM ONLY
778 Water Street
Biloxi, MS 39530
(601) 436-3110

California Maritime Academy
Vallejo, CA 94590
(707) 648-4200

Delgado Community College
4400 Dauphine Street
New Orleans, LA 73146
(504) 483-4083

Fire/Chuck Kimball
Solano Community College
4000 Suisun Valley Road
Suisun, CA 94585
(707) 864-7000

Firefighting Technical Institute
1600 20th Street
Kenner, LA 70062
(504) 469-9013

Great Lakes Region
MARAD Marine Fire Training Center
2600 Eber Road
Swanton, OH 43558
(419) 259-6362

Houston Marine Training Services
CLASSROOM ONLY
1600 20th Street
Kenner, LA 70062
(504) 558-1733

Louisiana State University
Fireman Training Program
6868 Nicholson
Baton Rouge, LA 70820
(504) 766-0600

Maine Maritime Academy
Castine, ME 04420
(207) 326-4311

Massachusetts Maritime Academy
Buzzards Bay, MA 02532
(508) 759-5761

Miami-Dade Community College
Southeast Florida Academy of Fire Science
11380 NW 27th Avenue
Miami, FL 33167
(305) 237-1360

Military Sealift Command (Atlantic)
Fire-Fighting and Damage-Control School
1029 Highway #33 East
Freehold, NJ 07728
(908) 938-4979

Military Sealift Command (Pacific)
Fire Fighting School
Bldg. 29C, Treasure Island
Oakland, CA 94625-5010
(510) 395-3126

Northeast Maritime, Inc.
105 William Street, 3rd Floor
New Bedford, MA 02740-6218
(800) 767-4025

Pyrotech Fire Fighting School
4201 Fellowship Drive
Mobile, AL 36619
1-800-HOT-SHIP

South Louisiana Vocational Tech. Inst.
201 Saint Charles Street
P.O. Box 5033
Houma, LA 70361-5033
(504) 857-3655

State University of New York
Maritime College
Fort Schuyler
Bronx, NY 10465
(212) 409-7200

Texas A&M University System
Fire Protection Training Division
Texas Engineering Extension Service
F. E. Drawer K
College Station, TX 77843-8000
(409) 845-1152

U.S. Merchant Marine Academy
Department of Continuing Education
Kings Point, NY 11025
(516) 773-5120

Washington State Fire Training Center
Marine Division, P.O. Box 1273
North Bend, WA 98045
(206) 888-4523

Continued on page 60

Fire-fighting exercises at Miami-Dade Community College.

Continued from page 59

Facilities with Coast Guard-approved **basic fire-fighting training

Alaska Department of Public Safety
Fire Service Training
P.O. Box 111200
Juneau, AK 99811-1200
(907) 465-3117

Calhoon MEBA Engineering School
27050 Saint Michael's Road
Easton, MD 21601
(410) 822-9600

Fire/Chuck Kimball
Solano Community College
4000 Suisun Valley Road
Suisun, CA 94585
(707) 864-7000

Great Lakes Region
MARAD Marine Fire Training Center
2600 Eber Road
Swanton, OH 43558
(419) 259-6362

Houston Marine Training Services
CLASSROOM ONLY
1600 20th Street
Kenner, LA 70062
(504) 558-1733

The Seafarer's Harry Lundeberg School of Seamanship
Piney Point, MD 20674
(301) 994-0010

Maine Maritime Academy
Castine, ME 04420
(207) 326-4311

Marine Safety Consultants
Tidewater School of Navigation, Inc.
CLASSROOM ONLY
100 W. Plume Street, Suite 208
Norfolk, VA 23510
(804) 625-7004

Maritime Institute of Technology & Graduate Studies (MITAGS)
5700 Hammonds Ferry Road
Linthicum Heights, MD 21090
(410) 859-5700

Military Sealift Command (Atlantic)
Fire-Fighting and Damage-Control School
1029 Highway #33 East
Freehold, NJ 07728
(908) 938-4979

Military Sealift Command (Pacific)
Fire Fighting School
Bldg. 29C, Treasure Island
Oakland, CA 94625-5010
(510) 395-3126

SCI Maritime Training
Seaman's Church Institute
241 Water Street
New York, NY 10038
(212) 349-9090

Sea School
5905 4th Street North
St. Petersburg, FL 33703-1417
1-800-HOT-SHIP

Texas A&M University System
Fire Protection Training Division
Texas Engineering Extension Service
F. E. Drawer K
College Station, TX 77843-8000
(409) 845-1152

Washington State Fire Training Center
Marine Division
P.O. Box 1273
North Bend, WA 98045
(206) 888-4523

Facilities with Coast Guard-approved ***advanced fire-fighting training

Alaska Department of Public Safety
Fire Service Training
P.O. Box 111200
Juneau, AK 99811-1200
(907) 465-3117

Fire/Chuck Kimball
Solano Community College
4000 Suisun Valley Road
Suisun, CA 94585
(707) 864-7000

Great Lakes Region
MARAD Marine Fire Training Center
2600 Eber Road
Swanton, OH 43558
(419) 259-6362

Maritime Institute of Technology & Graduate Studies (MITAGS)
5700 Hammonds Ferry Road
Linthicum Heights, MD 21090
(410) 859-5700

Military Sealift Command (Atlantic)
Fire-Fighting and Damage-Control School
1029 Highway #33 East
Freehold, NJ 07728
(908) 938-4979

Military Sealift Command (Pacific)
Fire Fighting School
Bldg. 29C, Treasure Island
Oakland, CA 94625-5010
(510) 395-3126

SCI Maritime Training
Seaman's Church Institute
241 Water Street
New York, NY 10038
(212) 349-9090

The Seafarer's Harry Lundeberg School of Seamanship
Piney Point, MD 20674
(301) 994-0010

Texas A&M University System
Fire Protection Training Division
Texas Engineering Extension Service
F. E. Drawer K
College Station, TX 77843-8000
(409) 845-1152

U.S. Merchant Marine Academy
Department of Continuing Education
Kings Point, NY 11025
(516) 773-5120

Washington State Fire Training Center
Marine Division
P.O. Box 1273
North Bend, WA 98045
(206) 888-4523

Continued on page 62

Students prepare for fire-fighting exercise at Miami-Dade Community College.

Continued from page 61

Facilities with Coast Guard-approved tankerman fire-fighting training

Hollywood Marine
CLASSROOM ONLY
55 Waugh Drive
Houston, TX 77251
(713) 868-1661

Kentucky Technical Region Ten
4818 Roberts Drive
Ashland, KY 41102-9046
(606) 928-6427

******Maritrans, Inc.**
Fort Mifflin Road
Philadelphia, PA 19153-3889
(215) 492-8100

Texas A&M University System
Fire Protection Training Division
Texas Engineering Extension Service
F. E. Drawer K
College Station, TX 77843-8000
(409) 845-1152

(Above) An open pit is ignited.
(Left) Fire-fighting students extinguish open pit fire with a dry chemical.
The exercises took place at Maritrans, Inc., in Philadelphia, Pennsylvania.

*** "Combined" means that the curriculum includes both basic and advanced course requirements.**

**** "Basic" means that the curriculum includes only basic fire-fighting course requirements. [An advanced fire-fighting course must be completed - usually within six months - as well to satisfy licensing regulations (46 CFR 10).]**

***** "Advanced" means that the curriculum includes only advanced fire-fighting course requirements. [A basic fire-fighting course must have been completed - usually within six months - as well to satisfy licensing regulations (46 CFR 10).]**

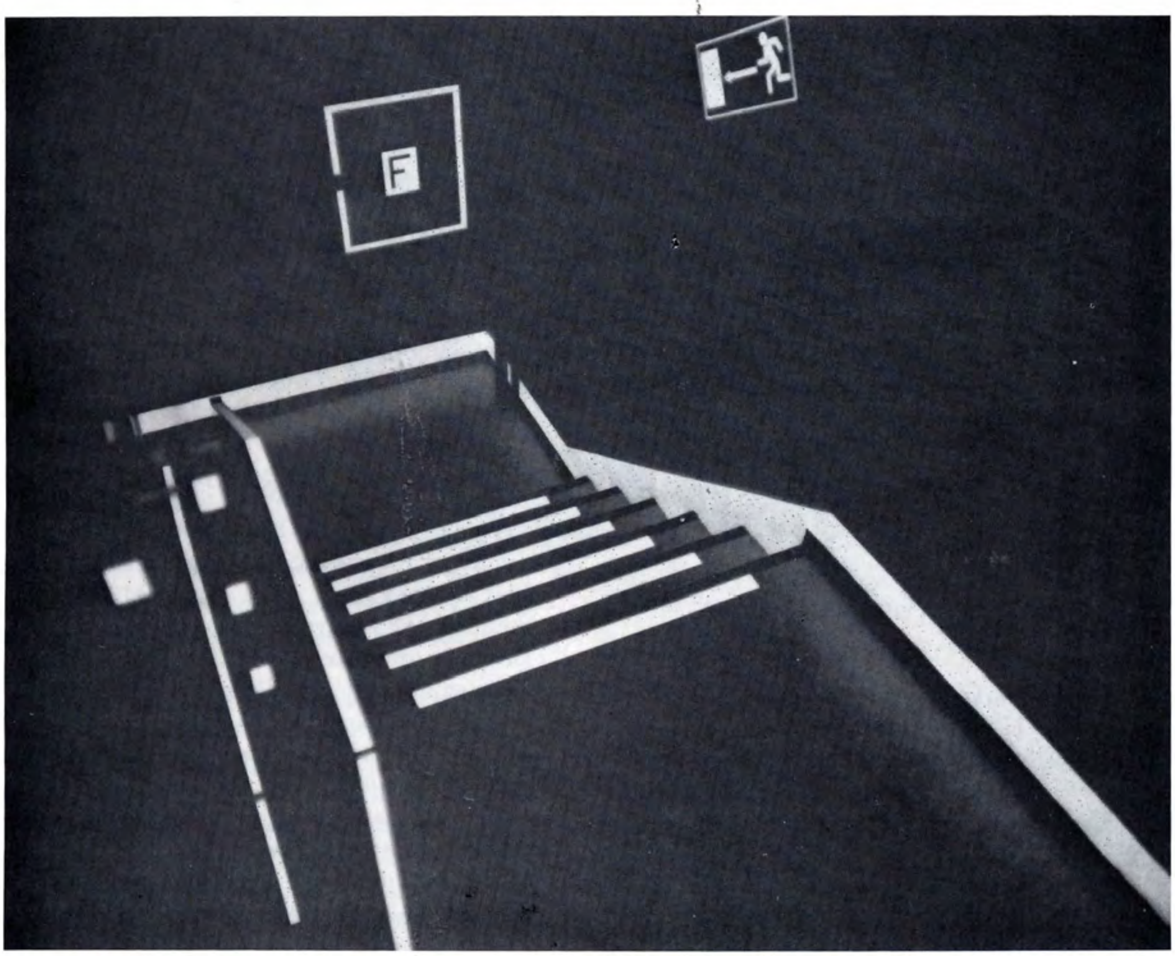
****** Approval pending.**

By Mr. Jack Westwood-Booth

In 1990, tragedy struck aboard the ~~Scandinavian Star~~, and 158 passengers and crew died within 45 minutes. The fire may have been set deliberately when the ship was enroute to Frederidshaven, Denmark, from Oslo, Norway. After an extensive investigation, it was determined that smoke was the cause of most of the deaths. As is the case in most fires, the smoke did its job very quickly.

The investigation also revealed that many passengers died in corridors while trying to find escape exits. Many of these corridors were dead ends without escape exits. (Such corridors will no longer be permitted in cruise ships built after October 1, 1994.)

-- low-location lighting --



How it can save lives

Continued on page 64

An accommodation deck in daylight.

The same deck in the dark.

Continued from page 63

Getting lost in smoke-filled corridors is easy to do because of poor visibility. Breathing is difficult and dangerous, due to toxic gases. It is wise to crawl during a fire since these gases and heated smoke rise to the ceiling. However, as the smoke gets heavy and cool, it works its way to the floor, severely limiting visibility. Breathing also becomes more difficult, especially when panic sets in.

To help passengers identify escape routes and exits, and not get into deadend corridors, low-location lighting was mandated.

Low location lighting

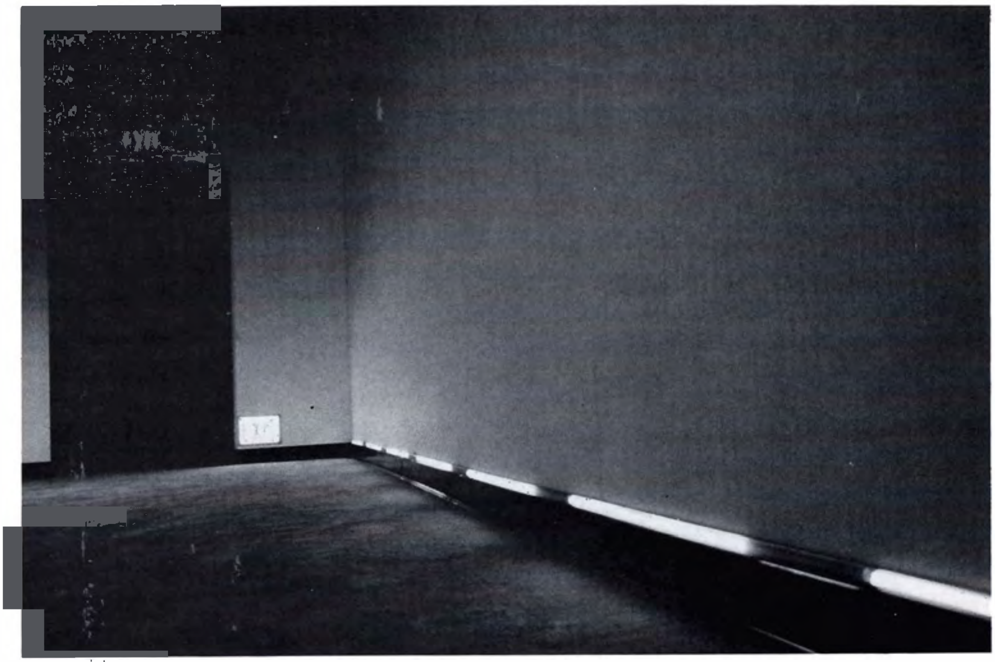
Lighting strips located near the floor have been found in commercial airplanes and movie theater aisles for many years. Now, they will be installed on cruise ships and referred to as low-location lighting. (The strips cannot be called "floor lighting" because ships don't have floors. They have decks, but the term "deck lighting" already has another usage. Low-level lighting could be confused with "mood lighting," and, thus, low-location lighting came to be.)

Although the cruise industry has a good safety record, shipboard fires can happen and can be devastating. In 1992, as a result of the *Scandinavian Star* fire and other similar casualties, the IMO required low-location lighting to be installed in passenger accommodation spaces on all cruise ships built after October 1, 1994, and retrofitted on all existing cruise ships with more than 36 passengers by 1997. It will also be required on all crew accommodation spaces by 1998.

Photoluminescent light

The lighting may be electric illumination or photoluminescent materials which glow in the dark. Used for escape exit signs and warning indicators, photoluminescent materials require no external source of power and no maintenance. They come in different forms, including paints, tapes and ready-to-use signs, all of which can be replaced when worn or faded.

Photoluminescent materials have vastly improved over the past few years, and can now provide light for at least 30 to 60 minutes after normal ambient light goes out.



Smoke obscures the "EXIT" sign over the door, but not the low location lights.

Other lighting types

Electric lighting strips, electroluminescent strips and fiber optic cables may also be used for low-location lighting. Commonly used on planes and theater aisles, electric lighting strips consist of small closely spaced lights placed along the floor. They are very durable and continue to operate until the power source is removed, even if one light on the strip fails.

Also becoming popular are electroluminescent lighting, which contains a chemical which gives off light when a small electric charge is applied.

The advantage of the electrically-activated systems is that they are very bright, especially in smoke. Also, while photoluminescent materials last for a limited period of time, electrically-activated systems remain in operation until the power source is removed.

IMO requires that electric systems be connected to the ship's emergency power supply. (Some electrically-activated systems have a three-hour backup battery, which continues to provide power even when the ship's emergency supply fails.)

When you next vacation on a cruise ship, immediately look for the exit nearest your cabin and check to see if low-location lighting is installed to help you find the emergency exit.

This may save your life.

Photos accompanying this article are courtesy of Permalight and Loctite Luminescent Systems.

Mr. Jack Westwood Booth is a staff member of the Fire Protection Section of the Ship Design Branch.
Telephone: (202) 267-0169.

Coast Guard and Hampton Roads

A novel cooperative effort in shipboard fire fighting

By LCDR Frank Sturm

The port of Hampton Roads, Virginia, includes more than 12 municipalities and major military installations. Historically, the local fire departments have been left to their own devices in fighting marine fires.

In 1992, the Hampton Roads Marine Fire Fighting Contingency Plan was revised to create a maritime incident response team consisting of members of the community and the Coast Guard to assist local fire departments in fighting marine-related fires.

April 8, 1993: Hampton Roads marine fire-fighting symposium participants embark on board Coast Guard cutter Chock to tackle a simulated fire on the Military Sealift Command supply ship USNS Altair.

Background

The port's contingency plan was established in 1982 by the Fire Protection Committee of the Hampton Roads Maritime Association, a "chamber of commerce" for the port. The plan was written primarily in response to a mandate from the Virginia state government to justify a request for funds for a dedicated fire boat. The funding was denied, but the plan remained in effect, updated in 1988.

In March 1990, voluntary representatives from MSO Hampton Roads, the maritime association and several local fire departments met to discuss how to fight marine-related fires without a fire boat. The participants were well aware of the potential impact a major ship or terminal fire could have on the safety and environment of the port. A port-wide safety plan was imperative.

Over the next 20 months, these volunteers exchanged ideas on marine fire fighting, port resources and ways to improve readiness. On January 7, 1992, a revised marine fire-fighting contingency plan was issued to assure a prompt, well coordinated response to port fires. It also informs marine facility operators, shipping agents and vessel operators of the steps to take, who to notify and other vital information in the event of a fire.

build response capabilities

The plan deals with three major items: jurisdiction and responsibilities, response coordination and a directory.

Jurisdiction and responsibility

The plan provides a brief overview of the fire fighting and emergency responsibilities of key federal, state and local agencies in the port. It also discusses mutual assistance agreements existing between many port municipalities and federal installations.

Response coordination

Notification procedures and initial information needs of response agencies are provided. Two categories of marine disasters and the level of response required for each are defined. (A level I disaster involves a small vessel of 65 feet or under, or a facility that does not pose a major threat to the harbor. A level II disaster is a vessel or facility fire that could be a significant risk to the harbor.)

Suitable fire-fighting piers and anchorages are also identified, and the establishment of an incident command post is mandated, along with a list of appropriate agencies to be represented. Response communications and embarkation points for equipment onto ships or barges for a shipboard fire are also discussed.

Directory

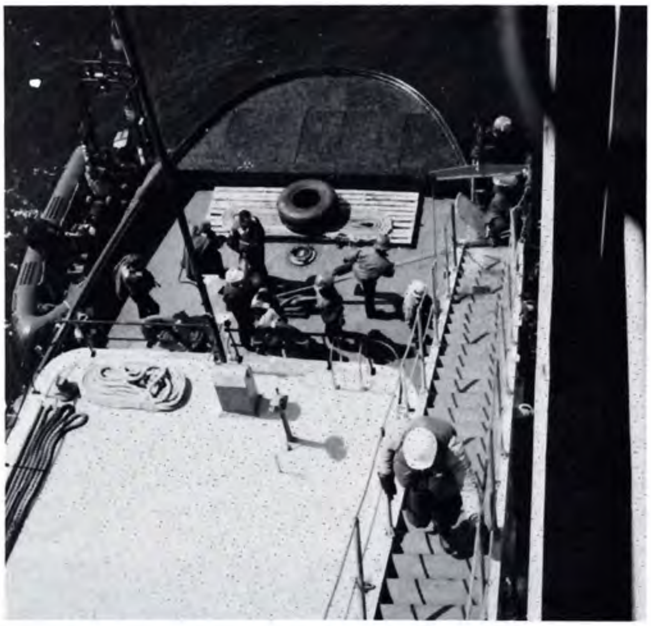
The response/assistance directory provided in the plan is a quick reference guide, listing phone numbers and addresses of local organizations with specialized fire-fighting equipment, and points of contact for government agencies and shipyards, cargo terminals, waterfront facilities, tug companies and other marine-related companies. It also provides a list of VHF-FM radio channels to be used during an emergency.

Incident response team

The plan calls for the creation of a team comprised of community and Coast Guard members for a coordinated response to a marine disaster. The role of this incident response team is to advise and assist the incident commander at a marine fire emergency.

Continued on page 68

Symposium students prepare to board USNS Altair from the tug Huntington and cutter Chock during waterborne fire-fighting exercise.



Symposium participants board USNS Altair from the Huntington to take part in the 1993 fire-fighting exercise.

Continued from page 67

In most commercial ship or terminal fires, the commander is a local fire department officer with little training or experience in shipboard fire fighting. The incident response team is to help the commander evaluate the situation at the scene of a shipboard fire and get assistance from appropriate agencies.

The incident response team is a two-tiered organization of volunteers from various agencies. The first tier is a response or advance team, and the second is a larger network of individuals who act as contact points for their agencies.

The advance team includes about a dozen people from local fire departments, the Virginia Department of Emergency Services, the Norfolk Navy Fire School and members of the Coast Guard.

The secondary network is made up of key people from the area's fire departments, military commands and commercial organizations. It continues to grow as more people volunteer their services.

During the past two years, the incident response team has proven its value several time assisting local fire fighters or the Captain of the Port (COTP). It was particularly helpful in improving communications between various agencies fighting a cargo fire at a terminal on the Elizabeth River in 1992.

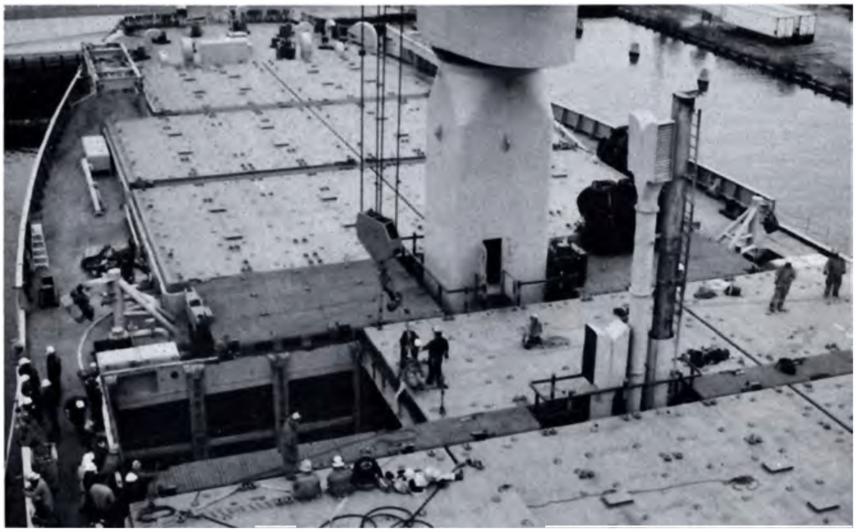
Annual symposium

The contingency plan also calls for an annual drill to be conducted. This is part of an annual Hampton Roads marine fire-fighting symposium, organized and produced by the incident response team. It was first held in July 1992 and again in April 1993.

This annual symposium helps educate land-based fire fighters in the problems and tactics of controlling shipboard fires, improves cooperative efforts between individuals representing different agencies in the port, and tests the contingency plan and the incident response team.

In 1993, the five-day events included vessel tours and presentations on ship construction, operations, safety, and cargo stowage and labeling of hazardous materials. Participants received hands-on training in shipboard fire fighting at the local Navy fire school. They were also lectured on fixed fire-fighting systems, construction and hazards of unique vessels (such as fishing boats) and shipboard fire-fighting strategy and tactics.

Participants also received a full day's training in fire fighting aboard an anchored ship. They loaded fire hoses, ladders, personal turnout gear and other equipment on tugs; boarded the vessel by Jacob's and accommodation ladders; hauled gear up; connected hoses to the tugs' fire pumps and ran water up to the main deck of the ship.


Tactical rescue teams extract "injured" person from cargo hold of the USNS Altair.

A shipboard fire drill was conducted on the final day of both symposiums. The first year, participants responded as one large fire company with complete gear and trucks. They fought a simulated boiler fire on the *USNS Denebola*, a Military Sealift Command supply ship.

This year's drill was expanded to include hazardous material and tactical rescue teams from local fire departments. The scenario was a simulated fire aboard the *USNS Altair*, another Military Sealift Command supply ship. A hazardous material container in the cargo hold was the scene of the fire. Symposium participants fought the fire with the ship's crew, while hazardous materials teams dealt with the contaminated container and the rescue teams extracted two "injured" people from the hold.

Continued on page 70

During the April 1993 fire-fighting exercise, a regional HAZMAT team disposesof simulated hazardous materials taken from cargo hold of the USNS Altair.

Continued from page 69

Both symposiums were successful joint efforts of a wide variety of people, including members of the Navy and Coast Guard, and representatives from shipping companies and terminal operators.

Conclusion

The incident response team and the annual symposium have greatly enhanced the ability of Hampton Roads to respond to marine fires and hazardous material events. They have increased the skills of local fire fighters in tackling shipboard fires and broadened the network of agencies providing assistance.

The Fire Protection Committee of the Hampton Roads Maritime Association is defining worst-case scenarios for marine fires in the port and will revise the contingency plan to address them. The committee is also trying to identify and obtain additional resources to accommodate these scenarios. At the same time, the group is focusing attention on training, education and public relations for marine fire fighting at the port, and establishing a network of individuals who are trained in marine fire fighting.

Volunteers on the incident response team and the fire protection committee will continue to improve the readiness of the port of Hampton Roads to face any marine calamity.

LCDR Frank Sturm is chief of the Inspections Department at MSO Hampton Roads, 200 Granby Street, Norfolk, Virginia 23510-1888.
Telephone: (804) 441-3287.

Does it matter how a fire might start on one of these cruise ships waiting to embark from the port of Miami? The results would be the same -- death, injury and financial loss.

Don't sell fire security short

By CDR Randall P. Parmentier

At 1:21 a.m., the Coast Guard at MSO Hiatusport received a radio call that the cruise ship SS Atlantic Monarch suffered an explosion, caught fire and was drifting off in the Pacific. Repeated attempts to raise the ship on radio have failed. A terrorist bombing is suspected. Aircraft report a ship matching the description of the Atlantic Monarch listing heavily to starboard on fire over its entire length. There is no sign of any of the 2,000 passengers on the heavily sloping decks. Coast Guard cutters and other vessels race to the scene..........

This is not a true story. But a fire aboard ship, no matter what the cause, too often results in death, injury and destruction. Even though constructed of fire retardant materials with state-of-the-art fire detection and suppression systems, today's ships, nevertheless, can be consumed in a large-scale conflagration.

While not very popular and far from the issue of fire protection, adequate security measures for passenger ships, and, for that matter, all vessels, is a very valid concern.

"Fire has no regard for the initial source of ignition."

Fire has no regard for the initial source of ignition. An explosive device can set off a fire just as easily as a grease-coated ventilation hood or a shattered diesel fuel line. In other words, security precautions should be an integral part of fire prevention. The security awareness of ship owners, operators and crews is an extremely valuable link in the prevention chain leading to the safety anchor which keeps fires and explosions from taking place.

Continued on page 72

Continued from page 71

IMO measures

The *Achille Lauro* hijacking in 1985 led the IMO to formulate and adopt "Measures to prevent unlawful acts against passengers and crews on board ships." While designed to prevent illegal acts, the measures recommend security plans for vessels and land facilities.

Listed in sections 4 and 5 of the IMO measures, the security plans require training for vessel and facility personnel, guards and watchmen in recognizing suspicious activities, items and hazards. Like fire prevention, security precautions require constant vigilance, observation and awareness. With little additional training, a security guard or crew member conducting rounds on a vessel could also be aware of fire hazards. Conversely, the same is true for a crew member conducting fire safety inspections to recognize security hazards.

The IMO measures were incorporated into United States law (Public Law 99-399) on August 27, 1986, as a modification to 46 United States Code 1801. Copies of the measures may be obtained through IMO, 4 Albert Embankment, London SE1 7SR, as MSC/Circ. 443.

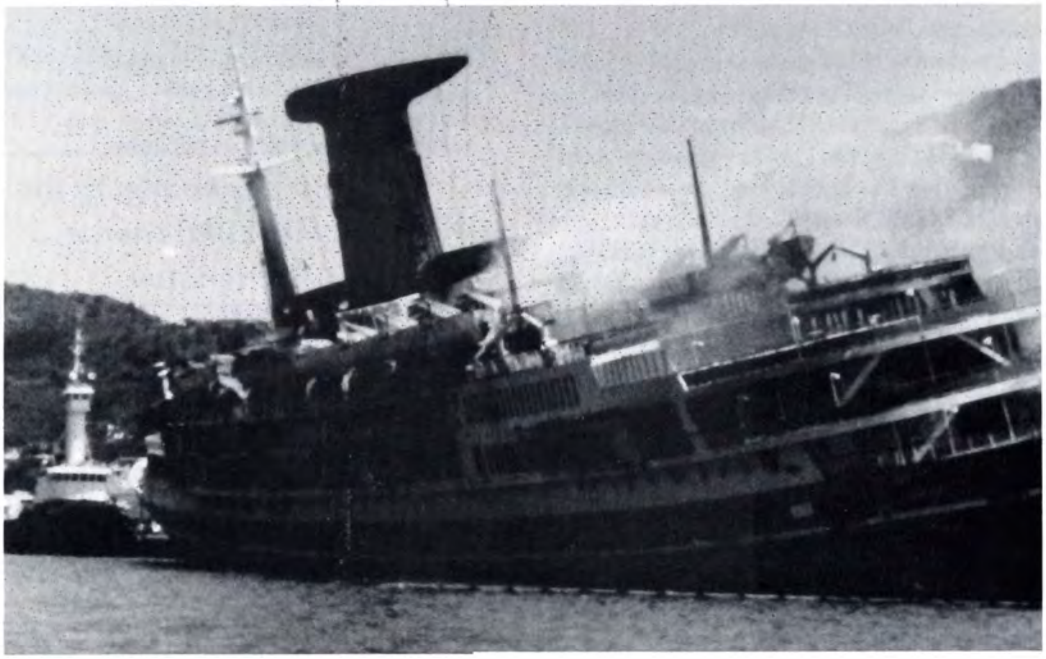
Terrorism

The whole issue of terrorism, attacks on ships and piracy, has focused primarily on hostage-taking, and the protection of passengers and crews from such activities as occurred on the *Achille Lauro*. The bombing attack on the World Trade Center in New York City in February 1993, however, heightened the awareness of security professionals all over the world of the need for tighter security precautions.

Is there any port in the world where a ship could not catch fire? Is there any cargo which will not burn or ignite a fire? Reflect for a moment on today's world situation. Is there any port of call where a ship or its cargo is totally immune from terrorism? Is there any place on earth where an attack on a ship would not make international headlines?

A good security program in coordination with an aggressive safety program is a valuable and cost-effective safeguard for any ship and any fleet. For years, safety management has been a priority to protect crews, ships and cargoes; and also has been required by insurance underwriters. There is no justification for a ship safety plan that only includes protection from unintentional hazards, especially nowadays.

The end of a cruise.



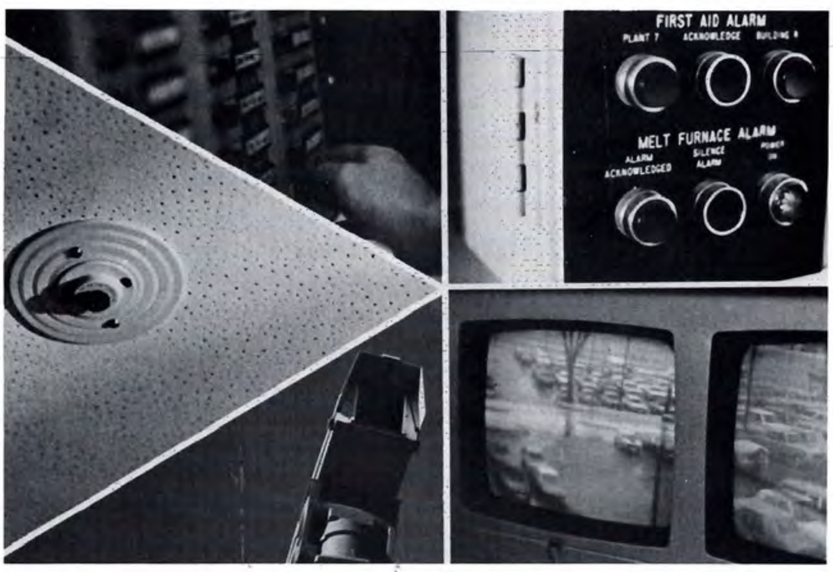
It was a fact of life in the recent past that ship safety programs did not routinely include security issues. The world situation, however, has caused prudent ship owners and operators to break out of this pattern and adopt security measures within the broader scope of safety protection. After all, isn't our goal safe ships, regardless whether potential damage or injury would be intentional or unintentional?

Program evaluation

The focus of ship fire prevention programs can be directed as follows:

— is the program based on how many fire hoses and spanners are on board, and how good they are?

— or is it based upon comprehensive training for terminal employees and ship crews in hazard awareness, including recognition of suspicious items, personnel and passengers; and a plan of action to pursue.



Fire detection or security systems? Why not use them for both?

Fire prevention should be regarded the same way as equipment and machinery maintenance. An overall program should be developed which would include both safety and security in fire prevention. Crews should be trained in security as well as safety hazard awareness. Also, procedures should be drawn up to follow in the event of the discovery of a suspicious object on board.

Information

Numerous books are available in libraries and book stores on vessel and terminal security issues. Government publications can be obtained through the superintendent of documents of the Government Printing Office. Information on security planning is also available from the American Association of Port Authorities, International Association of Chief's of Police and the American Society of Industrial Security.

Wrap up

You wouldn't dream of sailing to a new port without charts. Nor should you operate around the globe unprepared for an incident that could cost you, your ship, crew and/or passengers more than you can afford to pay. There are enough unexpected natural hazards of the sea to keep a weather eye out for without worrying about perils which can be planned and prepared for.

CDR Randall P. Parmentier is chief of the Port Security Branch of the Port Safety and Security Division.

Telephone: (202) 267-0475.

New river-boats demand new safety measures

By LCDR Roy Nash

America is returning to its harbors, rivers and coastal waters aboard dinner excursion and casino gambling boats. The rapidly accelerating demand for larger, more luxurious vessels for these cruises has kept the shipbuilding community very busy. Designers initially ran into some road blocks, however, with fire-protection regulations which were primarily developed for traditional ocean-going cruise ships.

World Yacht's New Yorker is available for dinner cruises and private charters around Manhattan. It accommodates up to 1,500 people and has the largest ballroom of any inland waterway vessel in the United States.

The Alton Belle Casino represents the wave of the future.

Stairway landings

For example, large stairway landings are required when large numbers of passengers are carried. However, ocean-going cruise ships typically carry less passengers in proportion to their size than the new riverboats since the former have many spaces for passengers including overnight accommodations, hotel services and crew quarters, which are built-in to the vessel design.

When computed through a formula in the regulations, high passenger loads on these new type vessels would have required large stairway landings, taking up a significant amount of available deck area.

The publication of Navigation and Vessel Inspection Circular (NVIC) 14-91 on October 2, 1991, was the first step toward solving this problem. It introduced the new safety concept of "qualified refuge areas" as an alternative to landing area requirements.

Qualified refuge areas

A "refuge area" is a protected location where passengers can find safety in an emergency. Such an area becomes "qualified" by special construction, location, the installation of fire detection and suppression equipment, and accessibility. This differs from the traditional approach which was designed to accommodate passengers on the large landings of enclosed stairways. This change in the concept of fire protection eliminated the need for the large enclosed stairway landings that were so cumbersome in riverboat designs.

Main vertical zone

Similar flexibility was recently introduced in an amendment to NVIC 14-91 for another design barrier, the main vertical zone. This change permits passenger vessels on "protected waters" to have longer public spaces, allowing for the "big casino" effect. In general terms, the NVIC maintains safety through fire prevention techniques, early detection and suppression of fire, efficient notification of passengers, in addition to emergency escape routes and refuge areas.

Prevention

Fire prevention is primarily accomplished through proper vessel management during operation. There is no substitute for good maintenance, housekeeping and crew training. The combination of efficient vessel upkeep, non combustible construction and a minimum of combustible materials permitted on board provides a safe vessel upon which fire emergencies will be rare occurrences.

Continued on page 76

Continued from page 75

Detection

Early fire detection is critical for passenger and vessel safety. The installation of a fire-alarm system to notify the person-in-charge and pinpoint the location of the fire is required. Early fire detection makes early suppression possible, along with adequate notification for orderly passenger evacuation.

Control

Measures to control the size and spread of fire are very important. Three methods of controlling fire and its effect are used on the new riverboats.

1) A restriction is placed on the amount of combustible material that can be installed in accommodation spaces. Limiting the amount of fuel present to feed the fire, in principle, limits the size of the fire.

2) An automatic sprinkler system is installed. The system consists of individually operating sprinkler heads that are activated by heat produced from the fire.

3) A smoke control system controls the spread of smoke in atriums, providing a clear passenger evacuation route.

Notification

Sequential notification of passengers can help bring about orderly passenger evacuation. A system which provides evacuation messages in specific areas of the ship allows the ship's master to direct passengers closest to the fire to safe refuge areas.

Constructed in 1976, the Mississippi Queen is one of the largest sternwheelers ever built.

Now under construction, the American Queen is slated to be the largest overnight passenger vessel built in a United States shipyard since the SS United States in 1953. The steamboat will accommodate 420 guests when completed in 1995.

Means of escape

When fire starts, the safe, rapid evacuation of passengers is vitally important. A good "means of escape" system should afford adequate protection and include carefully planned exits that are properly sized and spaced to easily accommodate all passengers. Details such as the direction of door swings, exit markings and door hardware are of particular importance.

The escape philosophy consists of two phases. The first involves the immediate evacuation of passengers who are directly threatened by the fire. This can be accomplished by providing many exits to areas that passengers can reach quickly during a confused evacuation.

The second phase moves passengers to the qualified refuge area if they are not already there. This is a somewhat slower and less chaotic process of getting passengers to safety.

Refuge area

A refuge area is a protected location to which passengers are directed in an emergency. The location is designed to protect passengers for a period of time to allow the fire to be extinguished and permit rescue arrangements to be made, if necessary.

Conclusion

When carefully followed, this NVIC guidance can provide both flexibility and passenger safety as America returns to its rivers.

The photographs accompanying this article are courtesy of the Passenger Vessel Association.

LCDR Roy Nash is chief of the National Fire Protection Policy and Implementation Section of the Ship Design Branch.
Telephone: (202) 267-2997.

Training

Student mariners attack a class "B" fire in the auxiliary machinery room of the Fire Queen, a 200-foot ship mockup at the MSCLANT/MARAD Damage Control and Fire-fighting School in Freehold, New Jersey.

for the inevitable

By LCDR John D. Hooper USCGR

Fire at sea is one of the most feared disasters for the merchant mariner. Only those who have experienced such an event can appreciate its magnitude. When a general alarm alerts you to a fire on board, your heartbeat races and palms sweat as you realize that there are only a few people to handle the crisis and there will be no help from shore.

Your success, in fact, your very life may depend on how well you keep your head and do your job. The training you and your crew have had to manage such an emergency will be a key factor in your response.

Fire-fighting school

One place that has been preparing mariners for at-sea emergencies for more than 30 years is the Military Sealift Command, Atlantic (MSCLANT)/Maritime Administration (MARAD) Damage Control and Fire-fighting School in Freehold, New Jersey. Established in 1962, the school is accredited by the Navy and approved by the Coast Guard.

The school offers both basic and advanced courses in fire fighting to mariners from the commercial fleet, tug companies, Military Sealift Command, Coast Guard and Navy. The average class size is 25.

Basic course

The Basic Shipboard Fire-fighting Course is three days, with approximately 50 percent practical application. Classroom lectures cover basics, including the chemistry of fire, fire prevention, protective clothing, fire station equipment, special hazard fires, breathing apparatus, fire-party organization, and search and rescue techniques.

Afternoons are spent fighting fires on mock-ups, including the *USNS Fire Queen*, a 200-foot ship mock-up with a pilothouse, foc'sle, cargo tank deck and enginerooms. Students first learn how to fight fires with extinguishers and work their way progressively through the course, finally putting out fires in a direct attack in the engine room wearing different types of breathing apparatus.

Continued on page 80

Under the watchful eye of a damage-control officer, a student learns the value of using a perijet eductor to de-water a flooded compartment.

"... If our training saves one life, or one ship,

Students respond to flooding with an electric submersible pump followed by box patches.

Continued from page 79

Advanced course

The Advanced Shipboard Fire-fighting Course is a far more intense three days of classroom instruction and hands-on training. The students are expected to use their acquired knowledge and seagoing experience in controlling severe fires.

Fires can occur at any time, even in the middle of a lecture. Students must organize themselves into well coordinated teams, rotating through different fire-party positions. This course plays heavily on the students' strengths and weaknesses, requiring them to think fast and be flexible in demanding and ever-changing situations.

In the advanced course, students are introduced to new techniques, including positive-negative ventilation and active desmoking; and new equipment, such as thermal imagers, fire-finders, cool vests, foam nozzles and fire fighters' ensembles.

Instructors

Most of the instructors at the joint MSCLANT/MARAD school are mariners with senior, unlimited ocean licenses. Others have extensive Navy or Coast Guard experience. Licensed deck and engineering officers are on staff, adding to a professional mix of education and experience. MARAD has two instructors on staff to train cadets from Fort Schuyler and Kings Point.

Additional training

Mariners can also be trained in shipboard damage control, afloat safety, shipboard helicopter fire fighting, the P-250 Mod 1 fire-fighting/dewatering pump, and shipboard chemical, biological and radiological defense techniques.

The training is intensive and has a high success rate in preparing mariners to face the most feared at-sea crisis. The school's philosophy is best expressed in a Naval Institute phrase which is framed and hung in the main office:

then our efforts will have been worthwhile."

Student floats off wearing exposure suit as protection against hypothermia.

Staff and students assemble aboard the <u>USNS Fire Queen</u> after having extinguished all the fires.

"It is not our objective to make seasoned fire fighters of you, but merely to teach you to respect fire and not to fear it, also to develop confidence in your equipment and your shipmates."

As one MSCLANT/MARAD instructor so aptly put it, *"it is not a matter of 'if,' but 'when.' If our training saves one life, or one ship, then our efforts will have been worthwhile."*

A fire party leader directs his team down a flight deck to attack a helicopter fire.

For more information on the school, contact:

Director, MSCLANT DC/FF School
1029 Highway 33 East
Freehold, NJ 07728
Telephone: (908) 938-7761.

LCDR John D. Hooper USCGR is an instructor at the MSCLANT DC/FF School.

U.S. Department
of Transportation

**United States
Coast Guard**

2100 Second St., S.W.
Washington, D.C. 20593

Official Business
Penalty for Private Use $300

Postage and Fees Paid
United States
Coast Guard
DOT 514

S/S Texaco North Dakota collides with drilling structure in Gulf of Mexico in August 1980.