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Coast Guard Captain of the Port workers inspect a dock warehouse for proper storage of hazardous cargo and proper labeling of containers. (Official U.S. Coast Guard photo)

Preparing for a Chemical Emergency: The Morgan City Case

LT Robert E. Acker

While assigned as supervisor of U.S. Coast Guard Port Safety Detachment Berwick Bay in Morgan City, Louisiana, in 1985-86, I had an unusual opportunity to participate in the organization and planning of a local hazardous material response exercise. It proved to be an excellent learning experience for me in my role as the Coast Guard's Captain of the Port (COTP) representative. I gained an appreciation for the problems a community may encounter in the event that dangerous chemicals are inadvertently released into the environment. I also gained respect for the need to prepare for such emergencies. There is no doubt that contingency planning and community exercise can prevent loss of life and property as well as damage to the environment.

Management of a response effort is often confusing and disorganized. Emergencies generate a lot of immediate concern to individuals from local, state, and federal entities who aren't used to working with each other. Responsibility isn't always clear, and sometimes there is conflict between two people whose roles overlap. There can also be roles that need to be filled, but no one to fill them. Without prior planning, it is safe to assume that any inadequacies in the response structure will become apparent when disaster strikes.

Since the community is likely to suffer the most in a chemical disaster, it should take the lead in preparing itself for emergencies. In the case of Morgan City, which is located in rural south central Louisiana, the local community should expect to spend at least the first 2 hours handling the emergency itself because that is about how long it would take for outside assistance to arrive. Much can be done in that first 2 hours to minimize the severity of the release to the local population. Hazard assessment can be made, evacuation plans and emergency medical services can be activated, and lines of communication can be set up if some foresight is used to address these subjects. Knowing the local resources available and how to access them could prove to be the difference between a minor incident and a catastrophe.

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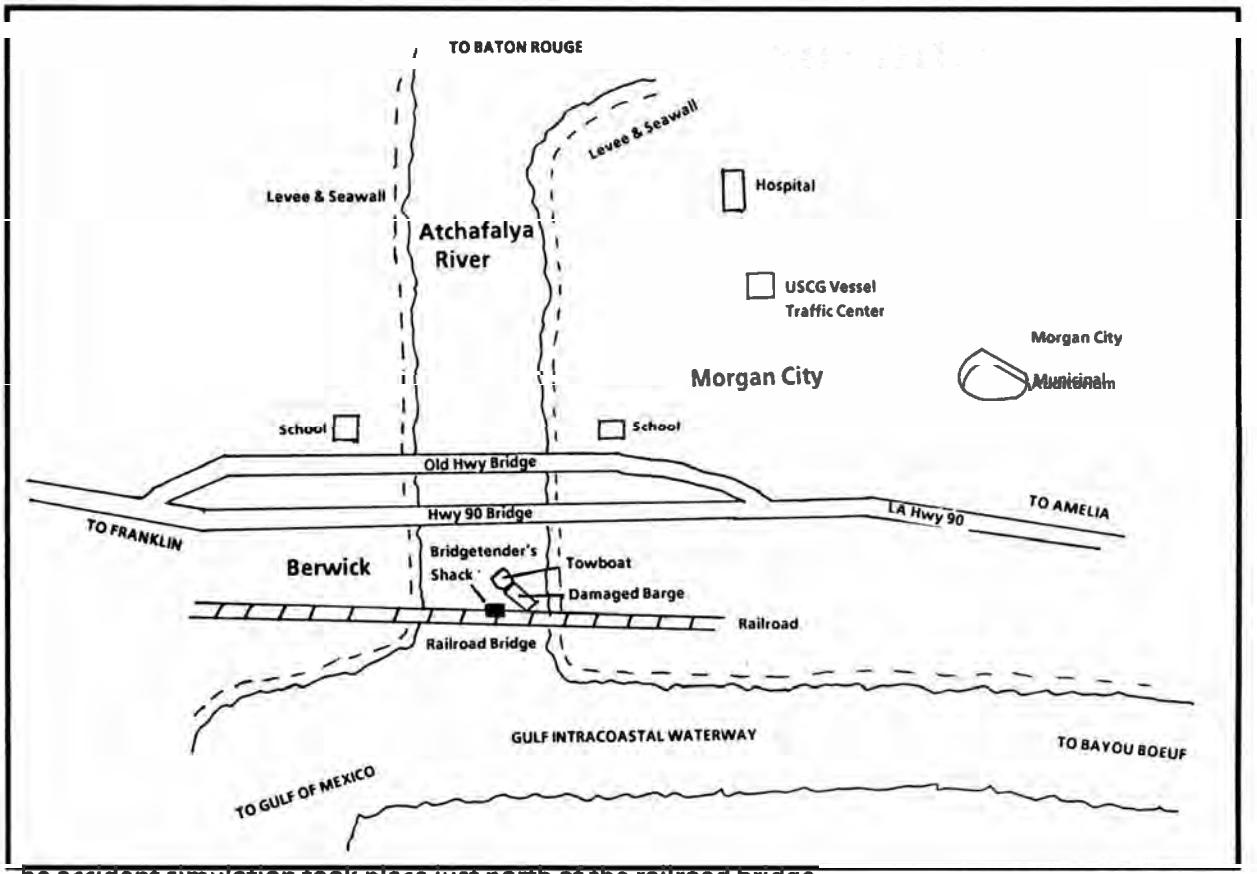
Hazard Assessment of Area

A realistic hazard assessment of the area was necessary prior to soliciting community participation in the emergency preparedness effort. Identifying the hazard helps persuade those officials with other time constraints that there is a need to devote some time and energy to planning. It also gives them a chance to evaluate their own role and responsibility in the community. Fortunately in the case of Morgan City, officials at the local, parish, and state levels are acutely attuned to the hazards of the area and were quite willing to become involved.

Morgan City is located about 90 miles southwest of New Orleans at the junction of the Atchafalaya River and the Gulf Intracoastal Waterway (GICW). From this point, tankbarge traffic proceeds east and west along the GICW between Houston and New Orleans or north up the Atchafalaya River to Baton Rouge and destinations north. To control this traffic, the Coast Guard has a Vessel Traffic System (VTS) which is manned 24 hours a day. Several companies move cargoes of particular hazard through this area. In a typical month, 250 loads (estimated amount from VTS quarterly statistics) of hazardous chemicals will pass through the system -- approximately 40 percent butane; 25 percent anhydrous ammonia, methane and propane; 20 percent butadiene, diisocyanate, toluene, chlorine, ethylene, and propylene. The remaining 15 percent may include such materials as



he accident simulation took place just north of the railroad bridge.

acrylonitrile,propadiene, vinyl chloride, butylene oxide, or ethylene oxide. Seasonal high water conditions increase the chance of collision or grounding which could result in release of a hazardous material.

The Southern Pacific Railroad runs east and west through St. Mary Parish. It parallels Louisiana Highway 90 and crosses over the Atchafalaya River near its junction with the GICW. This rail line averages six trains every 24 hours, and commonly carries such chemicals as sulfuric acid, chlorine gas, anhyhdrous ammonia, dinitrotoluene, hydrogen fluoride, vinyl chloride, propylene oxide, butane, toluene diisocyanate, and liquefied petroleum gas, to name a few. Two highway bridges cross the waterway near the railroad bridge. Highway 90 is the primary artery of transportation for hazardous chemicals by road through St. Mary Parish. Liquefied petroleum gas and other petroleum products are the most prevalent chemical hazards transported by truck through the area.

The geographical location of chemical traffic with respect to the local populations magnifies the potential hazard. The towns of Morgan City and Berwick are located on each side of this busy waterway intersection. Trains and trucks travel through the population centers of each town as well as other towns in St. Mary Parish. Many schools located in the area appear vulnerable to the adverse effects of a transportation accident involving chemicals. Recognizing the hazards of the area, the next step was to determine how to effectively mobilize resources available to minimize loss.

Responsibilities and Roles

The responsibility for mitigating the effects of a transportation accident ordinarily rests with the carrier. Most carriers in south Louisiana maintain resources for spill removal, often in the form of contract cleanup companies. These resources aren't immediately available, and this places the burden of initial response on municipal firefighters and law enforcement

agencies. State legislation places the responsibility for hazardous material response on the State Police Hazardous Materials Unit. The Coast Guard and Environmental Protection Agency (EPA) share a federally mandated regulation to act as on-scene coordinators in releases that pose an immediate threat to life or the environment. Other state and local entities are responsible for various aspects of the response.

Managing a coordinated response effort is enhanced by defining the roles of each individual beforehand. The first step is to make a list of all the possible participants. In the Morgan City case, the following were contacted and asked to explain their perceived roles:

St. Mary Parish Sheriff
Morgan City Police Department
Morgan City Fire Department
Berwick Fire Department/Civil Defense Director
Morgan City Civil Defense Director
St. Mary Parish Civil Defense Director
St. Mary Parish Chief Administrator
Louisiana Sate Police Hazardous Materials Unit
Louisiana Department of Environmental Quality (DEQ)
Louisiana Department of Wildlife and Fisheries
Morgan City Harbor & Terminal District/Port Commissioner
U.S. Coast Guard Gulf Strike Team
A railroad representative
Coast Guard Marine Inspection Detachment Morgan City
American Red Cross
Two local hospitals
Federal Aviation Administration
National Oceanographic & Atmospheric Administration (NOAA)
A local ambulance service
Franklin Fire Department
A New Orleans contract cleanup company
A tankbarge shipping representative
U.S. Wildlife and Fisheries
A local radio station and newspaper
An environmental volunteer group
A chemical manufacturer's representative
Environmental Protection Agency
Local Chamber of Commerce
Federal Emergency Management Agency
Louisiana Office of Emergency Preparedness

The survey revealed that there was a vast amount of expertise and resources available. Southern Louisiana seemed acutely aware of the dangers peculiar to their local economy. On the other hand, it became apparent that in the Morgan City case that there was very little formal communication between many of these concerned entities. Most seemed to be supportive of participating in a simulation exercise of a transportation accident to improve this deficiency, so it was decided to plan one and invite individuals from each entity to participate, either in person or via telephone.

The results of the survey were summarized into brief paragraphs describing the perceived roles of each key participant. These were consolidated into an information package which also included the area hazard assessment and geographical characteristics, a list of phone contacts, a list of chemical information resources, a list of response plan job function descriptions, and a list of available education and training courses designed for community emergency response personnel. This information package was mailed to each of the key individuals who could become involved in an actual response effort.

The Tabletop Exercise

After distributing the information packages, it was time to consider holding a drill of the response community. Since I would possibly become involved during a chemical emergency as the Coast Guard Captain of the Port's representative, I was extremely interested in gaining the experience a drill would provide. Having had little experience in hazardous materials response except for a couple of service-sponsored resident courses, I felt uncomfortable organizing and holding the drill. Fortunately, one of the missions of the Coast Guard's Gulf Strike Team is chemical and oil response training for USCG Marine Safety Offices and Captains of the Port. With their expertise and advice, we were able to put together a plan for a simulated chemical emergency tailored specifically to the Morgan City area.

The structure of the simulation involved a time commitment of 1-1/2 work days for the participants. The first session would take place in the afternoon and would include a discussion of the exercise (without revealing the actual scenario), presentation of community response

organization roles by the Strike Team representatives, and set-up of the emergency coordination center. The next morning, the actual simulation would take place with the Strike Team representatives introducing information to the response community in much the same manner that it would be received in an actual emergency. Individuals would simulate response to the events; meanwhile, the chronology of events and actions taken would be recorded. During the final session in the afternoon that day, the chronology would be reviewed by the participants to identify strengths and deficiencies in the response structure.

Invitation letters were sent out to key participants and followed up with a phone call to encourage participation. Most of those entities invited actually sent a representative, and those who couldn't made their resource or expertise available by phone. Morgan City's Civil Defense Director provided the local municipal auditorium as a site for the exercise and secured sufficient number of phones for external communications. The local radio station and daily newspaper announced the drill a few days before to invite anyone in the community interested to sit in on the discussions.

The actual simulation of a chemical transportation accident took place in Morgan City on March 24-25, 1986, under the supervision of three members of the Coast Guard Gulf Strike Team. The following is a synopsis of the scenario:

The situation began with a report from the operator of the towing vessel to the USCG vessel traffic system (VTS) watchstander that he had lost control of his vessel just after clearing the railroad bridge northbound on the Atchafalaya River. He then drifted down in the swift current and slammed into the bridge on the Morgan City side. He reported a strong smell on his barge and that his tankerman complained of dizziness.

The temperature was reported at 68 degrees F with winds from the southwest at 10-15 knots. The operator of the vessel wanted to get permission to move the barge, indicating that it was taking on water forward. People were congregating on the Berwick side of the waterway. The railroad bridgetender wanted to know how soon a train could come through, and

Participants in the exercise used proper safety equipment. *(Photo from USCG files)*

the news agency wanted information on the incident.

A coordination center was set up at the Morgan City municipal auditorium by the federal on-scene coordinator (USCG Captain of the Port New Orleans). His representative was the acting supervisor of Port Safety Detachment Berwick Bay. Meanwhile, the Morgan City fire department dispatched a unit to the scene and determined that the hazard posed by release of the chemical butadiene (also known as vinyl ethylene) was sufficient to justify evacuations. Local law enforcement coordinated evacuations of the Morgan City and Berwick sides with the St. Mary Parish and local civil defense directors. The local population grew hysterical over being evacuated, giving law enforcement officials resistance. One tank aboard the barge was apparently leaking a chemical from a cracked valve. Downriver water intakes were ordered closed by the civil defense director.

The State Police Hazardous Materials Officer and Louisiana Department of Environmental Quality had been contacted and

were enroute to Morgan City. The owners of the barge indicated that they would take full responsibility for the cleanup, but their response team would not be arriving for about 4 hours. Volunteers arrived on scene to offer assistance. Citizens mentioned concern for carcinogenic properties of the chemical. The NOAA Scientific Support Coordinator passed a vapor dispersion model on to the OSC's representative. Firefighters provided a water fog to knock down vapor clouds and help prevent a flammable vapor concentration at the source. The towboat operator, two deckhands, and the bridgetender were evacuated from the scene by ambulance personnel wearing protective gear. Firefighters continued to attempt to stop the leak at the valve. Highway bridge traffic was closed by law enforcement officials.

The State Police and DEQ representative arrived at the coordination center. Parish and local civil defense directors activated shelters in nearby Patterson and Amelia, Louisiana, for evacuees and prepared local hospitals to deal with mass casualties. The ambulance service transported the casualties to the hospitals. The Port Commissioner contacted local businesses concerning the status of commerce. Coast Guard boats enforced a safety zone about the area. The local civil defense director provided an update to the media. The Federal Aviation Administration was contacted to deal with a news helicopter violating the air safety zone. Contract personnel from a cleanup company arrived on scene.

Firefighters and contract response personnel dressed out in proper protection closed the valve aboard the tank barge to stop the leaking vapors. Coast Guard marine inspectors arrived on scene to survey damage to the vessel before allowing it to move. The DEQ representative also went to the scene with advice for minimizing environmental damage and cleanup techniques. The drill ended.

Hazardous chemical workers must flush their equipment when working with corrosives. *(Photo from USCG files)*

Lesson Learned

Following the drill, a debriefing was held to discuss the strengths and weaknesses in the response structure that became apparent during the exercise. The representatives of the Strike Team indicated that the review was most important because afterwards the individuals involved would be able to better appreciate how to interact with other key participants. Most participants felt that in the event of a chemical emergency, they would be better prepared to respond simply because they had worked together and had a chance to talk with one another.

Most also agreed that there were areas that could stand further improvement. Detailed evacuation plans for schools, nursing homes, and hospitals would facilitate coordination between civil defense and program administrators. Updating mutual aid agreements between fire departments (municipal and volunteer) would provide better accessibility to response sources and expertise. Additional chemical response and personal protection training would improve firefighter safety. Authority to issue evacuation orders needed to be clarified. Emergency medical services plans would be more effective if a specific coordinator was designated by parish officials. Advance preparation of shelters and collection areas would prevent confusion in the event of a real emergency. The exercise identified these and other areas of potential

improvement that weren't apparent beforehand.

The next step in the process of improving preparedness for a chemical incident would logically be to develop a parish-wide local contingency plan. This plan could be separate or part of a more comprehensive disaster plan. The plan would need to establish a strategy for responding to various potential incidents, like a train wreck, highway accident, or marine transportation accident. It should have a detailed operational plan with defined roles and job assignments. The format used for governmental local contingency plans can be found in "National Oil and Hazardous Substances Pollution Contingency Plan," *Federal Register* Vol. 45, No. 55, part III, March 19, 1980, p. 17850. A community could modify this outline to meet is own specific needs.

Once a local contingency plan is developed, it needs to be periodically updated. The information contained within can change, and the plan won't be of much use if it isn't kept current. Updating the list of contacts and phone numbers is essential to ensure rapid mobilization of manpower and resources. If key individuals in the community agree to meet periodically, the task should be simple once the basic plan is established.

A periodic exercise of the response plan should be done to enhance its effectiveness during an actual emergency. This is extremely important when key people in the response structure are replaced by new members. The more people work together, the better they understand their roles in an emergency. Exercises should be carried out as realistically as possible with consideration given to real time during the drill. Discussion of the exercise enhances the effectiveness of the drill.

Communities should take the initiative like Morgan City did in 1986 to prepare themselves for the possibility of a chemical emergency. By doing so, lives and property can be saved, and damage to the environment can be minimized.∎

Lessons from Casualties

Water in the Lazarette

The similarities between two recent capsizings jump out at us. Both vessels were about the same size -- one a tug, the other a fishing vessel. Both were encountering winds over 25 knots and seas of 8 to 12 feet. The crews of both vessels observed that the lazarette, which houses portions of the steering gear, had large quantities of water (three-quarters full in one case, 4 feet deep in the other). The crew of one of the vessels said it was not uncommon for there to be at least 1-1/2 feet of water in the lazarette. Both vessels subsequently lost steering and capsized. One crew member drowned.

The exact cause of the casualty could not be determined in either case because of the loss of the vessel, but the following scenario is a strong candidate: "routine" accumulations in the lazarette tuned into substantial flooding, shorting out the electrical portions of the steering gear and rendering the vessel uncontrollable and at the mercy of wind and wave.

The moral of the story? Pay attention to "routine" accumulations of water. They are an indication that there's a bigger problem: a loose packing, a leaky hose, a loose hatch or scuttle, a weak seam. If your lazarette is frequently "wet," look for the cause, and consider relocating vital equipment that can't stand immersion to another, drier space.∎

Blind Spots and No Lookouts

LTJG Mark Dix

Duplicate Accidents

Two local sport fishermen were enjoying the late afternoon sun and casting their lines just outside of the harbor of Cape Charles, Virginia, in July 1987. They were fishing in an area known locally for black drum and spot. These men drifted along slowly in their boat, relaxed because there was not much commercial vessel traffic in the area. However, a short distance away a tug backed away from the pier in Cape Charles towing a barge loaded with railroad cars along its port side. The railroad cars on board the barge extended above the height of eye in the pilot house of the tug, thus blocking the view on the port side. As the tug completed its backing maneuver and began to head out of the harbor, the tug captain told both of his lookouts on the bow of the barge to secure and come back to the tug.

The two fishermen spotted the barge bearing down on them when it was 150 yards away. They immediately realized the danger they were in and attempted to raise someone on the barge by shouting. The owner of the boat tried to start his engine in an attempt to motor out of harm's way, but he was unsuccessful. When the barge was but a few feet away, one man dove into the water to escape; the other fisherman was swept under the barge upon impact. Other nearby fishermen spotted the broken boat in the barge's wake, called the Coast Guard Station in Cape Charles, and attempted to render assistance. Miraculously, both men survived. The tug operator did not even stop because he had no knowledge of any collision. As the tug continued south, the operator's first awareness of the incident came from the Station Little Creek rescuers. Coast Guard Investigating Officers from Marine Safety Office (MSO) Hampton Roads met the tug when it came into Little Creek, Virginia, on the other side of the bay and began their investigation.

Five weeks later, again in the vicinity of Cape Charles, two sport fishermen anchored out in Chesapeake Bay were wrapping up a relaxing afternoon of fishing. They watched a tug and railroad barge combination maneuver out of the Cape Charles Channel and into the bay. They had no indication that they were in any danger until the barge turned in their direction. At that time, the pilot house of the tug was obscured from their view by the towering railroad cars on the barge. They blew their whistle and shouted in a futile attempt to alert someone on the barge of the impending collision. Unfortunately, there was no lookout on the barge to alert.

In the excitement of the situation, the men were unable to start their motor. They realized that pulling in their anchor would place them dead square in the path of the barge. When the barge was only feet away, they took shelter on the stern of their boat and waited for the impact. Their boat collided one-third of the way down the barge and continued to smack alongside the barge. The tug and barge snagged their anchor line so violently that it twisted a cleat completely around and took their vessel into involuntary tow. The men cut the anchor line, started their engine, and caught up to the tug. The operator didn't know he had hit another vessel. Incredibly, it was a different operator but the same tug that had an accident 5 weeks prior! MSO Hampton Roads investigators again met the tug at the dock in Little Creek and discovered that the operator didn't even have an operator's license.

Neither operator had lookouts at the time of the collisions, and both were prevented from seeing anything to the port side of their vessel by the tall railroad cars on the barge. In effect, their whole port side was blind. Both men contended that they were capable of acting as lookout and operator from the pilot house and hence needed no lookout. They added that they had made this voyage many times before, transporting railroad cars between Virginia's

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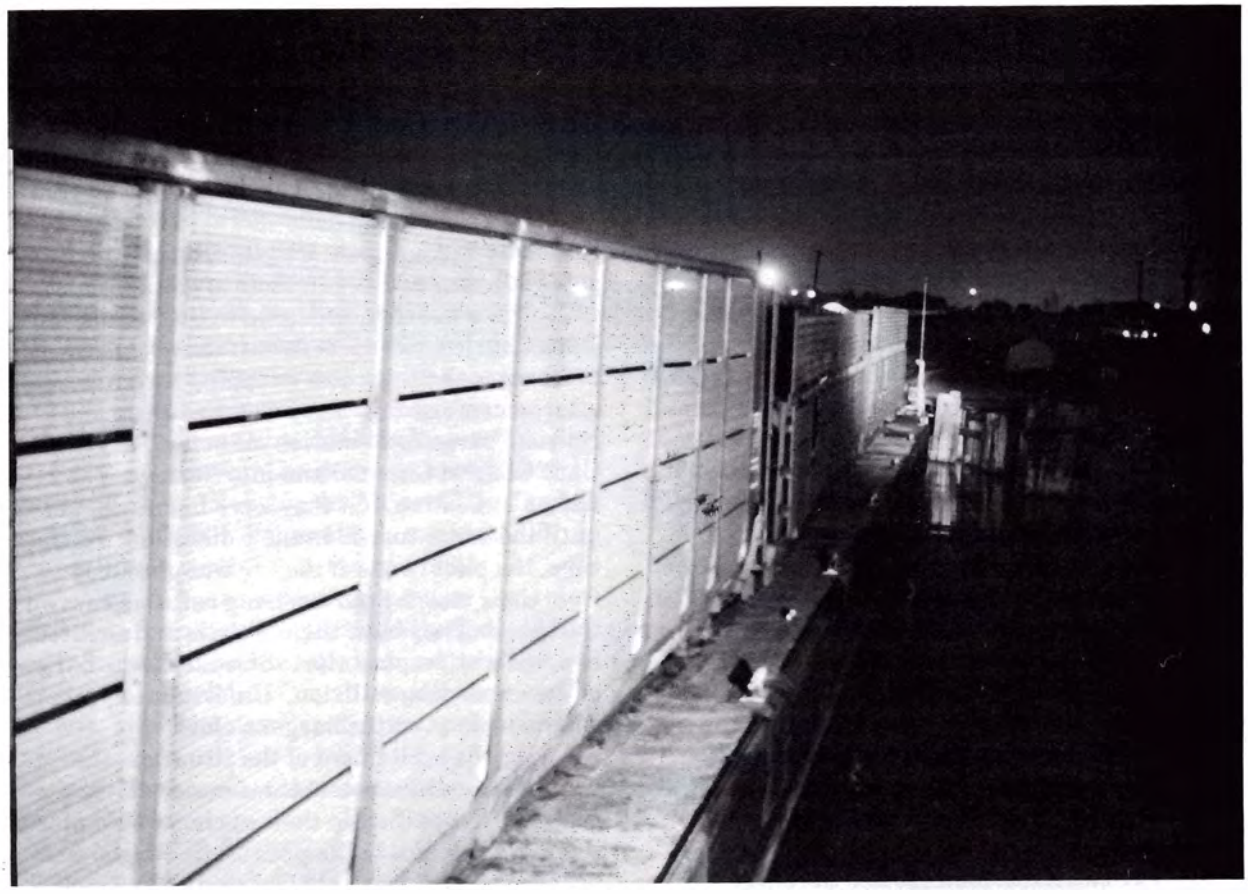

This photo was taken from the pilot house of the tug after it arrived in Little Creek, Virginia. *(Photo by LTJG Don Noviello)*

Eastern Shore and the south side of the Chesapeake Bay and had not had any problems.

History Repeats Itself

A similar case occurred in September 1984 when a tug was pushing a heavily laden barge in the James River near Newport News, Virginia. Although the tug had an elevated pilot house, the operator still had to contend with a blind spot that extended nearly a half-mile in front of him due to the size of the barge. Tragedy struck when the barge collided with a small pleasure boat filled with three fishermen. One man died and another was knocked unconscious. Another nearby fisherman who witnessed the collision caught up to the tug and informed the operator that he had hit another vessel. The operator had no lookout posted at the time of the collision and was unaware that he had collided with someone. The operator was charged with negligence and misconduct under the provisions of 46 USC 7703, and both charges were found proved by the Administrative Law Judge. When the decision was appealed, the Commandant of the Coast Guard maintained that "where the operator assumes the position of a lookout as well as that of the operator his vision must be unobstructed." The Judge's decision was upheld by the Commandant.

The Hearings

Both Cape Charles incidents resulted in the filing of charges of negligence and misconduct against the operators of the tugs: negligence for failing to maintain a lookout and misconduct for failing to sound proper signals or take action to avoid a collision. Both men admitted that they secured their lookouts early and went on to contend that fishing boats were generally obligated to get out their way.

The investigators filed a motion with the Administrative Law Judge for a "view" of the tug and barge combination. They wanted the judge to see for himself, on site, the enormous blind spot involved and the hazards it presented. The Judge granted the motion, and the

investigators arranged for a 41-foot boat from Station Little Creek to transport the Judge, the respondent, a company representative, and the investigators out to the tug while she was underway with the barge. They rode the tug and barge on a part of its voyage into Little Creek, Virginia. The impact of the "view" upon the Judge was profound.

The Administrative Law Judge found all charges proved against both men and he suspended outright for 1 year the license and merchant mariner's document of the operator in the first collision. Since the operator of the tug in the second collision had no license, the judge revoked his merchant mariner's document. He indicated in his decision and order for the second collision that "it is my opinion that the respondent was negligent, in failing to maintain a lookout on the Chesapeake Bay as well as the Cape Charles Channel, and that negligence directly resulted in allision with the [victim's] boat."

Conclusions

A lookout in any of these three incidents could have prevented the accidents. Rule 5 of the Rules of the Road (both Inland and International) states that "Every vessel shall at all times maintain a proper lookout by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision." The lookout may be the operator, but if something prevents the operator from fully assessing the conditions or situation, like a blind spot, another lookout also must be employed. There are no exceptions for adverse weather or miserable conditions. Indeed, a lookout often is the eyes and ears of the ship in unpleasant conditions.

The tug operators who lost their licenses did so because they grossly erred in their judgment when they acted as lookout from the pilot house with a huge blind spot in their tow make-up. Their negligence inflicted suffering, and in one case death, upon innocent pleasure boaters. Operators of all vessels should be aware that blind spots and obstructions call for additional lookouts. The necessity of a *proper* lookout cannot be emphasized enough in high traffic areas. A lookout could have saved these operators a great deal of money and could have spared the victims a great deal of harm.∎

SOLAS, Tanker Steering Gear, and 1988

On September 1, 1988, the last in a series of steering gear requirements for existing tankers in international service goes into effect. SOLAS Regulation II-1/29.20 requires tankers of 40,000 gross tons (and over) that were built prior to September 1, 1984 to meet a single failure criteria for their steering gear hydraulic piping and power units. Simply stated, SOLAS requires these vessels to:

Meet the retroactive steering gear requirements of SOLAS Regulations II-1/29.19 that came into effect on September 1, 1986;*

and

Be able to maintain steering capability after a single hydraulic failure;

or

Be able to restrain rudder movement after a single hydraulic failure and be able to **speedily** *regain steering capability.*

SOLAS lists three specific means of meeting this criteria, although several variations have been approved and successfully employed. Most vessels have already been modified. Detailed guidelines for the design and testing of steering gear to meet this regulation are available from the Commandant (G-MTH-2) by calling (202) 267-2206.∎

*See "SOLAS, Steering Gear, and 1986" in the September 1986 issue of *Proceedings*.

Fatigue and Reduced Manning

Sean T. Connaughton

It was past midnight when the Chief Mate finally got to sleep. Before standing his usual 8 to 12 watch, he had spent the day supervising the washing and mucking out of the cargo tanks in preparation for the next day's loading. After only a few hours of sleep, he was up and about again making last-minute inspections to ensure that the cargo systems were lined up properly, as well as completing the finishing touches to the loading plan. He then proceeded to the bridge for the vessel's docking. By 0700, the vessel was made fast alongside the marine oil terminal, and the vessel commenced to deballast. By 1300, the vessel had completed deballasting, the cargo tanks inspected and certified ready for cargo, and loading operations begun. Loading operations continued throughout the remainder of the day and into the night, largely under the Mate's supervision. By 0230 the next day, the last remaining tank was finally topped off. While the vessel prepared for sea, last-minute cargo and stability calculations, and an inspection of the cargo system, were completed. Once the vessel was clear of the dock, the Mate went back to his office to complete last-minute cargo and stability calculations for the Master's departure message as well as to begin planning for the discharge ports which lay ahead in the next few days. The thought crossed his mind when he finally lay down for some sleep before he went on watch was that he still had another 30 days like this until this rotation was over.

The above scenario is not new; the incidence of extended work hours in the marine industry is probably as frequent today as during any time in the industry's history. However, long hours, combined with demanding working conditions and the environmental conditions aboard a merchant ship, can have a detrimental effect upon an individual. These conditions sometimes result in the physical and/or mental exhaustion of an individual, commonly referred to as fatigue. Since fatigue can inhibit the physical and mental capabilities of an individual, it can have a major impact upon marine safety.

The issue of fatigue is receiving a great deal of attention. Fortunately, this increased attention is not the result of a catastrophic marine casualty but in reaction to the worldwide trend to reduce manning on board merchant ships. Many U.S. operators, in order to remain competitive, have attempted to minimize their operating expenses by reducing their personnel costs. The impact of these changes has been dramatic, with overall crew sizes being reduced as much as 50 percent in several instances. To many, reduced crewing is synonymous with fatigue.

The Coast Guard is extremely aware of the possible relationship between reduced manning and fatigue. The Coast Guard has been mandating the minimum number of personnel required on U.S.-inspected vessels since it assumed this function from the Bureau of Marine Inspection and Navigation in 1942. Until recent times, this activity had generally been of little concern to the industry. There are several reasons for this, with the most prevalent being the industry practice of crewing U.S. merchant vessels with numbers which substantially exceeded those required by the Coast Guard. By operating vessels with more personnel than required, the Coast Guard-mandated levels were usually not indicative of a vessel's actual complement. With the move to reduce vessel crews in recent years, however, the crewing levels on many modern merchant vessels now more closely reflect the levels required by the Coast Guard. Consequently, Coast Guard minimum crewing standards may now have a more direct impact on personnel fatigue on board merchant vessels.

In setting crewing level for a merchant vessel, the Coast Guard determines the minimum complement necessary to ensure the

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vessel's safe operation. Each inspected vessel is considered independently with emphasis given to vessel type, size, service, route, equipment, and degree of automation. The crewing level derived from this evaluation must also be consistent with the relevant statutes and regulations. Included in these statutes and regulations are provisions regarding work hour limitations. The Coast Guard utilizes these limitations when determining the complement so that the potential for personnel fatigue is minimized. The statute most commonly used states that seamen (including licensed individuals) on certain vessels may not be required to work more than 8 hours in one day (except in emergencies and other specified circumstances).

Work hour limitations, however, do not guarantee that fatigue will not occur. A fundamental problem is that shipboard conditions affect individuals in different ways. Twelve-hour work days may cause "classic" symptoms of fatigue in some individuals, such as drowsiness and diminished abilities, but not in others. While numerous studies have been conducted on the relationship between fatigue and the individual, only a few have taken into consideration the marine environment. The lack of information concerning fatigue in the marine industry makes it difficult to correct the conditions which lead to its detrimental effects.

To receive a better understanding of the extent of the fatigue problem, the Coast Guard has reviewed its casualty data from recent years and found that less than one percent of marine casualties investigated by the Coast Guard involve fatigue. It is suspected, however, that this data may not be truly representative of the incidence of fatigue on U.S. vessels. In an effort to improve its data, the Coast Guard recently distributed guidance to its field inspection offices concerning the issue of crew member fatigue. This guidance emphasizes that personnel fatigue be considered during the course of marine casualty investigations.

Additionally, the Coast Guard is funding a study by the National Research Council, entitled "The Effect of Smaller Crews on Maritime Safety," to evaluate the effects of reduced manning on safety. The Coast Guard has participated in discussions concerning fatigue at the International Maritime Organization (IMO), and this issue is now an agenda item for the IMO Subcommittee on Standards of Training and Watchkeeping. The Coast Guard is also continuing discussions with maritime labor and management regarding the issue of future crewing of vessels. In addition to the above referenced guidance concerning marine investigations, Coast Guard field offices were urged to more closely consider the issue of crew member fatigue when determining minimum crewing levels. Through these efforts, the Coast Guard hopes to obtain additional data regarding the fatigue problem, and determine whether regulatory or policy changes are necessary.

While these efforts will increase an understanding of the issue of fatigue, there are initiatives which presently can be pursued to avoid the overburdening of marine personnel which can lead to fatigue. Several possible areas that both management and labor should consider examining to ensure continued safe vessel operations while maintaining minimum crewing levels are described below.

Redefine Shipboard Personnel Practices

While common sense dictates that the personnel practices on board a ship with a 20-person crew would be dramatically different from those of a 40-person crew, such is often not the case. Due to a variety of reasons, many ships continue to utilize traditional personnel practices which consume vast amounts of effort, with only marginal benefits. Examples include standing watches in fully functional automated enginerooms, having shipboard personnel perform many duties that can be accomplished by shoreside personnel, utilizing licensed individuals to perform duties which can be accomplished by the unlicensed crew, and condoning inordinate amounts of overtime.

Redefine Shoreside Personnel Practices

Before today's instant communications, and when marine operations were particularly labor-intensive, a ship had to be prepared for every eventuality since many ports had few facilities to accommodate all ship operations. A merchant ship had to have on board enough personnel to satisfy every possible deck, engine, stewards, cargo, maintenance, and clerical need. Now, however, it could be possible to move many shipboard functions ashore.

A thorough review of present shipboard work and shoreside support should be performed to discern methods of decreasing the workload placed on shipboard personnel. Could shoreside personnel relieve shipboard personnel of such paperwork as payroll and entrance/clearance documents? Could a company clerk be responsible for maintaining charts, publications, and manuals for the fleet in a company office? Could a company representative oversee cargo operations? Could shore gangs or riding crews perform maintenance currently done by vessel personnel? Could maintenance contracts be effectively utilized to free vessel personnel from many of these duties? These are just some examples of possible areas that could be considered to reduce the workload burden on vessels' crews.

Utilize Automation

Increased automation is another method which could be considered in decreasing shipboard workloads. While the term "automation" usually conjures up images of extensive, and expensive, systems such as automated machinery spaces, automation can be something as simple as personal "beepers" to call personnel instead of having someone physically going to find an individual. Another example is the use of reels for mooring lines. This simple automation device has significantly decreased the amount of labor associated with mooring and unmooring a vessel. There are numerous other possibilities for decreasing workloads. Galley facilities and stewards duties are two areas where simple automation or other arrangements can decrease the amount of human effort necessary. Cargo equipment, bridge watch stations, and the engineroom are areas where more sophisticated or advanced automation need to be utilized.

Revise Work Schedules

As stated before, the Coast Guard refers to work hour limitations when considering fatigue. These limits, however, can be deceptive. As studies have shown, individuals perform best when they are on a regular work/rest cycle, and simple limits on work do not necessarily lead to regular work cycles. Rearranging work schedules could address a major cause of fatigue and unbalanced work periods, as well as possibly providing qualified individuals for watch augmentation and relief.

Is it possible to assign individual to a regular work schedule which they would stay on during an entire voyage? Is it feasible for watchstanders to regularly stand 8-hour watches, rather than the traditional 4 hours? Could maintenance workers be divided into rotating work schedules to coincide with regular watches so that they are readily available to augment regular watchstanders? Is a three-watch system the most appropriate method to reduce the likelihood of fatigue, or is some other watch or work schedule better? Although some initiatives might not be in compliance with the statutory work hour and watch provisions, these alternatives should be considered and, if appropriate, revisions to the law might be appropriate.

Eliminate Labor-Management Impediments

There are presently many labor and management policies and agreements that limit the effective utilization of ship's personnel. Consideration should be given to the elimination of these limitations so as to ensure that personnel are fully utilized and are available to safely operate the vessel.

Conclusion

It must be stressed that fatigue, as a marine safety issue, is the entire industry's responsibility. The Coast Guard does not have unlimited authority or resources to address this issue. Management and labor must do whatever they can to ensure that the incidence of crew member fatigue is minimized. Some of the initiatives mentioned here might be considered to ensure that the workload of vessels' crews is consistent with the actual number of personnel carried. Although the Coast Guard will continue its efforts, the cooperation of all parties involved is necessary to ensure that fatigue is controlled and that current levels of safety are maintained.▮

A Few Words on Nonmetallic Expansion Joints

LCDR John D. Koski

There's a problem out there, and vessel owners, operators, and inspectors need to be aware of it so that major marine casualties may be avoided. The problem is that nonmetallic expansion joints in seawater systems are failing, and engine rooms are flooding because of it. This article's purpose is to alert industry personnel and vessel inspectors of this situation, discuss proposed regulatory changes intended to remedy the problem, and provide guidance on how to ascertain the condition of nonmetallic joints.

A Few Examples

In June 1982, the U.S. tankship **Ogden Willamette** suffered major engine room flooding when a 26-inch nonmetallic expansion joint in the low sea suction failed. With the vessel sinking and the possibility of a boiler explosion, the master ordered the ship abandoned. Fortunately, the vessel did not sink, an explosion did not occur, and the **Ogden Willamette** was able to be towed to safety, dewatered, and repaired. There was no loss of life and no significant pollution. The cost of repairs totaled over $1 million.

In May 1986, another U.S. tankship, the **Prince William Sound**, also suffered major engine room flooding when a 36-inch nonmetallic expansion join in the main seawater circulating system failed. In this instance, the water rose to a level 61 feet above the keel in the machinery space. Once again, the vessel did not sink, there was no loss of life, and no pollution resulted. The cost to repair the **Prince William Sound** was in excess of $12 million.

It is extremely important that nonmetallic expansion joints be frequently examined for signs of wear, damage, or deterioration. Because of the head pressures to which seawater systems are subjected and the high volumes for which they are frequently designed, very rapid flooding of an entire machinery space can result if an expansion joint fails, as these two casualties clearly indicated. It is fortunate that the vessels involved were tankships. Had either been a cargo ship, constructed, as most are, to no specific subdivision or damage stability criteria, a sinking most certainly would have occurred. Casualties such as these give credence to the International Maritime Organization's efforts to develop subdivision requirements for cargo ships.

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How To Inspect Expansion Joints

Nonmetallic expansion joints are designed to meet specific criteria which will be encountered over their life. Expansion joints are designed to absorb relatively small vibratory and axial movements between fixed piping sections or fixed piping and operating machinery. They are not intended to correct piping misalignments. Misalignment causes undue stresses to be placed upon joints and can lead to joint failure. It is extremely important that piping be securely anchored as designed. Flange alignment and spacing must remain true. The dynamic forces which result from changing loading conditions and wave action upon a vessel necessitate periodic verification of relative flange positions to ensure they remain within acceptable limits. In addition, design operating pressures and temperatures must not be exceeded, and joints must be protected from physical damage.

As a result of the **Ogden Willamette** casualty, the Coast Guard developed nonmetallic expansion joint inspection guidelines for its marine inspectors. These are contained in Section 8 of Volume II of the

Marine Safety Manual and are presented here. Between inspections by the Coast Guard, vessel personnel must periodically inspect nonmetallic expansion joints to ensure that they are sound and suitable for continued service. The following symptoms are indicative of weakened joints. If any are discovered, the recommended corrective action should be taken.

Flange leakage. Most nonmetallic expansion joints use split metallic retaining rings to distribute bolt loads around the joint flange. The retaining ring ends should be as close together as possible, and flat steel washers should be used on the bolts over the ring sections. The bolts should be tightened uniformly by moving alternately around the flange from bolt to bolt until the rubber on the joint flange bulges slightly and uniformly between the steel retaining ring and the piping flange. Minor leaks at the flange are likely to be corrected by following this procedure. Larger leaks would necessitate joint renewal.

Cracks at the base of the arch or flange. Cracks in these areas are caused by pipe movements that unduly stress the joint. This commonly results from initial misalignment, excessive movement, or improper anchorage of the pipe. Cracks may sometimes be repaired, but only in accordance with manufacturer's recommended practices, and only after approval is granted by the cognizant Officer in Charge, Marine Inspection (OCMI). Additionally, the cause of the cracking must be determined and corrected.

Ballooned or otherwise deformed arches. This condition indicates that the interior reinforcing rings or wire have been displaced. It is usually a result of the expansion joint being subjected to internal pressures higher than those for which it was designed. Joints with ballooned or otherwise deformed arches must be replaced. Prior to replacement, the system working pressure should be verified for the manufacturer to supply a joint which is suitable for the system's range of pressure.

Loose outer body fabric. A feeling of softness or looseness near the surface of the arch indicates a loss of adhesion between fabric plies. If plies have separated, the joint must be replaced.

Spongy feeling of the joint body. Manufacturers apply a sealant to the edges around the flange and bolt holes to prevent moisture from entering between plies. When moisture penetrates the interior of a nonmetallic expansion joint, the fabric plies deteriorate, and the joint body becomes spongy. When moisture penetration does occur, it is usually initiated by loose bolts, which allow deterioration of, or cause physical damage to, the bolt hole sealant. Expansion joints exhibiting this symptom should be replaced, and the operating conditions which caused it (faulty installation, excessive pipe movement, improperly sized bolts) should be determined and corrected.

Hardness and cracking of the cover. Hardness and cracking of the cover are caused by exposure to extreme heat, chemical fumes, ozone, and other elements encountered during service conditions. Joints exhibiting these defects must be replaced. The cause of the condition should be determined and corrected.

Cuts and gouges in the cover. Cuts and gouges in the cover are caused by careless handling and physical damage from tools or other objects. Depending on their severity, such flaws may sometimes be repaired. Repairs should be made only after consulting with the expansion joint manufacturer and the cognizant Officer in Charge, Marine Inspection (OCMI).

Life expectancies of nonmetallic expansion joints depend on their applications and upon their surrounding environments. In addition to the above symptoms, aging deterioration is inevitable, since the principal materials used to fabricate joints are usually organic in origin, such as rubber and cotton fibers. Aging deterioration results in hardness and cracking of the cover or loss of adhesion between the fabric plies. Joints with these symptoms should be replaced as described above. Complete internal examinations of nonmetallic expansion joints should be made whenever they are available for inspection or whenever an external examination reveals signs of deterioration or damage. If an adequate external or internal examination cannot be made in place, joints should be removed for inspection. When a new joint is installed, it is important that the design specifications of the joint are compatible with the dimensional, pressure and temperature, and environmental conditions which will be encountered in service.

Proposed Regulatory Changes

A regulatory change is presently underway which is intended to reduce the

chances of nonmetallic expansion joint failures. The proposed regulations, if promulgated, would affect vessel owners and operators, expansion joint manufacturers, and marine inspectors. Nonmetallic expansion joints would be required to be inspected externally at each inspection for certification for signs of excessive wear, fatigue, deterioration, physical damage, misalignment, improper flange-to-flange spacing, or leakage. To enable inspectors and vessel personnel to ascertain whether the design parameters of a nonmetallic expansion joint are being exceeded, each expansion joint would be required to be marked with its nominal diameter, maximum allowable working pressure and temperature, the recommended face-to-face flange spacing, and the month and year of manufacture. Finally, because a contributing cause of expansion joint failures is aging deterioration, nonmetallic expansion joints in seawater service systems would be required to be renewed within 10 years of their date of manufacture.

Two Final Examples

Two final examples of expansion joint failures are presented to serve as illustrations of how prompt and proper action can prevent a catastrophic situation.

In March 1963, the **Esso Zurich** experienced a failure of a nonmetallic expansion joint on the discharge side of the main circulator pump. The chief engineer immediately ordered the first assistant and third assistant to put the auxiliary plant in service and the oiler to start the bilge pumps. He then notified the bridge, informed the mate on watch of the flooding, and had him summon all engineering personnel. The main engine was stopped, and all sea connections to the main condenser, including cross-over valves, were closed and checked. With the water level at 5 feet, the first assistant and the machinist entered the bilge and, by feel, located the ruptured expansion joint. They then looped a twisted wool blanket around the joint so it could apply pressure against the hole, whipped it with line, and applied supporting rags. After the bilges were pumped dry and it was determined that all sea connections were holding tight, the expansion joint was removed from the line and used as a template for a blank for the condenser side of the main circulator pump. The main condenser was then put back in service with the auxiliary circulator, and the vessel proceeded to port under her own power.

In June 1987, an alert deck machinist aboard the **Santa Adela** discovered a small leak in the bottom of a 28-inch nonmetallic expansion joint on the inlet side of the main condenser. The chief engineer was notified, and temporary repairs were made by wrapping the joint with manila line and rags. The vessel was able to proceed to port where the joint was replaced.

There's a problem with shipboard nonmetallic expansion joints, and vessel owners, operators, and inspectors need to be alert to it. Nonmetallic expansion joints serve an important purpose in shipboard piping systems, but they are prone to failures in ways which metallic pipe and components are not. They must be frequently and carefully inspected for signs of wear, deterioration, or damage. This is especially true when they exceed 10 years of age, since the materials used to fabricate joints are generally organic in nature and prone to natural aging deterioration. Piping must be inspected to ensure that proper alignment and flange spacing is maintained. Watchstanders must be alert during their rounds for joints which leak or show signs of imminent failure. Vessel personnel must be familiar with the piping and valving arrangements of all seawater systems so that, in the event of a joint failure, the damaged portion of the system may be isolated from the sea and the ingress of water quickly stopped.

Nonmetallic expansion joints are one of those items which are too often overlooked and taken for granted. This article has been written to serve as a reminder to take a little time now to inspect their condition. It may prevent a big problem later.

Correction

The February 1987 issue of *Proceedings* contained an article entitled "Watertube/Firetube Hybrid Boilers." The article indicated that, for inspection purposes, these boilers should be considered to be of the watertube type and hydrostatically tested quadrennially. This statement was in error. Hybrid boilers should be viewed as firetube boilers and hydrostatically tested annually.


USCG

"I Love You Both. Goodbye."

Survival and Death in the Pacific Ocean

PS2 Michael M. Zanoni

Stories of survival always contain elements of tragedy. The events associated with the sinking of the fishing vessel **Lisa Lorraine** off the California coast present a story of heroism, friendship ending in poignant tragedy, and rescue. The factors involved with survival demonstrate the important points of proper clothing and the will to live. The loss of lives illustrates how independent factors can quickly combine to produce unfortunate consequences.

Circumstances

On February 5, 1988, the 58-foot steel-hulled dragger **Lisa Lorraine** left Pillar Point Harbor, near Half Moon Bay, California. The four young men on board were experienced fishermen. Their destination was the grounds near the barren Farallones Islands, approximately 20 miles west of San Francisco. Around 0200 on February 6, they were anticipating the end of a successful crabbing expedition. Crew member Greg Hayes was asleep below. Grant Coles and James Chew, both 22 years of age, were on deck using an outrigger and a block to raise crab pots from the sea bottom. Keith Young, age 31, was operating the vessel from the wheel house. The weather was relatively calm, with periodic gusts and a 3-foot chop. Visibility was so good that Coles recalled being able to see the glow from San Francisco.

As the crab pots were lifted, Chew would dump their catch into a bucket and then place the pot on the after deck of the boat. He later stated that there were 74 pots weighing 100 pounds each on the deck.

Petty Officer Zanoni is a member of the Coast Guard Reserve. He holds a Ph.D. in criminology and is licensed by the State of California as an investigator.

Chew was dressed in jeans with sweatpants underneath, a cotton sweater, and a down jacket. Over all of this he was wearing a rain slicker and rain pants. He had on heavy socks and rubber boots. Coles was dressed in a similar fashion. Both were wearing wristwatches.

The Casualty

Young maneuvered the vessel next to a crab pot float. Chew attached a line, and Coles began pulling the pot up with a winch. As sometimes happened, the line slipped out of the block. Young turned the boat hard to starboard in order to slack the line and allow it to be replaced in the block. As he completed the turn, the vessel came back onto an even keel and then very slowly continued rolling to port. Chew thought something was wrong immediately and looked toward the crab pots, thinking that they had shifted. He saw that they were in place, but knew that the boat was going to roll over when the port rail dipped toward the water.

Coles went below to alert Hayes. The roll had tossed Hayes from his bunk, and he was already coming on deck. Since he had been asleep, he was clad only in jeans and a short-sleeved cotton shirt.

Coles then went to the pilot house to obtain survival suits. He was met by a wall of water rushing around the house. He could not see Keith Young, but kicked out a window to see if he was trapped inside. Coles was forced back by the water washing over the house.

As the vessel rolled over completely, the men were able to climb over the rail and walk the hull as it turned under them. Coles, Chew, and Hayes huddled on the overturned hull. They called for Keith Young but did not see or hear anything. Next, they tried to spot the 15-man liferaft that had been on deck. Chew recalled hearing the auto-inflator "pop," but apparently the raft had become fouled in the

rigging as the boat turned over. Less than one minute had elapsed since the turn.

Soon the vessel began sinking. Seeing a hatch cover approximately 4 feet square floating by, they jumped into the water and held on to the cover. They tried to find other debris to assist, but none was nearby. The boat went under completely in less than 5 minutes.

The three men held on to the hatch cover and drifted. Hayes especially was suffering from the cold water. They alternately prayed and discussed what to do about their situation. Hayes was particularly upset because he was engaged to the daughter of the owner of the boat. Also, Hayes' father had been a fisherman and had drowned at sea approximately 2 years before.

After about 2 hours, Hayes was growing progressively weaker. Finally, he said to Coles and Chew, "I love you both. Goodbye." He then let go of the hatch cover and drifted away. Chew saw him go under and not resurface. Both Coles and Chew were so weakened by hypothermia that they could not assist Hayes. It was obvious to them that Hayes had lost the will to live and was not able to continue fighting the cold.

Coles and Chew got onto the hatch cover and sat back-to-back, trying to stay out of the water. When daylight came, hope increased that they would be spotted by another fishing boat. But none was seen, and soon the bright sun was playing tricks with reflections and mirages.

The Rescue

No one knew the vessel had sunk, and they were not overdue. They continued praying and looking for another vessel. At 0900 they were spotted by a 22-foot powerboat, which circled them twice before coming alongside -- the operator was unable to believe what he saw in the water. They were taken on board, and Coast Guard Group San Francisco was notified by marine radio. A helicopter was immediately dispatched. When it was learned that the survivors could not stop shaking and had lost manual dexterity, a Coast Guard emergency medical technical (EMT) swimmer was dropped from the helicopter to assist. Coles and Chew were hoisted aboard the helicopter and taken to Letterman Army Hospital at the Presidio, San Francisco.

Search and rescue photo from the Coast Guard files.

With a water temperature of 52°F, the probability of death is 99 percent for a person in the water without a survival suit for 3-1/2 hours. Coles and Chew had been adrift over 7 hours at the time of rescue.

The helicopter returned to the rescue area and located a large oil slick and debris. An extensive air search was conducted, focusing on a projected drift as demonstrated by the oil slick. Two survival suits and an empty survival suit pack were found. There was no sign of Keith Young, and he is presumed to have drowned.

Treatment

Survival in a hypothermia situation requires correct and prompt medical treatment. If a person's "core" temperature falls below the area of 93°F, then shivering stops and the body cannot rewarm itself without assistance. Temperature will continue dropping until unconsciousness and death result. If attempts are made to rewarm the victim by the sudden application of external heat, the body temperature may be lowered even more. This is because the surface capillaries expand, allowing blood to rush into areas of the extremities that are still quite cold. Proper treatment involves slow rewarming and treatment for shock and exhaustion.

In the case of Coles and Chew, at Letterman Army Hospital they were given warm, moist oxygen, intravenous dextrose solution that was warmed by a heating pad-like arrangement, and were placed under several infrared heat lamps. Their body core temperatures were monitored by rectal temperature probes. Within 6 hours of the rescue, they were able to walk from the hospital. Both had extensive bruising and abrasions from attempting to stay on the hatch cover, but were otherwise sound.

Presumed Cause of the Casualty

Several hours prior to the sinking, a line had become fouled around the propeller. This was quickly removed, but it is presumed that it had wrapped tight enough to pull the shaft away from the packing gland. This would allow sea water to leak along the shaft tunnel and into the fish hold. This hold was separated from the engine room by a steel bulkhead. It would have been possible for any leakage into the engine room to be handled by the bilge pumps, but either no water leaked into the engine room or the pumps did not operate. If the fish hold contained a large amount of water, any significant movement of the fishing vessel would create a free-surface effect. The mass and inertia of the moving water would exert a force that would progressively change the center of gravity. With almost 2 tons of crab pots on the aft deck, an out-of-balance situation could then easily result without there being any apparent freeboard or draft problems. Upon coming out of the right turn, the movement of the water in the hold could exert a force which would explain the roll to port and subsequent overturning of the vessel.

Conclusion

The survival of Coles and Chew can be attributed to their heavy clothing, remaining out of the water as much as possible, and maintaining their will to live. The loss of Greg Hayes should be seen as a case where minimal clothing, combined with cold water exposure, resulted in his physical and mental strength being so depleted that he could not continue.

The sea is a relentless schoolmaster. We can learn through the experience of those persons fortunate enough to survive mishaps that would normally leave only scattered floating debris. The lesson here is that despite the presence of survival suits, personal flotation devices, VHF radios, an EPIRB, and a liferaft, the vessel went over so fast that one man was trapped and three others found themselves in the water for an extended period, resulting in further loss of life.∎

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Purged and Pressurized Enclosures

Thomas M. Nolan

This article is the second in a series on "Electrical Installations in Hazardous Locations". It follows "Intrinsically Safe and Nonincendive Systems" published in the November 1987 Proceedings, *which discussed classification of hazardous locations and the proper application of low energy circuits.*

When electrical equipment is installed in areas where flammable gases or vapors may be present, the electrical equipment must be designed or protected so that it is not a source of ignition. The regulations for hazardous areas on vessels and mobile offshore drilling units ensure that the electrical equipment in these areas is adequately protected. Purged or pressurized enclosures are a suitable alternative to explosion-proof equipment, and for some applications, intrinsically safe and nonincendive systems in Division 1 and 2 hazardous locations.

Purged or pressurized equipment and enclosures are permitted by the electrical engineering regulations (46 CFR Subchapter J) for the protection of hazardous are equipment. The regulations require that this type of equipment be constructed to the National Fire Protection Association (NFPA) Standard 496, Purged and Pressurized Enclosures for Electrical Equipment.

The NFPA standard addressed pressurized instrumentation and other small enclosures in Class I locations, power equipment closures in Class I locations, pressurized instruments and other small enclosures in Class II locations, and pressurized power equipment in Class II locations.

The standard defines pressurization and purging as follows:

Pressurization: The process of supplying an enclosure with clean air or an inert gas with or without continuous flow at sufficient pressure to prevent the entrance of combustible dusts.

Purging: The process of supplying an enclosure with clean air or inert gas at sufficient flow and positive pressure to reduce to an acceptably safe level the concentration of any flammable gas or vapor initially present and to maintain this safe level by positive pressure with or without positive flow.

There are three types of purging protection in NFPA 496: Type X, Y, and Z.

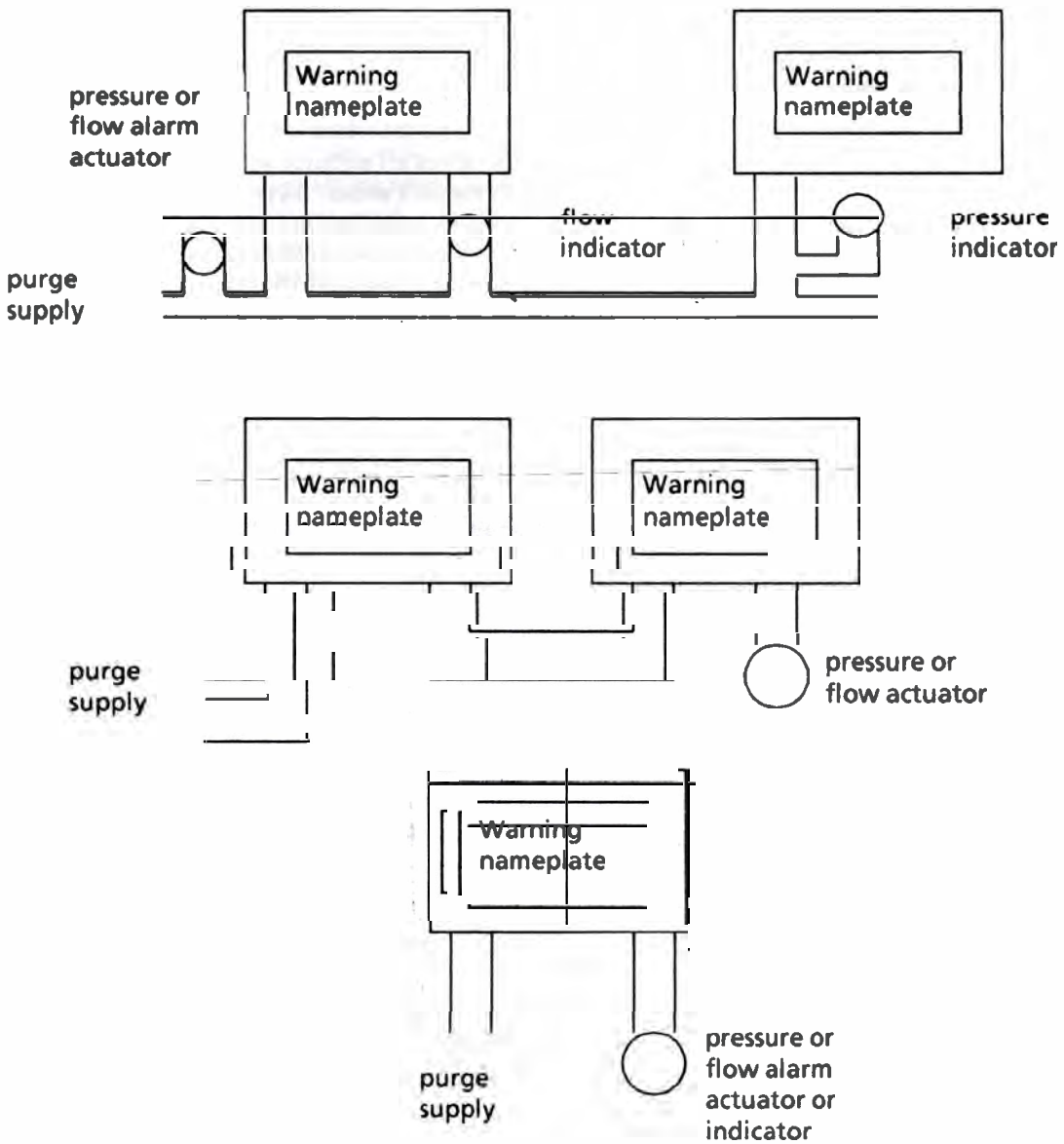
Type Z purging reduces the classification within an enclosure from Division 2 to nonhazardous. With type Z purging, a hazard is created only if the purge system fails at the same time that the normally nonhazardous area becomes hazardous. For this reason, it is not considered essential to remove power from the equipment upon failure of the purge system.

Type Y purging reduces the classification within an enclosure from Division 1 to Division 2. The equipment and devices within the enclosure must be suitable for Division 2. This requires that the enclosure not contain an ignition source under normal conditions. Thus, a hazard is created within the enclosure only upon simultaneous failure of the purge system and of the equipment within the enclosure. For this reason, it is not considered essential to remove power from the equipment upon failure of the purge system.

Type X purging reduces the classification within an enclosure from Division 1 to nonhazardous. Because the probability of a hazardous atmosphere external to the enclosure is high and the enclosure normally contains a source of ignition, such as a hot element or arcing contact, it is important that any

Thomas M. Nolan is a staff engineer in the Electrical Section, Marine Technical and Hazardous Materials Division, at U.S. Coast Guard Headquarters.

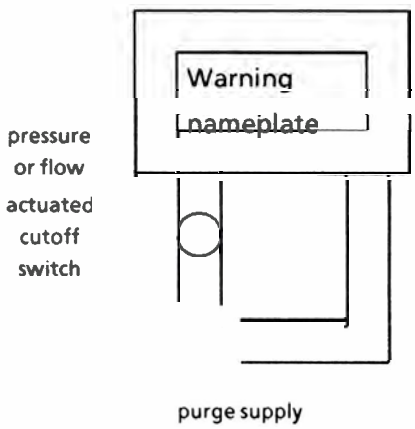
Diagram 1 Typical Type Y and Type Z Purging



interruption of the purging results in deenergizing the equipment. Also, it is essential that the enclosure be tight enough to prevent the escape of sparks. When type X purging is used in purged power equipment enclosures in Class I locations, power to the equipment should be immediately removed upon loss of pressurization, unless immediate loss of power would result in a more hazardous condition, such as not allowing for the *safe* shutdown of a process or system.

The NFPA standard presents some diagrams of acceptable installations for Types X, Y, and Z purging (see Diagrams 1 and 2). The NFPA standard requires that a nameplate be mounted on the enclosure in a prominent location so that it can be seen before someone opens the enclosure. The name plate should contain the following statement (or equivalent):

Diagram 2 Typical Type X Purging



Enclosure shall not be opened unless the area is known to be nonhazardous or unless all devices within have been deenergized. Power shall not be restored after enclosure has been opened until enclosure has been purged for ____ minutes.

It is apparent from this requirement that purged or pressurized enclosures should be designed in such a manner that *normal operation* of the equipment does not require that the enclosure be opened. Therefore, opening in the enclosures for inserting computer disks or slots for computer printouts and normal procedures that require the enclosure to be opened to retrieve data or take readings should be avoided. The NFPA standard has very specific requirements for purged or pressurized enclosures, and they must be adhered to.

All three types of purging require the warning nameplate. Type X purging generally requires an interlock which immediately deenergizes all circuits which are not suitable for Division 1 areas. Type Y purging does not require an interlock but requires an alarm which operates when the enclosure is opened. Type Y is suitable for Division 1 if the internal components are suitable for Division 2. Type A purging is suitable for Division 2 and requires an alarm, but does not place restrictions on internal components.

A copy of NFPA Standard 496 may be obtained by contacting the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

If at all possible, electrical equipment should not be installed in hazardous locations. However, when it cannot be avoided, special precautions must be taken to ensure that electrical installations are not a source of ignition. The purging or pressurizing of electrical equipment enclosures can provide an alternative to explosion-proof enclosures, intrinsically safe or nonincendive systems, depending on the classification of the hazardous area in which the equipment is to be utilized.∎

New Publications

Shipmaster's Handbook on Ship's Business

Cornell Maritime Press is pleased to announce the availability of a totally revised and updated edition of a book that has been an invaluable aid to shipmasters around the world for nearly 20 years. The Shipmaster's Handbook is a complete guide for the newly appointed master and useful as well to the experienced master. The book is a "checklist" for the myriad forms, statements, and paperwork required in all phases of ship's business including shipping articles, vessel documents and certificates, crew lists, customs, immigration, accounting, bills of lading, charter parties, vessel accidents, logbooks, and others.

The author is a graduate of the California Maritime Academy with a B.S. in nautical science. Captain Aragon has been going to sea for 15 years, serving as master on a variety of vessels, coastwise and foreign, for U.S.- and foreign-flag carriers.

Shipmaster's Handbook on Ship's Business, Second Edition, by James R. Aragon, based on the original edition by Ben Martin, is available at the price of $24.00, postage paid, from Cornell Maritime Press, P.O. Box 456, Centreville, MD 21617.

Guide for Building and Classing Fishing Vessels

The American Bureau of Shipping (ABS) has developed standards for the design, construction, and periodic survey of fishing vessels, entitled *Guide for Building and Classing Fishing Vessels*. It is the intention of ABS that this *Guide* will be recognized by industry, government, regulatory agencies, underwriters, and others connected with the fishing industry as an authoritative source of criteria for the mechanical and structural fitness of fishing vessels. The development of this 288-page, 31-section *Guide* has been based on the extensive experience with all types of vessels and marine structures, including the classification of over 1,000 fishing vessels.

Of particular concern to ABS in the development of this new *Guide* is the subject of intact stability (the ability of a vessel to right itself when heeled over from any outside cause, if the vessel's hull is intact or undamaged). The new *Guide for Fishing Vessels* requires, as a condition of classification, that a suitable guide on stability be developed and placed aboard the vessel for use by the crew to promote safe operation.

The stability information considers the effect of the following design considerations and environmental forces as applicable: (1) lightship and inclining experiment, (2) free surface effects, (3) lifting weight and fishing gear, (4) watertight integrity and flooding, (5) water on deck, (6) icing and ice loads, (7) standard loading conditions, (8) trim of the vessel, (9) ballast.

In addition to a section on Intact Stability, the *Guide* contains sections on plating, structure, equipment, longitudinal strength, and other hull-related items, as well as section on engines, gears, propellers, pressure vessels, piping, electrical, and other machinery-related items. A concluding section concerns surveys after construction, i.e., surveys during the vessel's life.

Orders for this publication may be directed to the ABS Book Order Department, 45 Eisenhower Drive, Paramus, New Jersey 07653-0910. The cost of the *Guide* is U.S. $15.00 in the United States, Canada, Mexico, Central America, Colombia, and Venezuela. In all other countries the price is U.S. $17.00.

Shipwrecks Along the Atlantic Coast

In many respects, shipwrecks are time capsules preserving our early maritime history. *Shipwrecks of the Atlantic Coast*, by William P. Quinn, breaks the seal on a comprehensive selection of such records. The author's artful combination of photographs with detailed descriptions and enjoyable prose provides a maritime perspective of American history since the mid-19th century.

Pictures are the prevailing feature of the book, but the easy-reading text carries the reader through fascinating backdrops of period superstition, technology, and politics which frame the disasters. Painstaking research is obvious in both captions and historical descriptions. The book provides an extensive pictorial record of prominent marine disasters since the advent of photography. The author graphically portrays the results of mariners' efforts when unsuccessful in their challenge to the perils of the sea.

Many of the author's intriguing accounts include photographs and descriptions of lifesaving efforts which leave the reader with a feeling for the anxiety and drama surrounding the catastrophes. The photography conveys a sense of the action -- and often futility -- of man's struggle to overcome insurmountable odds.

The author's expertise and dedication are not surprising if you take a moment to scan the backleaf. William P. Quinn has over 30 years of professional news photography experience. In addition, he attributes his very being to the survival of his grandfather, William H. Quinn, from an 1870's shipwreck on Cape Cod.

The author successfully spans his period to include accounts of disasters you may remember viewing on the evening news a few years ago. The 16 pages of color photographs provide some interesting underwater details of shipwrecks but detract from the distinctive stage set in black and white.

All told, *Shipwrecks Along the Atlantic Coast* provides both informative and entertaining reading for mariner and landlubber alike. The book may be ordered from Parnassus Imprints, P.O. Box 335, Orleans,. MA 02653. Cover price is $34.95. (Ed. Note: Photographs from Mr. Quinn's personal collection have appeared in the *Proceedings*' pictorial feature, "Shipwrecks!")▮

Chemical of the Month

Jennifer A. Rusiecki

Sodium Chlorate Solution 50% or Less

Anyone who has utilized good-quality, white paper for a formal report, has owned an artificially colored, leather product, or has shot off a rescue flare from a ship has come in contact with this month's chemical. Sodium Chlorate Solution 50% or less ($NaClO_3$), more commonly known as Chlorax, Klorex, Chlorate of Soda, or Kusatol, is an oxidizing agent and a bleach for paper pulps. It is also used for a variety of purposes such as manufacturing flares, explosives, and matches and is odorless with a saline taste.

Because this chemical will decompose at high temperatures, it must be kept at ambient temperatures in areas with open vents when shipping or storing. It may be transported by ship in bulk within a freight container, which should be no longer than 20 feet, its interior free of all sharp objects and lined with a plastic material resistant to both $NaClO_3$ and moisture. In packaging, it should be hermetically sealed in glass or plastic bottles, packed with inert cushioning and absorbent material together in a wooden box. It can also be packaged in cans or metal drums. Anyone involved in the transporting of $NaClO_3$ should wear coveralls and rubber boots, because when clothing absorbs chlorates, it becomes dangerously flammable.

The first step in dealing with any accidental discharge of $NaClO_3$ solution is to water down the immediate area. **Do not touch** or get near the discharge. The next step, after making sure that there are no combustibles present in the vicinity, is to dry-flush the discharge with water. After that, liquid-absorb the chemical with sand or earth. If large amounts spill, contact the National Response Center at 800-424-8802.

When liquid $NaClO_3$ dries out, it becomes a hazard, and it therefore should be kept wet. Although by itself the chemical is nonflammable, it should be stored away from combustible, organic metals; ammonium compounds; sulfur and sulfides; phosphorus finely powdered metals; and oil because it becomes highly explosive when rubbed or heated with these materials. Another chemical property to know about $NaClO_3$ is that when it is in close contact with strong acids it will release chlorine dioxide. In putting out the fire, use water spray and water as primary firefighting agents. Dry chemical, CO_2, and foam may also be used as secondary agents.

Although it is not a skin irritant or a hazard to inhale, $NaClO_3$ is very painful and harmful when it comes in contact with one's eyes. If this should occur, wash and flush eyes thoroughly with water. If ingested, abdominal pain, nausea, cyanosis, liver damage, and kidney damage will result. If someone does ingest $NaClO_3$, and the victim is conscious, the best thing to do is to induce vomiting and follow up with gastric lavage, saline catheric, fluid therapy, and oxygen. If the victim is unconscious, do not induce vomiting, but keep the victim warm and await first aid or further treatment.

Because of its slow corrosive action on mild steel or lined tanks, there are not many problems with shipping or storing in most steel tanks. $NaClO_3$ corrodes under .1 inch per year.

Sodium Chlorate Solution 50% or less is classified under 49 CFR Subchapter C as an oxidizer. It is also in 46 CFR Subchapter O, Group O, and in 40 CFR Subchapter C. ∎

Jennifer A. Rusiecki was a Third-Class Cadet at the U.S. Coast Guard Academy when she wrote this article. It was written under the direction of LCDR J. J. Kichner for a hazardous materials transportation class.

Chemical Name
Sodium Chlorate Solution 50% or less

Formula
$NaClO_3$

Synonyms
Chlorax, Klorex, Chlorate of Soda, Kusatol

Physical Properties
boiling point: 170°C (338°F)
freezing point: 19°C (65°F)
flash point: n/a
vapor pressure: slightly lower than water

Threshold Limit Values
unavailable

Flammability Limits
nonflammable

Densities
liquid (water = 1): 1.5
vapor (air - 1): n/a

U.N. Number: 1495

CHRIS Code: SDC

Cargo Compatibility Group: 0 (Unassigned Cargoes)

Nautical Queries

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

Engineer

1. The difference in water spray patterns between the high-velocity tip and low-velocity applicator is due to

A.
B. a difference in water pressure
the method of breaking up the water stream
C.
D. the type of fire being fought
the capacity of the fire pump

Reference: MARAD, *Marine Fire Prevention, Firefighting, and Fire Safety*

2. Coast Guard regulations require that a horizontal dry exhaust pipe from a diesel engine must _____.

A. be equipped with a watercooled muffler
B. have adequate insulation in any berthing space
terminate above the deepest load
C. waterline
D. not penetrate the engine room casing

Reference: 46 CFR 58.10-5(d)(ii)

3. The thermal bulb of the thermostatic expansion valve is located _____.

A. in the diffuser-fan inlet air stream
B. in the diffuser-fan outlet air stream
C. before the back-pressure regulating valve
D. after the back-pressure regulating valve

Reference: Gunther, *Refrigeration, Air Conditioning, and Cold Storage*

4. What is the phase angle of a six-pole, three-phase, rotating field generator?

A. 60°
B. 120°
C. 180°
D. 360°

Reference: NAVPERS 10086-A, *Basic Electricity*

5. Properly filing the ends of carbon ring segments removed from a turbine gland will _____.

A. reduce the ring segment end clearance
B. reduce the clearance between ring segments and shaft
C. increase the possibility of steam leakage past the rings
D. increase the possibility of air leakage into the turbine

Reference: Elonka, *Standard Plant Operator's Manual*

Deck

1. You are planning a heavy lift. When the lift is suspended in air from the falls of your jumbo boom, where is the CG of the lift acting?

A. The head of the jumbo boom.
B. The geometric center of the lift.
C. Midway between the center of the lift and the head of the jumbo boom.
D. The heel of the jumbo boom.

Reference: LaDage, *Stability and Trim for Ship's Officers*

2. The proper sequence to follow when connecting a bonding cable to a tanker is to _____.

A. close switch, connect bonding cable, and connect cargo hose
B. connect cargo hose, connect bonding cable, and close switch
C. connect bonding cable, close switch, and connect cargo hose
D. connect bonding cable, connect cargo hose, and close switch

Reference: *Merchant Marine Officer's Handbook*

3. Because of the arrangement of the cell guides, the *most* important factor while loading containers is the _____.

A. contents of the container
B. list of the vessel
C. size of the shoreside crane
D. weight of the container

Reference: *Cargo Handling*

4. You must medevac a critically injured seaman by helicopter hoist. Which of the following statements is true?

A. The ship's relative wind should be from dead ahead at 10 to 30 knots.
B. The deck crew at the hoist point should not wear baseball hats.
C. The helicopter's drop line should be secured to the ship not more than 15 feet from the hoist position.
D. When using a "horsecollar," the bight of the loop should be around the chest of the injured seaman.

Reference: *Knight's Modern Seamanship*

5. How many board feet of dunnage are there in a draft 3 feet wide, 1-1/2 feet high, and 14 feet long?

A. 526
B. 756
C. 876
D. 906

Reference: Sauerbier, *Marine Cargo Operations*

Answers

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

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

Special Notice

Programs for Chemical Drug and Alcohol Testing of Commercial Vessel Personnel

Due to the safety and health concerns associated with drug abuse by merchant marine personnel, as well as legal restrictions on drug use, the Coast Guard is proposing drug abatement programs which include periodic drug tests (urinalysis) as part of required physical exams, preemployment testing, and random sampling programs for all marine employees, and post-accident and reasonable-cause testing. The post-accident and reasonable-cause portions of the program will also involve testing for alcohol use. Four options are proposed concerning rehabilitation for those individuals who are detected as drug users for the first time.

The Coast Guard is also proposing an implied consent provision for the chemical testing of license, certificate of registry, and merchant mariners document holders as well as for all individuals accepting employment on board any vessel on which licensed, certificated, or documented personnel are required.

Through chemical testing, the Coast Guard expects to discourage drug and alcohol use by merchant marine personnel, an activity which adversely impacts the users, their shipmates, the marine industry, and the public in general. Chemical testing should also reduce the potential for marine casualties related to drug and alcohol use.

It is estimated that approximately 132,000 individuals will be directly affected by this proposed Coast Guard rulemaking. Interested persons are invited to participate in the rulemaking by submitting written data, views, or arguments. Comments should include the name and address of the person making the comments, identify this notice with the numbers CGD 86-067, give the specific section of the proposal to which the comment applies, and the reasons for the comment. Persons desiring acknowledgment that their comment has been received should enclose a stamped, self-addressed envelope. All comments received before the expiration of the comment period will be considered to the extent practicable before final action is taken on this proposal.

No public hearing has been scheduled; however, the Coast Guard is considering holding a public hearing on this proposal. If a hearing is scheduled, the time and place will be published in the *Federal Register*.

Comments must be received on or before September 6, 1988, and should be addressed to Executive Secretary, Marine Safety Council (G-LRA-2/21) (CGD 86-067), U.S. Coast Guard, Washington, DC 20593-0001. Comments may be delivered to and will be available for inspection or copying between 8:00 a.m. and 3:00 p.m. Monday through Friday, at the Marine Safety Council Office, Room 2110, 2100 Second Street, SW, Washington, DC; telephone (202) 267-1477.

For further information, contact Mr. Sean T. Connaughton, Project Manager, Merchant Vessel Personnel Division, U.S. Coast Guard, telephone (202) 267-0229.∎

Keynotes

Final Rule

CGD 84-025, Incinerator Vessels (May 4)

This document finalizes safety rules for incinerator vessels carrying liquid hazardous wastes in bulk for the purpose of incineration at sea. Existing regulations do not specifically address safety hazards unique to the operation of incinerator vessels. The rules in this document adopt standards for incinerator vessels in Chapter 19 of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (International Bulk Chemical Code) of the International Maritime Organization (IMO) as well as standards in existing safety regulations that apply to chemical tank vessels. These rules apply to vessels required to obtain an ocean incineration permit from the Environmental Protection Agency (EPA). EPA has proposed rules for obtaining a permit in EPA rulemaking docket FRL-2698-5.

This regulation is effective June 3, 1988. The incorporation by reference of certain publications listed in the regulations is approved by the Director of the *Federal Register* as of June 3, 1988.

For further information, contact CDR Ronald Tanner, (202) 267-1217.

CGD 82-105, Documentation of Vessels (May 17)

The Coast Guard is revising 46 CFR 67.03-5 to provide the basis for applying the phrase "controlling interest in the partnership" which was inserted in the Vessel Documentation Act by amendment just before the new vessel documentation regulations were published in the *Federal Register* on June 24, 1982 (47 FR 27490). The change in the regulations specifies when the controlling interest in a partnership is deemed to be owned by citizens of the United States for purposes of vessel documentation. This will reduce the number of inquiries concerning eligibility for documentation of a vessel owned by a partnership.

The effective date is June 16, 1988. For further information, contact LT Gregory Oxley, telephone (202) 267-1492.

CGD 82-042, Specification for Hand Held Flashlights (May 18)

This final rule deletes 46 CFR 161.008, and incorporates by reference in the specific vessel regulations the American Society for Testing and Materials Standard ASTM F1014-1986, Standard Specification for Flashlights on Vessels. This rulemaking incorporates this industry standard by reference in the regulations which require flashlights on lifeboats and liferafts, and flashlights suitable for use in hazardous classified atmospheres in emergency lockers and fireman's outfits, and as part of the safety equipment on self-propelled vessels carrying bulk liquefied gases. These regulations incorporate an up-to-date standard which will allow a wider variety of flashlights to be used, without jeopardizing the safety of either the vessel or personnel.

This regulation is effective on August 16, 1988. The incorporation by reference of certain publications listed in the regulations is approved by the Director of the Federal Register as of August 16, 1988.

For further information, contact Mr. Thomas M. Nolan, (202) 267-2206.

CGD 81-030, Vital System Automation (May 18)

The Coast Guard is adding regulations for automated vital systems on self-propelled commercial vessels to the Marine Engineering Regulations contained in various subchapters of Title 46 of the Code of Federal Regulations. Since the early 1960's, technological advances have caused an ever-growing dependence on automation to provide for the safe operation of vessels while reducing operating costs. Domestically, the Coast Guard has published a series of Navigation and Vessel

Inspection Circulars (NVIC's) to promulgate its policy and guidance regarding the safe design, testing, maintenance, and manning of automated vessels. These circulars are inadequate and outdated. Internationally, the need for safe automation on vessels has resulted in the inclusion of automation regulations in the first set of amendments to the International Convention on the Safety of Life at Sea, 1974 (SOLAS '74). These amendments entered into force internationally on September 1, 1984. To ensure that safety is not compromised by automation or reduced manning, uniform safety regulations are needed to replace the NVIC's currently in effect, and to conform to and interpret the provisions of the recent SOLAS amendments. The Coast Guard intends these rules to provide minimum performance and testing standards that do not restrict use of technological developments or alternative arrangements that provide an equivalent degree of safety. Additionally, these rules detail the configuration and degree of automation the Coast Guard deems necessary when authorization for minimally attended or periodically unattended machinery plant operation is requested by the owner or operator of a vessel.

This regulation is effective August 16, 1988. The Incorporation by Reference of certain publications listed in the regulations is approved by the Director of the Federal Register as of August 16, 1988.

For further information, contact LCDR Peter L. Randall, (202) 267-2206.

CGD 87-017, Assistance Towing Licenses (May 24)

The Coast Guard is amending the regulations for the licensing of maritime personnel to include specific licensing and manning requirements for all vessels, regardless of size, which engage in towing a disabled vessel for consideration. This regulation was developed in response to a statutory change requiring such licenses. This action is intended to provide assurance to all involved parties that persons who provide assistance towing services have met minimum established standards for knowledge and experience.

The effective date is September 15, 1988. For further information, contact LCDR Gary R. Kaminski, telephone (202) 267-0221.

CGD 84-098a, Self-Inspection of Fixed OCS Facilities (May 26)

The Coast Guard is amending the regulations concerning the inspection of fixed facilities on the Outer Continental Shelf (OCS) to require the owner or operator to conduct the annual scheduled inspection rather than the CoastGuard. The owner or operator is required to report the results of that inspection to the Coast Guard. This amendment is necessary in order to provide for statutorily mandated inspection of all fixed OCS facilities. This program will improve safety by providing at least one inspection annually of all fixed OCS facilities by allowing the Coast Guard to focus the efforts of its available marine inspectors on inspections of manned fixed facilities, particularly those which have a poor safety record. The Coast Guard will perform additional inspections of other fixed OCS facilities sufficient to provide oversight of the self-inspection program.

The effective date is June 27, 1988. For more information, contact LCDR Anthony Dupree, Jr., telephone (202) 267-2307.

CGD 87-015a, Delegation of Authority to Measure Vessels (June 6)

The Coast Guard is establishing the criteria necessary for an organization to qualify as a delegate to formally measure U. S. commercial, recreational, and public non-combatant vessels. This rulemaking implements the statutory provision authorizing the Coast Guard to delegate measurement functions, yet ensures high quality service to the maritime industry.

The effective date is June 6, 1988. For more information, contact Mr. Joseph T. Lewis, telephone (202) 267-2992.

CGD 87-013, Anchor Requirements for Certain Vessels (June 6)

Coast Guard regulations in Subchapters H - Passenger Vessels, I - Cargo and Miscellaneous Vessels, and U - Oceanographic Research Vessels require vessels to be fitted with anchors and chains in general agreement with the current standards established by the American Bureau of Shipping (ABS). The 1973 ABS Rules for Building and Classing Steel Vessels Less Than 200 Feet in Length included standards for

anchors and chains that allowed a reduction in equipment required for ferries, supply vessels, and tugs. The Coast Guard accepted these reduced standards. In 1983, ABS revised its standards for anchors and chains and the optional reduced standards for ferries, supply vessels, and tugs were removed. The purpose of this rulemaking is to include the reduced anchor standards in 46 CFR Subchapters H, I, and U for vessels of less than 200 feet in length with equipment numbers less than 150 as defined in ABS rules.

These regulations are effective July 6, 1988. For more information, contact Mr. Allen W. Penn, telephone (202) 267-2997.

CGD 88-038, OMB Control Numbers; Reporting and Recordkeeping Requirements (June 17)

Pursuant to the Paperwork Reduction Act of 1980 all regulations which contain recordkeeping or reporting requirements must be approved by the Director, Office of Management and Budget (OMB). Once approved, these regulations are assigned an OMB Control Number. OMB Control Numbers for regulations within Title 33, Code of Federal Regulations are displayed in a Table appearing at 33 CFR 4.02. This document amends the table to include OMB Control Numbers assigned to certain regulations in Chapter 1 of Title 33, Code of Federal Regulations and makes minor corrections.

This regulation is effective June 17, 1988. For more information, contact LCDR Don Wrye, telephone (202) 267-1534.

Notice of Proposed Rulemaking

CGD 82-004a, Alternative Provisions for Reinspection of Offshore Supply Vessels in Foreign Ports (May 17)

The Coast Guard is proposing regulations to permit alternative examinations of Offshore Supply Vessels (OSVs) of less than 400 gross tons operating from foreign ports in place of the Coast Guard examination required for reinspection of these vessels. OSV owners must reimburse the Coast Guard for the expenses of marine inspectors conducting foreign inspections, and they occasionally bear the cost of relocating vessels to certain ports to facilitate required inspections. Foreign inspections of OSVs frequently required Coast Guard personnel to be assigned to temporary duty in remote locations where their official status and personal security are matters of concern, and result in a less than optimum allocation of Coast Guard resources. The benefits of alternative examinations would include flexibility and financial savings to the OSV industry, and more effective and secure use of limited Coast Guard resources.

Comments are due on or before August 15, 1988. For more information, contact CDR R. S. Tweedie, telephone (202) 267-1045.

CGD 86-034, Hazardous Materials Pollution Prevention (June 13)

The Coast Guard proposes changing the oil pollution prevention standards to also apply to vessels and facilities which transfer bulk liquid hazardous materials including those intended for incineration at sea. An analysis of data for bulk hazardous liquids materials shows an increase in the number of cargoes transported with a corresponding increase in the number of transfers, posing an ever increasing threat of harm to the navigable waters and the resources therein. These rules, if adopted, would prevent or mitigate the results of a discharge of hazardous materials into the navigable waters and would provide the same level of safety for these materials during transfer operations as currently provided for oil transfer operations.

Comments must be received on or before September 12, 1986. For more information, contact Mr. Kenneth J. Szigety, telephone (202) 267-0491.

Supplemental Notice of Proposed Rulemaking

CGD 77-140, Vessel Piping Systems (May 18)

The Coast Guard is proposing to amend the vessel piping systems regulations to clarify technical requirements, correct errors, and revise the lists of acceptable standards and specifications. In addition, these proposed amendments would delete the manufacturers' affidavit system used to verify compliance of various piping components with the regulations and, instead, would incorporate industry developed standards. The affidavit system has proven to be flawed and misunderstood and

many regulations are confusing or out of date. These changes would eliminate the submission of technical information for these components and reduce the overall cost burden in staff hours and paperwork for both industry and the Government, while providing a better method for ensuring that the components comply with Coast Guard regulations.

Comments may be mailed to Commandant (G-CMC/21)(CGD 77-140), U.S. Coast Guard, 2100 Second Street, SW., Washington, DC 20593-0001. For more information, contact Mr. Howard L. Hime, telephone (202) 267-2206.

CGD 84-060, Licensing of Pilots; Manning of Vessels-Pilots (June 6)

The Coast Guard is changing its original proposal (50 FR 26117) of June 24, 1985, to amend the regulations concerning the Licensing of Pilots and the Manning of Vessels-Pilots. This proposal would: (1) Delineate when certain inspected vessels are required to be under the direction and control of a pilot, (2) describe first class pilotage areas where local pilotage expertise is warranted, (3) allow licensed individuals to serve as pilot in areas not identified as first class pilotage areas on vessels that they are otherwise qualified to control, and (4) permit individuals with 5 years service on towing vessel combinations of at least 5,000 gross tons while acting under the authority of a license as master, mate, or operator of uninspected towing vessels, with a minimum of 2 of the 5 years having been on towing vessel combinations of at least 10,000 gross tons, to obtain without a written examination, an endorsement as first class pilot, restricted to tug and barge combinations only, for those routes over which they have made the required number of round trips prior to (the effective date of the final rule). The applicant is required to have the same number of round trips that the respective OCMI's require of other applicants for an endorsement as first class pilot, and 2/3 of the required number of round trips must have been on towing vessel combinations greater and 1,600 gross tons.

These changes are necessary to eliminate confusion over where and on what vessels pilotage expertise over and about that held by licensed masters, mates, and operators is warranted. They will also provide relief to tank barge operators who have demonstrated experience in performing this function.

Comments must be received on or before September 6, 1988. For more information, contact Mr. John Hartke, telephone (202) 267-0214.

Advance Notice of Proposed Rulemaking

CGD 88-002, Regulations Implementing the Pollution Prevention Requirements of Annex V of MARPOL 73/78 (June 24)

The Coast Guard is seeking public participation in the drafting of rules to implement the requirements of the "Act to Prevent Pollution from Ships," as recently amended by Congress. Rules to implement this law and Annex V of the International Convention for the Prevention of Pollution by Ships, 1973 are mandated by Congress to be in effect by December 31, 1988. These rules would generally apply to marine craft of any size or type, including recreational boats, and the ports and facilities servicing them. With early participation of the public, the Coast Guard expects to publish cost effective rules which will reduce the incidence of discharges of plastics, including synthetic fishing nets and other ship-generated garbage into the marine environment.

Comments must be received on or before July 25, 1988. For more information, contact LCDR Joel R. Whitehead, telephone (202) 267-0491.

Statistics of Marine Casualties -- 1986

Annually the Coast Guard presents a statistical summary of commercial vessel casualties that were investigated by Coast Guard marine investigators during the calendar year. The casualty statistics are presented in two subsets; accidents which resulted in a total loss of the vessel and accidents which resulted in a non-total loss of the vessels involved. In 1986, there were 3026 marine accidents that involved 5129 commercial vessels; of these, 282 resulted in a total loss of the vessels involved and of these, 184 were fishing vessels. There were 4847 vessels involved in accidents that did not result in a total loss; of these, 960 were freight barges.

There were 72 deaths and 34 injuries as a result of vessels involved in a total loss. For those vessels not involved in a total loss, there were 90 deaths and 206 injuries. In 1986, there were 109 deaths and 877 injuries on board commercial vessels not related to a vessel accident.

The public, industry, and the Coast Guard have used the findings of the investigations to establish standards and determine the need for legislation to improve the protection of safety of life and property at sea. 46 CFR 4.05-10 states: "In addition to the notice required by paragraph 4.05-1, the person in charge of the vessel shall, within five days, report in writing to the Officer in Charge Marine Inspection, at the port in which the casualty occurred or nearest the port of first arrival." The following summary represents casualties for which reports were received at Coast Guard Headquarters during calendar year 1986. These casualties, involving U.S.-flag commercial vessels or foreign-flag vessels in U.S. waters, were required to be reported to the Coast Guard whenever the casualty resulted in any of the following:

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

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

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

Comments and recommendations for changes or improvements in the statistics should be addressed to Commandant (G-MMI-3), U.S. Coast Guard, 2100 Second St., SW, Washington, DC 20593-0001.

Marine Boards of Investigation in 1986

There were two Marine Boards of Investigation in 1986.

At about 10:30 a.m. on October 28, 1986, explosions and fires occurred in the engineroom and starboard fuel oil tanks of the 811-foot-long U.S. tankship **Omi Yukon O.N. 547919**. The **Omi Yukon** was en route from Hawaii to South Korea for scheduled vessel repairs and a biennial inspection by the U.S. Coast Guard. At the time of the explosions, the tankship was located about 1,000 miles west of Honolulu, Hawaii, and was not carrying any cargo. There were 24 crew members, 2 U.S. welders, and 11 Japanese workers employed in cleaning the cargo tanks aboard the vessel. Four persons were killed; the other 33 persons safely abandoned the vessel and were later rescued by a Japanese fishing vessel. The estimated damage to the **Omi Yukon** was $40 million. The vessel was towed to Japan and sold for scrap.

At approximately 4:11 p.m. on February 8, 1986, the 62-foot-long U.S. passenger vessel Merry Jane, O.N. 596815, broached while approaching Bodega Bay, California. The vessel was returning from a day of fishing at the Cordell Bank area with 48 passengers two crew, and one operator on board. As the vessel approached the passage between Bodega Head and Bodega Rock, it broached and heeled sharply to starboard. A total of 19 persons were thrown or fell from the vessel. A "Mayday" call was broadcast and was responded to by two boats from Coast Guard Station Bodega Bay, two charter fishing boats from Bodega Harbor, and several smaller craft. Ten survivors were rescued; five bodies were recovered. Three bodies were later recovered and one person remains missing and is presumed deceased.

TABLE 1

SUMMARY OF COMMERCIAL VESSEL TOTAL LOSSES BY NATURE OF CASUALTY AND VESSEL SIZE FOR 1986

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	MISSING	OTHER	TOTAL
	No.	No.	No.	No.	No.	No.	No.	
FREIGHTSHIP								
Less than 100 GT	1							1
100-199								
200-299								
300-499								
500-1599								
1600-4999				1				1
5000-9999								
10,000-19,999					1			1
20.000 and Above								
SUBTOTAL	1			1	1			3
TANKSHIP								
Less than 100 GT	1							1
100-1599								
1600-4999								
5000-9999								
10,000-19,999		2						2
20,000-39,999		1						1
40,000-99,999								
100,000 and Above								
SUBTOTAL	1	3						4
PASSENGER VESSEL (inc. ferries)								
Less than 100 GT	6	5	1	1		1		14
100-1599								
1600-4999								
5000 and Above								
SUBTOTAL	6	5	1	1		1		14
TUG/TOWBOAT								
Less than 100 GT	10	6						16
100-199	2							2
200-299	2		1					3
300-999		3						3
1000 and Above								
SUBTOTAL	14	9	1					24

TABLE 1 Cont'd:

OFFSHORE SUPPLY								
Less than 100 GT	1							1
100-199			1					1
200-499								
500 and Above								
SUBTOTAL	1		1					2
MODU								
Less than 300 GT								
300 GT and over								
SUBTOTAL								
PLATFORM								
SUBTOTAL								
FISHING VESSEL								
Less than 100 GT	59	22	13	17	10	3	3	127
100-199								
200-499		1						1
500-999	1	2						3
1000 and Above								
State Numbered	19	6	3	2	3		2	35
SUBTOTAL	84	39	18	22	13	3	5	184
TANK BARGE								
Less than 500 GT								
500-999								
1000 and Above		2						2
SUBTOTAL		2						2
FREIGHT BARGE								
Less than 100 GT								
100-999	6		3	2	3		2	16
1000 and Above				1	2		3	6
Unknown			1				1	2
SUBTOTAL	6		4	3	5		6	24
MISCELLANEOUS								
Less than 100 GT	6	2	6	1	3		1	19
100 and Above (SP)	1							1
100 and Above (NSP)	4				1			5
SUBTOTAL	11	2	6	1	4		1	25
TOTAL	124	60	31	28	23	4	12	282
FOREIGN FLAG *								
Freight				1	1			2
Tank								
Other	1	1						2
SUBTOTAL	1	1		1	1			4

* These vessels have been included in the above total.

TABLE 2A

TOTAL LOSSES DURING 1986
TYPE OF VESSEL BY AGE OF VESSEL

Type vessel Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN	TOTAL
FREIGHTSHIP				2			1		3
TANKSHIP		2	2						4
PASSENGER VESSEL (inc. ferries)	2	4	2	3	1	1	1		14
TUG/TOWBOAT		4	1	5	4	3	7		24
OFFSHORE SUPPLY					1		1		2
MODU									
PLATFORM									
FISHING VESSEL	11	31	20	18	10	8	45	6	149
STATE NUMBERED	6	5	6	3	2	4	2	7	35
TANK BARGE		1		1					2
FREIGHT BARGE		3	4	8	1		5	3	24
MISCELLANEOUS	7	2		1	3		6	6	25
TOTAL	26	52	35	41	22	16	68	22	282

TABLE 2B

TOTAL LOSSES DURING 1986
NATURE OF CASUALTY BY AGE OF VESSEL

Casualty Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN	TOTAL
FOUNDERED	7	25	14	16	12	9	32	10	125
FIRE/EXPLOSION	9	14	10	9	5	3	11	1	62
COLLISION	5	3	5	2		1	9	6	31
GROUNDING	2	7	1	7	1	1	8	1	28
HULL/MACHINERY DAMAGE	2	1	4	4	3		6	3	23
MISSING	1	1			1		1		4
OTHER			1	3		2	1	1	12
TOTALS	26	52	35	41	22	16	68	22	282

TABLE 3

SUMMARY OF COMMERCIAL VESSELS NOT INVOLVED IN A TOTAL LOSS
BY NATURE OF CASUALTY AND VESSEL SIZE FOR 1986

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	WEATHER DAMAGE	OTHER	TOTAL
	No.	No.	No.	No.	No.	No.	No.	
FREIGHTSHIP								
Less than 15 GT	3		4	1	1		1	10
15-99	1	1	1		2			5
100-199			1					1
200-299			1		2			3
300-499		1	1	1	4			7
500-1599			5	4	8	1	4	22
1600-4999			13	4	6		1	24
5000-9999			8	13	11		2	34
10,000-19999	4	4	48	20	48	3	5	132
20,000 and Above	1	7	28	28	67		7	138
SUBTOTALS	9	13	110	71	149	4	20	376
TANKSHIP								
Less than 100 GT		1	3	1				5
100-1599	1		4	8	6			19
1600-4999	1	1	3	3	5		1	14
5000-9999			2	1	3			6
10,000-19,999		1	10	10	34		2	57
20,000-39,999	1	5	16	18	38	4	4	86
40,000-99,999	1	5	7	7	36	1		57
100,000 and Above		1	1		4			6
SUBTOTALS	4	14	46	48	126	5	7	250
PASSENGER VESSEL (inc. ferries)								
Less than 100 GT	23	14	27	42	82		7	195
100-1599		3	5	6	27			41
1600-4999			4	8	13			25
5000 and Above		2	5	2	2			11
SUBTOTALS	23	29	41	58	124		7	272

Table 3 Cont'd.

SUMMARY OF COMMERCIAL VESSELS NOT INVOLVED IN A TOTAL LOSS
BY NATURE OF CASUALTY AND VESSEL SIZE FOR 1986

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	WEATHER DAMAGE	OTHER	TOTAL
	No.	No.	No.	No.	No.	No.	No.	
TUG/TOWBOAT								
Less than 100 GT	40	6	89	73	56		10	274
100-199	23	12	141	116	54	2	18	366
200-299	7	2	40	47	19	2	5	122
300-999	6	3	122	164	19	1	17	332
1000 and Above			8	20	1			29
SUBTOTAL	76	23	400	420	149	5	50	1123
OFFSHORE SUPPLY								
Less than 15 GT	2						1	3
15-99		2	5	2	1			10
100-199			1		1		1	3
200-499		3	7	4	3		2	19
500 and Above					1			1
SUBTOTAL	2	5	13	6	6		4	36
MODU								
Less than 100 GT								
100-299	1							1
300 GT and Above	5	1	4	3	9	1	1	24
SUBTOTAL	6	1	4	3	9	1	1	25
PLATFORM								
SUBTOTAL			8		3		1	12
FISHING VESSEL								
Less than 100 GT	119	27	67	92	394	5	57	761
100-199	22	10	23	26	66		17	164
200-499	2	3		1	1			7
500-999		5	1	1	1			8
1000 and Above	1	1		1			1	4
State Numbered	30	5	20	14	95	1	9	174
SUBTOTAL	174	51	111	135	557	6	84	1118

Table 3 Cont'd:

SUMMARY OF COMMERCIAL VESSELS NOT INVOLVED IN A TOTAL LOSS
BY NATURE OF CASUALTY AND VESSEL SIZE FOR 1986

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	WEATHER DAMAGE	OTHER	TOTAL
	No.	No.	No.	No.	No.	No.	No.	
TANK BARGE								
Less than 100 GT				3	1			4
100-499			3	3	4			10
500-999	6	1	47	49	10	1	3	117
1000 and Above	6	8	182	146	50	2	6	400
SUBTOTAL	12	9	232	201	65	3	9	551
FREIGHT BARGE								
Less than 100 GT	9		25	18	8		11	71
100-999	20	1	206	297	59		121	704
1000 and Above	9	4	50	90	14	1	17	185
Unknown								
SUBTOTAL	38	5	281	405	81	1	149	960
MISCELLANEOUS								
Less than 100 GT	17	4	46	2	11	1	8	89
100 and Above (SP)		1	9	3	13		2	28
100 and Above (NSP)	5	1	8	4	5		4	27
SUBTOTAL	22	6	63	9	29	1	14	144
TOTALS	366	146	1309	1356	1298	26	346	4847
FOREIGN FLAG								
Freight	5	4	69	49	55		8	190
Tank	1	4	23	19	23		2	72
Other	4	4	17	8	9		1	43
SUBTOTAL	10	12	109	76	87		11	305

TABLE 4A:

VESSELS NOT INVOLVED IN A TOTAL LOSS DURING 1986
TYPE OF VESSEL BY AGE OF VESSEL

Type vessel Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN	TOTAL
FREIGHTSHIP	21	82	67	69 57	26 11	24	26	6	252
PASSENGER VESSEL (inc. ferries)	57	54	32	30	26	20	52	4	275
TUG/TOWBOAT	71	274	237	138	98	79	190	38	1125
OFFSHORE SUPPLY	10	15	3	2	3	1	1	1	36
MODU	9	8	6	1		1		1	26
PLATFORM	1	3	1	3				4	12
FISHING VESSEL	55	221	149	97	63	30	278	51	944
STATE NUMBERED	18	33	27	27	19	10	27	13	174
TANK BARGE	23	121	109	114	55	44	41	24	531
FREIGHT BARGE	69	291	205	84	82	27	43	159	960
MISCELLANEOUS	22	22	18	14	13	5	16	26	136
TOTAL	429	1195	929	616	396	244	706	332	4847

TABLE 4B:

VESSELS NOT INVOLVED IN A TOTAL LOSS DURING 1986
NATURE OF CASUALTY BY AGE OF VESSEL

Casualty Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN	TOTAL
FOUNDERED	25	59	42	38	41	32	103	30	370
FIRE/EXPLOSION	10	33	30	22	7	9	29	7	147
COLLISION	128	348	251	168	113	69	144	101	1322
GROUNDING	122	364	282	179	101	67	149	104	1368
HULL/MACHINERY DAMAGE	112	293	256	177	114	55	244	59	1310
WEATHER DAMAGE		8	5	6	2	1	4		26
OTHER	32	90	63	26	18	11	33	31	304
TOTAL	429	1195	929	616	396	244	706	332	4847

TABLE 5A

SUMMARY OF COMMERCIAL VESSEL CASUALTIES
BY CAUSE* AND NATURE OF CASUALTY - 1986

PERSONNEL	FOUNDERED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	HULL/MACHINERY DAMAGE No.	MISSING No.	OTHER No.	TOTAL
Inatt. to duty	6	1	19	22	1		1	50
Judgmental error	11	1	93	200			5	310
Carelessness	7	5	5	8	7		1	33
Lack of knowledge	1		3	3				7
Relied on floating ATON				3				3
Failed to								
Account wind/current	3		16	14			1	34
Use nav. equip/charts			1	3				4
Use radiotelephone			3	1				4
Ascertain position	2		24	45	1		1	73
Establish Pass Agreement			3	2				5
Keep Proper Lookout			19				2	21
Keep Right of Channel			4	1				5
Comply w/Rule, Reg, Procedure			2	1				3
Proceed at Safe Speed	2		9	2				13
Yield Right of Way			6	1				7
Stress								
Fatigue								
Physical impair.								
Intoxication			3					3
Improper Loading	11	1		1	1		2	16
Improper Maintenance	14	5			36			55
Improper Mooring/Tow	5		8	5	1		15	34
Improper Securing/ Rigging	4						1	5
Improper safety Precaut	8	7	10	2	6			33
Operator Error	15	4	210	213	17		12	471
Other	11	4	17	14	13		1	60
SUBTOTAL	100	28	455	541	83		42	1249

* Cause is first one listed in each record

TABLE 5B

SUMMARY OF COMMERCIAL VESSEL CASUALTIES
BY CAUSE* AND NATURE OF CASUALTY - 1986

ENVIRONMENT	FOUNDERED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	DAMAGE HULL/MACHINERY No.	MISSING No.	OTHER No.	TOTAL
Adverse weather	23	1	14	24	10		25	97
Adverse current	14		4	7	4	1	3	33
Debris	1				1			2
Ice								
Lightning		1						1
Shoaling			1	108				109
Submerged object	8		25	7	9		1	50
Channel hazard			14	17	1			32
Inadequate AtoN								
Other			9	5				14
SUBTOTAL	47	5	70	168	50	1	31	372

* Cause is first one listed in each record

TABLE 5C

SUMMARY OF COMMERCIAL VESSEL CASUALTIES
BY CAUSE* AND NATURE OF CASUALTY - 1986

MATERIAL RELATED	FOUNDERED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	HULL/MACHINERY No.	MISSING No.	OTHER No.	TOTAL
Failed Materials:	155	20	10	10	98		27	320
Mechanical	30	29	5	3	609		17	693
Electrical	4	37	2		114		4	161
Corrosion	2				5			7
Normal wear		1			8			9
Improper welding					3			3
Improper riveting								
Steering failure								
Fouled propeller			1	1	45		51	98
Inadequate:			1					1
Lighting								
Stability	8							8
Lifesaving equip								
Firefighting equip								
Controls								
Lubrication					3			3
Maintenance								
Insufficient fuel					4		2	6
Propulsion Failure					29		23	52
Fatigue Failure								
Other	10	1	6	11	15		1	44
NEC SUBTOTAL	209	88	25	25	933		125	1406
CAUSE UNKNOWN								
TOTAL	356	121	550	734	1066	1	198	3026

TABLE 6

DEATHS/INJURIES RESULTING FROM TOTAL LOSS OF
COMMERCIAL VESSELS DURING 1986

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY	MISSING	OTHER	TOTAL
FREIGHTSHIP	2/0							2/0
TANKSHIP		4/5						4/5
PASSENGER VESSEL								
TUG/TOWBOAT	0/2							0/2
OFFSHORE SUPPLY								
FISHING VESSEL	32/4	0/2	7/0	0/1	0/4	5/0		44/11
STATE NUMBERED	5/0			0/1	0/1			5/2
MODU								
PLATFORM								
FREIGHT BARGE			1/0					1/0
TANK BARGE		6/9						6/9
MISCELLANEOUS		2/0	4/5	3/0	1/0			10/5
LICENSED OFFICER		2/3						2/3
CREW	27/5	4/5	10/1	0/2	0/1	5/0		46/14
PASSENGER	12/1		1/4	3/0	1/3			17/8
OTHER		6/8	1/0		0/1			7/9
TOTAL	39/6	12/16	12/5	3/2	1/15	5/0		72/34

TABLE 7

DEATHS/INJURIES RESULTING FROM A COMMERCIAL VESSEL
NOT INVOLVED IN A TOTAL LOSS DURING 1986

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY	WEATHER DAMAGE	OTHER	TOTAL
FREIGHTSHIP	2/1	1/2	5/4		0/2		0/1	8/10
TANKSHIP		2/13	1/2		1/10	0/3		3/28
PASSENGER VESSEL	9/6	0/7	0/21	0/3	1/0			10/37
TUG/TOWBOAT	3/2	3/2	14/31	0/2	1/11			21/48
OFFSHORE SUPPLY	1/0				0/1			1/1
FISHING VESSEL	5/1	3/1	1/4	0/1			1/1	10/8
STATE NUMBERED	5/1		0/12		0/1			5/14
MODU	0/1							0/1
PLATFORM			0/1		1/1		0/1	1/3
FREIGHT BARGE		1/0	3/15	0/1				4/16
TANK BARGE		0/1	10/12		0/5			10/18
MISCELLANEOUS	5/1	1/3	9/12		0/6			15/22
LICENSED OFFICER	3/0	5/1	2/5	0/2	0/5			10/13
CREW	15/4	4/11	35/67	0/4	3/23	0/3	2/3	59/115
PASSENGER	11/9	1/3	4/36	0/1	0/9			16/58
OTHER	1/0	1/14	2/6				1/0	5/20
TOTAL	30/13	11/29	43/114	0/7	3/37	0/3	3/3	90/206

TABLE 8

OTHER DEATHS/INJURIES ONBOARD COMMERCIAL VESSELS DURING 1986
(NOT RELATED TO A VESSEL CASUALTY)

	SLIP/ FALL ONBOARD	FALL OVER BOARD	DISAPPEAR	STRUCK BY OBJECT	PINCH OR CRUSH	BURN SCALD	ELECTRIC BURN/ SHOCK	CUT	CAUGHT IN LINES	ASPHYXIA	SPRAIN OR STRAIN	LIVING	UNKOWN OR NOC	TOTAL
FREIGHTSHIP	6/87	6/1	2/0	1/28	1/24	0/5		0/3	1/1	0/1	0/6		0/4	17/160
TANKSHIP	0/37	0/1	1/0	1/18	0/10	0/3					0/2		0/2	2/73
PASS. VSL.	0/52	5/2	1/0	0/2	1/5	0/1			0/1	1/0		13/4	0/2	20/69
TUG/TOWBOAT	0/11	13/1	4/0	0/5	0/2		0/1	0/1	0/1		0/4			18/22
OFFSHORE SPLY	0/15	2/0		0/5	1/7				0/4			0/1	0/1	3/37
FISHING VSL.	0/6	12/1	7/0	2/16	0/20	0/2	1/0		0/12			2/1	2/1	26/59
STATE NUMBERED	0/1	3/0								1/0		1/0		5/1
MODU	2/67	1/1		1/36	0/49			0/4	0/4	0/1	0/17		0/1	4/180
PLATFORM	1/93			1/50	0/33	0/2	1/2	0/6	0/3		0/29		0/2	3/220
FREIGHT BARGE	0/2											1/0		1/2
TANK BARGE		1/0		0/1										1/1
MISCELLANEOUS	0/16	1/2	2/0	2/9	1/18	0/1	1/0		0/1	1/1	0/2	1/3		9/53
LICENSED OFFICER	1/25	2/1	1/0	1/11	1/3		1/0			1/0	0/59		0/1	8/41
CREW	7/320	33/6	13/0	7/152	3/162	0/13	2/3	0/14	1/27	2/2		2/1	2/11	72/770
PASSENGER	0/31	4/1	2/0								0/1	14/4		20/36
OTHER	1/11	5/1	1/0	0/7	0/3	0/1				0/1		2/4	0/1	9/30
TOTAL	9/387	44/9	17/0	8/170	4/168	0/14	3/3	0/14	1/27	3/3	0/60	18/9	2/13	109/877