of March 2, 1929, was passed and finally became effective in September, 1930. For the first time in load line history, it was now possible for American ships to enter foreign ports on a legal parity with other ships rather than by virtue of international courtesy. The rules and regulations adopted under the act were based to a considerable extent on a most exhaustive study of ship construction and loading by a technical committee appointed for the purpose in 1928 by the Secretary of Commerce. In these regulations due consideration was given to, and differentials made for, the various types and character of vessels and the trades in which they were engaged.

At about this time, the United Kingdom called for an International Conference on Load Lines to be held in 1930. The technical committee established for consideration of national regulation was invaluable in providing the United States with expert knowledge required for the international conference. The conference brought forth the first international instrument for universal regulation of load lines. Emphasis was placed on the safety of the crew in the performance of their duties, as well as on securing and maintaining an effective closing of the openings in the weather decks and sides of ships. The oceans of the world were divided into weather zones, and the depth to which a vessel could be loaded in those zones was dependent upon the average weather conditions therein.

The United States became the first to ratify this Convention on February 27, 1931. The Convention became internationally effective on January 1, 1933.

Since 1930 great changes have occurred in ship design and construction, shipbuilding technology, and ship operation. New types of closing appliances, (in particular metal hatch covers), have improved the watertight integrity of ships. Other technical developments (the extensive use of welding, the rounded gunwale, etc.) have also become widespread. The vast increase in the size of ships, particularly tankers and bulk carriers, has made it necessary to extend the existing freeboard tables to cover ships up to a length of 1200 feet, doubling the length covered by the present table. All these considerations, together with the experience gained from the use of the 1930 Convention, merited a sweeping revision, but under its provisions it is necessary to have unanimous agreement among its contracting governments to make any amendment effective. It is all but impossible to reach complete mutual consent, particularly as several members are not now speaking to one another. Further, with the tremendous change in governments since 1930, it is questionable just who is a member. The unlikelihood of attaining such unanimity strengthened the need for a completely new convention.

With this in mind, the United Kingdom as bureau power for the 1930 Convention called, in 1957, for a new conference on the subject to be held under the sponsorship of IMCO (Intergovernmental Maritime Consultative Organization) in conjunction with the 1960 International SOLAS (Safety of Life at Sea) Conference. To prepare for these conferences, the Secretary of State, through the Secretary of the Treasury, requested the Commandant of the Coast Guard to initiate and coordinate the preparation of the U. S. proposals. To carry out this request, the commandant, in 1958, established the U. S. Load Lines Committee. The committee was made up of some 30 members repersenting various segments of the maritime industry. It immediately commenced its task, using as a starting point the various proposals the United States had submitted in the past for amending the 1930 convention. However, due to the heavy workload imposed on maritime nations in preparing for the 1960 SOLAS Conference, the United Kingdom cancelled its call for a Load Lines Conference. Nevertheless, the U. S. Load Lines Committee was not disbanded and its work continued.

In January 1961, at the 4th session of the Council of the IMCO, the United States proposed a resolution "that the Assembly authorize a conference to adopt a Load Lines Convention and invite the Maritime Safety Committee to determine what preparations are necessary." The Council decided to postpone consideration of the proposal for one year. The United States again presented the same proposal at the sixth session of the Council in February 1962. With a few changes, this proposal was adopted. Accordingly, following recommendations of its Maritime Safety Committee and Council, the Assembly of IMCO decided, at its third session in October 1963, that the organization should convene an international conference on load lines in the spring of 1966, in order to draft a new convention and thus bring the load line regulations into accord with the latest developments and techniques in ship construction. The invitations to the Conference were sent to member states of the United States, its specialized agencies and the International Atomic Energy Agency as well as to a number of intergovernmental and international non-governmental organizations.

The United States was in excellent position for this conference due to the work of the U. S. Load Lines Committee. Realizing the obvious advantage of having a U. S. proposal as a working document during the conference, the U. S. Load Lines Committee finalized its work and presented a draft convention. This draft was forwarded to IMCO through the Department of State. IMCO circulated this document to all member governments, suggesting their proposals be submitted in the form of comments on the United States draft convention.

Prior to the start of the conference, twenty-one governments had submitted comments on the U. S. draft convention, including the U.S.S.R. which had submitted a complete draft text of its own.

The United States participated in this conference with an eighteen man delegation headed by the Commandant of the Coast Guard. The remainder of the delegation consisted of representatives from various maritime organizations; a legal representative from the Department of State; and four additional Coast Guard representatives, almost all having had previous experience on the U. S. Load Lines Committee.

The conference set up three main committees, namely: the General Committee, the Technical Committee and the Zones Committee. The General Committee considered questions relating to the legal aspects and general provisions of the proposed Convention, as well as the form and contents of the Load Lines Certificate. The Technical Committee was responsible for considering matters relating to the assignment of load lines for all vessels. And the Zones Committee considered questions relating to the determination of boundaries of zones and seasonal areas, as well as the seasonal periods for these areas.

It was decided early in the conference that the format for this convention should be as similar as possible to the 1960 SOLAS Convention, even to adopting the same wording when covering identical subjects. It has long been felt both here and abroad that the 1960 SOLAS Convention and the Load Lines Convention should be merged into one, as they both speak to safety of life at sea. In fact, the conference stated in a recommendation annexed to the convention that "recognizing the common aims of the International Convention for the Safety of Life at Sea (1960), and the International Convention on Load Lines (1966), concerning the safety of life and property at sea, recommends that the Intergovernmental Maritime Consultative Organization should consider the relationship between the provisions of the two Conventions with a view to suggesting how they could be consolidated in a single international convention."

As compared with the 1930 Convention (currently in force), the new convention introduces a number of changes, the most significant of which is the reduction in freeboards for large ships of over 550 feet in length. Large tankers and large ore carriers which meet the prescribed subdivision and other conditions will have their freeboards reduced about 10-15 percent. Large dry cargo ships having steel hatch covers will have their freeboards reduced about 10 percent. Such vessels having hatch covers of dogged type and complying with subdivision conditions may be permited further freeboard reductions, with a maximum total reduction of 20-25 percent. On the other hand the freeboards of small ships under 300 feet in length, when fitted with little or no superstructure, will be slightly increased in order to improve the range of stability and other safety conditions. For small ships having wooden hatch covers a further freeboard increase of about 2 inches applies.

An important improvement in the safety of ships is the complete elimination of the provisions for Class 2 closing appliances; this means that only enclosed superstructure fitted with gasketed weathertight doors will be taken into account in freeboard computation.

The Japanese proposed freeboard tables, supported by the United States, were generally adopted. These tables accommodate vessels larger than the 1930 Convention with tabular values being given for vessels up to 1200 feet in length.

There was lengthy discussion on the relationship between freeboards and subdivision and stability; as a result, the subdivision concept has been introduced into the assignment of freeboards for large ships. This means that vessels with two-compartment subdivision may be eligible for deeper drafts.

In the Zones Committee, the conference established criteria for estimating weather conditions, and these criteria were used as a basis when defining the zones, areas, and seasonal periods.

The boundaries of the winter seasonal zones were changed considerably, particularly in the North Atlantic and the South Pacific. The new boundaries will permit ships sailing round the Cape of Good Hope and south of the coast of Australia to remain within the summer zone. The Baltic Sea, the Black Sea, the Mediterranean, the Sea of Japan, and part of the Atlantic Ocean along the east coast of the United States of America will be considered as being in the summer zone; however, for small ships (330 feet in length and under), these regions will remain winter seasonal areas requiring additional freeboard.

The conference also considered the possibility of assigning load lines to fishing vessels. While deciding that fishing vessels should not be included in the convention, it was agreed that IMCO should pursue studies on the minimum freeboard for such vessels, the object being to establish recommended international standards. A recommendation to this effect was annexed to the convention.

The U. S. Delegation felt that the convention brought forth is an acceptable and workable one and will accomplish improvements in safety as well as in the economics of shipping. It will be a convention that has a suitable amendment clause similar to the SOLAS conventions, to permit the initiation of needed changes without requiring unanimous consent or a new conference to put into effect the lessons of tomorrow. We will not have to wait another 30 years to update and improve this convention to keep it abreast of changes in the maritime industry. It is hoped there will be early acceptance and enactment by this country as well as others.

The 1966 Load Lines Convention will come into force 12 months after it has been accepted by at least 15 countries, seven of which possess not less than one million gross tons of shipping.

As I stated previously, the United States was the first country to ratify the 1930 International Load Lines Convention. This was due, I feel, in a large measure to its then recently completed work on the 1929 Load Line Act, and possibly in part to a feeling of guilt in not having had legislation in this area a long time before. Over 30 years later we find the United States still in the forefront for the safety of seamen, since it was at the instigation and insistence of the United States that IMCO convene this second Conference on load lines. It now seems fitting that the United States maintain its lead in the safety of its seamen and ships and be the first to ratify the International Convention on Load Lines, 1966.

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SHIP OPERATION (Tankers)

SAFETY PRACTICES IN TOWING

By FRANK L. BARTAK
Admiralty Counsel, Great Lakes Towing Company, Cleveland, Ohio

The Great Lakes Towing Company has operated tugboats on the Great Lakes since 1899 and presently operates a fleet of 46 diesel and diesel-electric tugboats, furnishing habor towing service in 20 United States Great Lake Ports, towing over-the-lakes from Lockport on the Chicago Sanitary Canal to Montreal, and wrecking and salvage service anywhere in the Great Lakes. In addition, by special arrangement we will furnish local service in any U. S. Great Lakes Port.

In the course of our business, we tow or assist lake and salt water vessels, barges, both river and lake, and all other types of floating craft or equipment. Necessarily, our company is from time to time involved in damage cases including both injuries to property and, unfortunately, injuries to persons. I am responsible for the handling of these matters. In selecting for discussion today particular items, I have tried to choose those which may be of general interest rather than those peculiar to our own company.

We could well spend our time reviewing what has been done on our tugs in the way of safety, such as the use of non-skid paint on the decks and rails, the use of safety glass in the windows, the installation of grab rails; but probably the area that deserves the most attention is that of the towing tackle. The parts are: (1) towing pad, (2) shackles, (3) pendant, (4) towline, and (5) trip line. We should also consider another item: chocks. The condition and handling of these items can result in personal injury or property damage.

(1) *Towing Pad.* Under our definition of "towing pad" we find many variations. Some vessels use a stem pad or clevice. Others merely drill a hole in the stem bar for the pin of the shackle. On most deep sea vessels it is non-existent. Several years ago we published a sketch to introduce the deep sea trade to a towing arrangement which would permit our tugs to render the most effective service. We have been advertising this towing arrangement since 1958 with moderate success. The effectiveness of a tug is drastically reduced with a high lead of a towline or a lead from a chock on either side of the bow or stern. In the Indiana Harbor Canal, the Elgin, Joliet & Eastern Railway Bridge Draw has a clear width of 61.7′. We assist vessels of 57 and 58 foot beams through that draw.

Incidentally, the recommended towing tackle is commonly used on Great Lakes vessels. We take no credit for its design but strongly urge its use by all vessels trading on the Lakes.

(2) *Shackles.* We will now consider the "running" or moveable parts of the towing gear. We must start off with the premise that there must be a "weak link" in the towing tackle. This must be the towline. Consequently, the shackles, pendants, chains and wire rope that are used must be of greater breaking strength than the towline itself. Since we have experienced failures in these items, let us determine what can be done to minimize them. From the standpoint of an officer on a vessel, safety demands inspection. Shackles should be inspected for evidence of wear, cracks, distortion, or the stripping of threads of the pin. In my opinion, a shackle should never be painted since the paint merely hides defects which would be apparent on visual inspection.

Several years ago one of our men suffered a severe knee injury when a shackle, between a chain pendant and a nylon towline, failed. The gear flew aboard the tug and struck him. We had a metallurgist examine the shackle and his conclusions were as follows:

1. The failure of the shackle resulted

from the application of a pull on an interlocked chain link producing a maximum tensile stress on the inner surface of the arms.

2. The actual fracture occurred at a location where a 1/8" deep crack existed in the arm prior to failure. The fact that the surface of this crack was both rusted and partially painted indicated the prior existence of this crack.

3. The crack was probably a fatigue crack produced by repeated load applications.

4. A similar type of crack existed in the other arm of the shackle approximately opposite the crack from which fracture occurred. It appears that this crack would have eventually led to a service failure had not a prior fracture of the shackle taken place.

5. The steel used for this shackle is poor quality as revealed by the serious attack during macroetching, high phosphorus content, and non-metallics in the microstructure. The phosphorus content was appreciably in excess of that specified for shackles in Federal Specification RR-C-271.

(3) *Pendants.* Wire rope pendants should be inspected for kinks, fish hooks, rust, wear and flattening of individual wires, exposed hearts (cores) of the strands or of the center of the cable.

Two years ago two of our men were injured when a splice of a wire pendant pulled out. A nylon towline was part of the towing tackle. The gear flew aboard the tug striking the men. The wire pendant was of 1⅜" galvanized plow steel 6x12x7, six strands of 12 wires with seven hemp centers. It was in good condition. However, our wire rope experts arrived at the following conclusions:

1. First and foremost this wire rope was not suitable for towing. For any particular size of wire rope, the more wires per strand the more flexibility. To give this wire pendant flexibility, with its relatively heavy individual wires, it was annealed.

2. Secondly, the splice consisted of three tucks when there should have been a minimum of five tucks.

3. Thirdly, the normal maneuvering of the tug, namely the repeated application of strain and easing off, along with the shifting of position, and the normal surging of the vessel, will tend to unlay or loosen the splice.

While splicing is getting to be a lost art among our seamen, I must state that this was the only case that I can recall where a splice pulled out.

Chains, used as pendants, should be regularly inspected for wear, distortion, stretch, and surface gouging and bruises. I believe it is worth repeating that paint may cover up a defect that might otherwise be easily discovered. Chain inspection should be made with the chain hanging free. Twists are then easily seen. All the links should be in a straight line. Any binding will also be easily detected. If any cracks are observed, the chain should be immediately taken out of service. We recommend against the use of chain where wire rope can be used, since any deficiencies of the latter are more readily apparent upon inspection.

(4) *Towline.* We have an open field as to towlines. The Towing Company recommends 8 inch manila or its equivalent. The field of synthetic lines is still developing. We are presently using dacron and a blend of dacron and polypropylene. These lines are easy to handle and do not have the tendency to stick to the bitts as does the 100 per cent polypropylene line. Quite frankly, we probably have not as yet found the "best" synthetic towline for harbor towing. Presently, we find dacron to be the best all-around harbor towline with one reservation—that it tends to retain water, which makes it heavy to handle. This should not be a problem for ships since the towline can be hung in a dry place between tows.

While nylon is an excellent line, we cannot recommend its use in harbor towing. Its elasticity presents a serious problem both to the tug and her personnel. Because of its stretch, it is impossible to maintain precise positioning of the tug, especially during alongside maneuvers. It can have a sling-shot effect.

We had a lineman killed while one of our tugs was assisting at the stern of a vessel. One of the chain links of a chain towing pendant parted. The bitter end of the chain carried by the contracting nylon line struck the stern of the tug and struck the man in the head. Most regrettably he was dead on arrival at the hospital.

One problem with all synthetic lines is the difficulty in ascertaining just when the line should be discarded. We have seen some sad synthetic lines which have tested substantially in excess of 52,000 lb. tensile strength of an 8″ manila. We have also seen good looking synthetic lines test below their advertised tensile strength.

(5) *Trip Line.* A trip line is a line about the diameter of a heaving line attached to the towline to facilitate pulling the towline aboard at the completion of the tow. A trip line should not be spliced into the towline but should be belayed to the towline. A clove hitch is a good knot to use. The tug crew can then shift it when it interferes with the handling or securing of the towline.

(6) *Chocks.* We can only recommend that they be inspected for grooving or sharp edges. When requested, we furnish towline tackle. In Ports like Chicago, we sometimes have to furnish a bridle (two cables secured to a towline). Each cable of the bridle is led through a chock on the side of the bow or stern. We have experienced some cutting of cables in the chocks, or outside the chocks. In one accident, we found that the shell plating extended above the deck level so that the cable was cut on leaving the chock. If such a condition exists, we suggest that a beading bar be placed over the sharp edge or that chafing gear be used. Better yet—install the recommended towing tackle.

While we have spent a great deal of time on the maintenance and inspection of equipment, we should mention one area that has resulted in much sharp language and has also resulted in injury to our personnel and damage to our tugs. As stated before, in some circumstances we are forced to furnish towlines to vessels. Attached to our towline will be either a single cable or a bridle which the ship hauls aboard and secures to its bitt or bitts. The problem arises in getting the gear back. It seems that once the tow is completed, good seamanship is suddenly forgotten and instead of passing the gear down to the tug on a heaving line, it is often dropped.

We have had several propeller foulings. These can be exceedingly serious, especially when the tug is released while under way.

We have also had two personal injury claims, both resulting in litigation. In both cases the vessel was alongside the dock when the towing gear was dropped. In one case. the gear fell into the water. At the time, the tug was under the bow of the freighter and was drifting into a bank. Since it was necessary to maneuver the tug, the tug captain ordered his men to haul in the gear as soon as possible. The deckhand, with the line in his hand, ran up the deck to haul it aboard. He fell when the shackle between the cable and towline caught on the rail at the stern of the tug. This ended up being a very expensive case.

In the other case, the tug was again under the bow of the steamer when the gear was dropped. It struck the knee of a deckhand. He was hospitalized for 10 days.

One of the most important of all aspects of safety practice in towing is the establishment and maintenance of good communications between tug and tow. Our Company insists that whenever possible, the master or pilot of the tow and the tug captain discuss and mutually understand the procedure to be followed during the tow. Once the service starts, it is a cooperative venture with everyone alerted, we hope, for the safety of everyone else.

Most of our tugs are equipped with VHF (FM) radio-telephone, with necessary channels to permit bridge to bridge communication throughout the service. At the present time, most lake ships and all salt water ships entering through the Seaway have VHF (FM) radio-telephone equipment. Some of our tugs have MF (AM) radio-telephone equipment, which is useful for long distance purposes, but is not as satisfactory for close aboard communication as VHF (FM). There is in addition to radio, the voice hail from the forecastle or bridge to the deck of the tug. This, of course, can become totally ineffective due to wind and other interferences with hearing.

Neither radio nor direct voice communication can fully supplant the whistle as a standard means of communication between tug and tow. Our Company many years ago designed a whistle signal system which improved as a result of experience over the years and is now in use in all of our Great Lakes Ports and works very well. (See Exhibit #3.) To insure that masters and pilots of our tows and especially those that are entering the lakes from salt water for the first time are familiar with the signals, we have made and continue to make every effort to see that all ships have these aboard. They are part of a booklet describing our service in some detail and which includes a description of our recommended towing tackle and the reasons for its use. Referring specifically to the whistle signals, our notice to shipmasters and pilots points out that they do not supplant any navigational signal required by statute and regulation nor can they in any case supersede any requirement of the "Great Lakes Rules of the Road." They are, however, of extreme importance to the safety of tug and tow during the towing operation.

Whistle Signals

Ship to Tug

One long and one short blast (— –) *ship ready to proceed, O.K. or all-right.*

One long and two short blasts (— – –) *let go of the bow towline.*

One long and three short blasts (— – – –) *let go the stern towline.*

Both Ship to Tug and Tug to Ship

One short blast (–) *work propeller ahead when propeller is stopped; stop propeller when propeller is working either ahead or astern.*

Two short blast (– –) *work propeller astern.*

Three short blasts (– – –) *"check" or slow down.*

Four short blasts (– – – –) *work propeller strong in the same direction it is working at the time the signal is blown.*

Five or more short blasts (– – – – –) *the standard danger signal.*

SAFE PRACTICES IN LOADING PETROLEUM PRODUCTS IN TANK VESSELS

By PHILIP NEAL
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The prevention of explosion and/or fire is a major concern in the loading of flammable hydrocarbons into tank vessels at terminals or sea berths. In view of the wide scope of potential problems in such operations, this paper has been limited to vapor control and ignition prevention precautions applicable to petroleum products having flash points of 80°F or less, which would include Grades A, B and C products. Since precautions for preventing ignitions for this most flammable range of products would apply essentially to all grades, it is felt that these safe practice suggestions will suffice.

I have also omitted static ignition and fire fighting techniques as they are not within the scope of this paper. Further, the problems of switch loading of products are not dealt with in this memoranda.

A survey of recent serious tanker damage by fire or explosion reveals that about 25 per cent took place while the vessel was handling cargo or preparing to do so. There exists, of course, more and greater hazards at this time, but you will realize that personnel are also more cautious and follow a set of procedures designed to minimize the hazards. In spite of these precautions, accidents do happen. Let us examine some of these hazards and how they can be overcome.

Potential Hazards

Let us examine conditions at start of loading.

At the time of initial loading into a gasfree tank, vapor is immediately released. The ambient temperature, product temperature, vapor pressure of the product and the product and the turbulence will determine the rate of vapor release. The turbulence in turn, will depend on the loading rate. The vapor blanket forms above the surface as soon as the tank bottom is covered.

The stratified conditions in the tank consisting of product, vapor blanket and air, move upward in an intact state, except that the vapor blanket tends to thicken particularly with a product such as gasoline. It should be kept in mind that at the interface of vapor and air there is always one point (or level) at which an explosive mixture exists. The depth or the volume of this mixture would partly determine the violence of an explosion.

Under quiescent conditions, gasoline vapor is sufficiently heavy so that the diffusion into the air space is relatively slow. Under high loading rates, no firm prediction of the thickness nor the explosibility of the vapor/air strata can be made.

As the product level approaches the upper quarter of a tank, vapor release through the tank vents will normally be too rich to explode until such time as it is diluted by air into the explosive range.

Release of Gas to Deck

At the point referred to immediately above, any release of vapors at the deck level is most hazardous. Vapors released at the deck level can penetrate accommodation areas where electrical equipment and/or smoking areas may act as a source of ignition. In this connection, I suggest to you that vapor control will pay off much more in fire prevention than trying to eliminate ignition sources in accommodations.

In an effort to control this hazard, some tank vessels have vent piping directing the vapors up the mast through a P/V valve. This is known as a closed venting system. Closed venting on tanks requires precautions to avoid damage to tank compartment structurally as excessive pressures of product, air, or gas can cause distortion or rupture of any large flat surfaces.

Some of your carriers probably load with open venting. For open venting, ullage screens must be kept in place during loading except during brief gauging operations. Ullage covers should be in a closed position resting on the pin and P/V valves must be open to obtain all possible masthead venting.

Unauthorized Release through Closed Loading Systems

The liquid level in a tank must be closely watched and controlled, especially during the stages when the tank is nearly filled. This is done through either a standpipe, enclosed tape gauge, or manometers. When these devices fail or are suspect or cause a surge by the compressive effect to the entrapped air/vapor, the tank is too often vented at deck level by opening the ullage cover or slightly opening the tank lid. This perversion causes a worse hazard as there is no protecting flame screen. Through good design and maintenance of gauging equipment and pressure/vacuum release valves, and adequate sizing, cleanliness, and manifolding of vent lines and mast head flame screens, it is possible and much safer to use closed loading systems. The United States Coast Guard requires all new tankers carrying grade A liquids to have a closed venting system.

Recommended Safe Methods and Procedures

I am sure all of you know that safe loading starts long before the vessel arrives in port with the gasfreeing of the cargo spaces, maintenance and inspection of piping and valves, and the formulation of a loading plan that has safety as one of its more important considerations.

Due to the increased chance of ignition sources while in port, openings into cargo spaces and pumprooms should be protected or secured before arrival. Ballast or slop should be gathered in the minimum number of tanks. The ordinary precautions such as posting warning signs, closing doors and ports to quarters, bonding, plugging scuppers, rigging firewires, should be carried out.

The connecting of hoses should be closely supervised as it is a particularly vulnerable operation involving overhead loads, running rigging, flanging up and the decision of which manifold is most direct and segregated. The initial tanks to be loaded are selected with careful regard to parcel separation, hull stress, trim and condition of cleanliness. Those tanks nominated to receive middle distillates should be tested with a vapor tester just before start of loading.

Loading should be started at a low rate, preferably by gravity, and the joints and valve set-up examined for leaks and to ensure that not only is the product flowing into the particular tanks chosen but into no other. When this has been confirmed the loading rate maybe increased to a level consistent with safety.

Venting during loading should be with the pressure/vacuum valves manually fully opened, except when the gasses displaced could contaminate a cargo to be loaded in tanks sharing the same vent header. In this case the vents should be separated by closing the P/V valves in the empty tanks until just before loading into them.

The safe loading rate is determined by many variables, one of the most important and often neglected being the ability of the crew to cope with a number of tanks being loaded simultaneously. Among the other considerations are pressure on hoses, valves and pipelines, stress and trim, time required for shut down, vapor formation and venting and static generation which will be dealt with later. Generally pipeline pressure is limited to less than 100 pounds p.s.i. Venting limits loading by the following approximate table bearing in mind that these rates are for one compartment and assuming the vent header is adequate for all the individual vent lines.

Size of Tank Compartment Vent Line	*Maximum Rate In Barrels Per Hour*
4″	3,000
5″	5,000
6″	6,000
8″	10,000
10″	15,000

For those ships still using "open" deck-level venting, which is usually accomplished through ullage holes or short ullage pipes, these openings should be screened at all times except when actually sighting or gauging. The ullage cap should be resting on the pin and the P/V valves manually open for all possible masthead venting. As soon as any tank has been loaded, the P/V valve should be returned to the automatic condition.

When topping off tanks to the predetermined ullage, the loading rate should be carefully controlled and observed. Early and clear notice is given of the intention to slow or stop loading and must be confirmed by the jetty operating staff. Shore pumps should be stopped and valves shut before those on the ship. A check should be made after a tank has been finished, to see that through failure of the valve, oil does not continue to come into a tank beyond the desired ullage.

After finish of loading and allowing any static relaxation time, ship's ullages, samples and temperatures are taken and the tank tightly sealed before allowing harbor craft alongside. Hoses are best drained into the ship's pipelines and tanks before disconnecting, taking care to raise any low spots. Before the hoses are lifted from the deck they are tightly blanked.

At one terminal dock fitted with an open grating some boys were discovered in a rowboat underneath catching gasoline as it dribbled from the end of an open hose. On being challenged they replied they had five empty cans and a book of matches and which one was to be used to dispose of the gasoline first.

Control of Ship and Shore Personnel While on Board

Access to a tanker is usually controlled by the terminal gate, but once on board, shore personnel and crew alike come under a considerable degree of self discipline. The ship's officers in the course of their other duties observe and correct any dangerous practices. Various notices, posted in pertinent places, outline the expected conduct of those on board. A seaman's own colleagues exert considerable control over him in safety matters as they are "all in the same boat."

Smoking in dangerous places presents a control problem on tankers. Years ago smoking was prohibited any place on board while handling cargo. Now the concept is to allow smoking in designated safe places in order to diminish the desire for smoking in dangerous places. Strange shore personnel should be escorted through hazardous areas and only those allowed on board who have a bona fide reason. Crew personnel selection is another big factor contributing to safety on board.

Emergency Shutdown and Special Precautions for Unfavorable Conditions

Occasionally during loading, a problem such as valve malfunction, tank overflow or pipeline or hose burstage requires that the loading be stopped very quickly. Sometimes it is not possible to immediately proceed to shut the dock loading valve as the delivery pumps would soon build up excess pressure on the loading line. Shutting off the ship's manifold adds the hazard of subjecting the hose to excessive strain. This problem is best met by having an emergency pump shut off switch located at the dock loading station. Lacking that, good communication between ship, dock and loading pumphouse is a must. Of course, whenever possible, adequate standby time must be given prior to shutdown.

I wonder whether any of you have recently encountered problems at deepsea tanker berths where you find the shore valve and dock station unattended for some length of time and what you have done about this problem.

During severe lightning storms, nearby fires, high seas or winds, or in the event of the vessel surging up and down the berth from passing traffic, all loading should be stopped as a precautionary measure. Also, if during regular conditions, hazards arise such as too many compartments becoming full at one time or unexplained oil appearing on the surface of the water, it is recommended that the vessel stop loading.

Under grave enough conditions, a vessel should not hesitate to disconnect and leave a berth.

Precautions for Repairs and Other Abnormal Conditions

Except under pressing conditions and then only with the utmost caution, repairs should not be undertaken while alongside a loading terminal. This is because of the added hazards and exposures, the inability to move if the repairs involve disabling the engine, and the dilution of attention.

Repairs have been successfully completed, however, by gasfreeing the vessel prior to arrival or by inerting and sealing tanks.

Whenever possible material or machinery should be removed ashore for repair and returned after repairs are completed. Loading should not be started if repairs are to be undertaken on deck or if heavy gear has to be carried across the deck.

The loading of drum cargo should not be done without explicit instructions from the home office and especially those drums containing product with a flashpoint below 150°. I feel that drum loading is a risky business and should be discouraged by the industry.

High temperature cargo presents it's own problems in gas generation and hull stress and should be loaded only by well thought out procedures.

Crude oils rich in hydrogen sulphide gas should be handled by methods designed to minimize the exposure of personnel to its danger. Anyone who must work in concentrations of over 20 ppm should wear respiratory protection gear.

Special Precautions
A. Static Generation

There have been well documented cases of explosions and fire on vessels loading kerosene-type middle distillates. These casualties have been traced to static generation caused by the flow through the pipeline and loading valve which results in turbulence and agitation of the product without sufficient conductivity to dissipate the charge, which then arcs to any ground causing an incendiary spark.

The precautions to be taken against this hazard include minimizing the water, dirt and air in the product or tank and loading at a slow rate to decrease the static generation, gasfreeing the compartment well below the lower explosive limit, and, in the case of the more dangerous gasoline based jet fuels, filling the compartment full.

B. Anode Inspection

Because some recent tanker explosions can be attributed to a spark caused by falling anodes/cathodes striking the steel tank members, the supports for these elements should periodically be examined for wastage of the element, supports and fastenings and these renewed or reinforced as necessary. Some ship owners enclose the anodes in nylon mesh to insulate the point of impact should the anode fall.

C. Unauthorized Probes and Spark Promoters in Tanks

Static charge, as generated by product movement, is dissipated to a safe level during a time determined by many variables. However, experience indicates that 15 minutes is a safe minimum relaxation time. Before that time no conductor or semiconductor should be introduced into a tank. This includes ullage or innage tapes, thermometers, or sample pots.

There are other probes such as tank washing machines, vapor testers, blowers and eductors which are not so obviously dangerous when inserted into a tank but should be used with caution in a gassy mixture.

Safety and Emergency Equipment

A. Gas Testing Equipment

Every tanker should be equipped with a vapor tester or explosimeter plus a calibration kit and spare element cells. This instrument is essential to determine just where explosive mixtures exist. Some vessels in hazardous trades also employ a portable constant gas monitor fitted to give an alarm at a set level. There is a fixed cabinet plus scattered detecting heads fitted on some vessels that constantly monitor and record the vapor concentration at different critical stations.

On those vessels that might carry hydrogen sulphide crudes, a simple quantitative analyzer is very useful.

B. Rescue and Personnel Protective Equipment

Classification societies and inspection bodies having jurisdiction, require that vessels be supplied with safety harnesses, stretchers, lifelines, signal circuits, supplied and forced compressed air breathing apparatus, axes, fire gloves and suits. Some tanker operators go beyond the minimum required and supply goggles, hard hats and safety shoes. This equipment can function only if it is used and by men trained in its use, and is part of periodic drills.

C. First Aid Respiratory/Resuscitatory Equipment

Many hazards aboard tankers involve respiratory impairment or failure. With a view to providing for or resuming normal breathing, a resuscitator/respirator/aspirator should be part of a vessel's equipment. This equipment is designed to restore breathing if it has stopped, to supply oxygen where a deficiency exists, or to clear obstructions in the breathing system.

To summarize this matter of safe loading of petroleum products into tankers, safe practice consists of knowing the hazards to be encountered and then preparing for and overcoming them. While accidents have happened, hundreds of tankers are safely loaded every day.

SHIPBUILDING AND REPAIR

WHEN DISASTER STRIKES—AN ACCOUNT OF HURRICANE BETSY

By J. R. O'DONNELL
Safety Director, Avondale Shipyards, Inc., New Orleans, La.

On September 9, 1965 Hurricane *Betsy* tore its way through the Port of New Orleans and, in the brief span of 13 nightmare hours, left the marine industry reeling under its worst peacetime disaster in American history.

Avondale Shipyards main yard took the full brunt of the storm, with winds in excess of 160 mph and a tidal surge that rolled up the river, 12½ feet above normal and churned with waves 16 feet high. Throughout the night the men of Avondale fought with everything they had to protect life and property but, when the storm had subsided, one ship was down in 110 feet of water and five others were hard aground on the opposite bank 9 miles upriver. Nothing that man could muster would have been able to hold the ships against the vicious onslaught of wind and water . . . yet at no time did anyone concede to the elements.

At the height of the storm the river at Avondale was alive with runaway barges that had broken loose from their moorings at countless terminals in the area. Tossed against the ships by the tidal surge, and driven by the wind upriver against a 3-knot current, they were indiscriminate battering rams against each other and everything in their path. A total of 171 barges were tossed on the bank between Kenner (10 miles upriver from the Avondale yard) and New Orleans and the number of tugs and barges sent to the bottom were almost uncountable. More than 75 persons died during Hurricane *Betsy*, over 250,000 evacuated and property damages were estimated by the government at $1,419,830,429.

Reeling under what to a lesser organization could have been a death blow, Avondale fought its way back and within six days was back in full production. All of the runaway ships, with the exception of the Letitia Lykes and the Genevieve Lykes, were back at the outfitting dock and all facilities were operative. The comeback was tremendous . . . there was no disorganization, no lack of direction . . . only devoted men working with determination to rectify a catastrophe.

One factor must be emphasized and that is the fact that Avondale Shipyards was not advised that the hurricane would strike New Orleans until late afternoon of that same day. Contradictory reports were received all day . . . the majority of which clearly stated that the storm would skirt the city and that there would be no danger whatsoever. Fearing supplementary effects of wind and tide the yard began preparations to tie down all equipment and, in general, to protect company property.

Additional lines were placed on the ships at the outfitting docks and all cranes were secured with their brakes applied and the load lines attached to the gantry rails. Security guards patrolled the yard and docks and the second shift was placed on alert. There was nothing further left to do than to wait out the storm.

The communications and power system of the city was completely disrupted with the initial onset of the hurricane. Power lines were whipped into a tangled maze and the service poles were either snapped off or uprooted. By morning almost 383,000 telephones were no longer in service.

Arriving on the yard at 9 a.m. the following morning, I was met by the vice president in charge of production who had already made an initial survey to make certain that none of our people had been injured. All of the ships that had broken loose at the outfitting docks had carried one or more persons . . . workmen who had been attempting to secure the vessels up until the last moment. All personnel had managed to get off the ships when they grounded and the two onboard the sunken Letitia

Lykes had made it to shore. There were no injuries which, considering the havoc, was almost a miracle.

A destroyer escort, complete and standing off the outfitting dock with a full crew, was pressed into service and its power plant used to supply electricity to vital yard areas. Its communication department was similarly used and furnished contact between the yard and the various agencies of the community including the police, Civil Defense and the vessels in the area.

Temporary lines were run from the river, over the levee, and into the main buildings to service the sanitary system. Running contact between the supervisors was maintained by means of portable two way radios.

Clean up crews went to work immediately while the production force attempted to salvage the grounded vessels. Temporary plates were welded to the hulls of the torn ships and every effort was made to make them sufficiently watertight for transfer to the main yard. Only the Genevieve Lykes, precariously balanced on shore, slid free and came to rest on her side with her cargo booms enmeshed with the sunken Letitia.

No lost time accidents occurred during the storm or the salvage operations. However, on the Monday following the hurricane, a first class, experienced electrician was electrocuted, while making up a junction box when he cut into a live 440 volt line.

In analyzing this disaster there are many things which we have learned. Should such a situation occur again we will make every attempt to protect the ships at our dock from the effects of a high wall of water which moved up the river and caught us completely by surprise.

The following procedure has been adopted by Avondale's management and it will be placed into effect should such an emergency threaten the yard:

Remembering our experience of last September 9th, it is necessary that we take steps to prevent a recurrence of the extensive damages incurred by this company during Hurricane *Betsy*. It is considered most unwise to attempt to keep the ships at dockside exposed to the destructive battering of hundreds of loose barges. There is a great danger of having them sunk at our wharf.

It is suggested that should a hurricane threaten this area that all ships afloat be taken and anchored upstream, well out of the area that may be endangered by the several fleets of barges near the shipyard. The U.S. Engineers may help us in choosing a favorable location.

The following steps are suggested:

Step One: Each vessel afloat will be equipped with anchor and a minimum of 500′ of chain. As the vessel will not be powered, it will be necessary to provide a means of safely releasing the anchor once at the chosen site.

Step Two will be taken in case a storm has been declared hurricane intensity and though it be several days away and is moving toward the Gulf of Mexico, we will begin to close all manholes in tank top, all temporary openings in bulkheads and decks on these vessels that will least affect Production.

Step Three will be started should the hurricane definitely show signs of entering the Gulf of Mexico. All manholes on all vessels will be closed and tightened. All openings in bulkheads and decks will be closed. Hull openings will be closed.

Step Four: Should the hurricane continue to be a threat and is within 24 to 36 hours of New Orleans, this step should be started. This would be to engage tugs and beginning with the vessels that would least retard production, tow them to the prechosen site and anchor them. Other vessels at the dock would have all hatches battened down and all loose materials secured.

Step Five should be taken if the storm moves within 24 hour distance and is moving toward the coast anywhere between Mobile, Alabama, and Lake Charles, Louisiana. This step would be to tow the remaining vessels to safe anchorage. Secure all loose materials in the shipyard, lash down and secure gantries, cranes, etc., protect materials in warehouse, secure doors, etc., in all buildings, etc.

It is not intended that barges be removed from the shipyard. We are installing adequate deadmen in the yard for mooring such craft. These are to be located far back in the plant so as to permit a considerable rise in the river without tightening or breaking the lines.

In case we should have a drilling rig or other submersible rig under construction, it is suggested that, should it be advanced far enough to be a problem, it be towed to a suitable site and ballasted to sit firmly on the bottom of the river. In less advanced stages of construction, it will be treated as other barges.

Avondale lived through its 13 hours of hell and came back in full force. It suffered but it learned and, in learning, safety moved one step forward.

Perhaps another disaster of this magnitude may never occur again but, if it should, we feel that we may be better able to cope with it through our experience with Hurricane *Betsy*.

ADDRESS

At a Joint Luncheon of the Marine Section and the Propeller Club, Port of Chicago

By V-ADM. J. A. HIRSCHFIELD, USCG, (RET.)
President, Lake Carriers Association, Cleveland, Ohio

Little reflection is needed to realize how broad the connotation of safety can be, and how close it is to all of us, in our daily lives, to our country, and to the whole world. I realize that the primary purpose of the National Safety Council is to prevent accidents in what could be called the nuts and bolts area of safety. Because of limited knowledge in this field, I want to talk to you from a broader point of view, that of the safety of the ships themselves. After all, the safety of the crew depends upon the safety of the ship.

We on the Great Lakes are proud of what we have done to promote safety on the lakes, and welcome every opportunity to tell of our achievements and our problems, and to hear about those of other segments of the industry. Such an interchange permits all of us to benefit, and hopefully to plant seeds of still further progress.

The very origin of the Lake Carriers' Association more than 80 years ago can be traced to safety — the need of early lake vessel operators for safer navigation. Since the association was organized, practically every improvement to a lake channel, erection of a lighthouse, and many other safety measures, have received their principal impetus from the association.

The association also can be credited for the establishment of load lines on Great Lakes vessels; putting in force present Great Lakes rules of the road, and establishing separate courses for upbound and downbound ships. At one time, near the turn of the century, it maintained at its own expense lightships at strategic points and an extensive system of buoys and ranges.

Incidentally, Captain John Ward Westcott, who founded the Detroit River mail and dispatch boat service known as the J. W. Westcott Co., established the first range light at Grosse Point, Mich., in 1873, and also the first lightship on Lake St. Clair. Captain Ward rowed a skiff nightly to Snake Island (now Belle Isle) to hang a lantern on a pile as a beacon to mariners. These were among the first navigation aids on the Great Lakes.

We also are proud that the association had something to do with the origin of the Marine Section of the National Safety Council. The late George Marr, an association vice president, proposed, at a meeting in Cleveland more than 40 years ago, that such an organization be formed. It is our understanding that the seed he planted grew and blossomed into the organization we have today.

Lake operators, working with manufacturers, pioneered in the development of a multichannel safety oriented marine radiotelephone system. They were also quick to press for the development of radar sets suitable for marine use in the lakes.

Referring to the inclination of lakes people to hide their light "under a bushel," former Coast Guard Commandant Edwin J. Roland recently said: "The Great Lakes maritime people know they are 'way out in front, and they don't care how quick the rest of the world catches up with them." Well, there is plenty of evidence that Admiral Roland was not jesting. I will cite an example.

At its recent meeting in Detroit, the American Association of Port Authorities heard a report from its Ship Channels and Harbors Committee on separated shipping lanes and bridge-to-bridge radio-telephone communication. The Coast Guard has proposed a system of separating the inbound and outbound channels in the approaches to New York Harbor and the Delaware River, and it is expected that by the end of next year similar traffic lanes will be considered for all major United States seaports. The report of the port authorities correctly stated that the system of separate courses was initiated on the Great Lakes in 1911.

Two years ago our association's vice president and secretary, Oliver T. Burnham, went to England to tell the Institute of Navigation of Great Britain, France and Western Germany, about the Great Lakes use of separate courses. Just what part his talk played in the decision is not known, but it is interesting to note that the three countries later arranged to establish them in the North Sea and in the English Channel.

Further, I understand that the Canadian government is actively studying the establishment of divided courses in the St. Lawrence River below Montreal in section where there have been several serious collisions in the past several years.

The port authorities report was concerned with bridge-to-bridge radiotelephone communication as proposed by the Coast Guard. This would require that all vessels in U. S. waters be equipped with single channel bridge-to-bridge communication. The proposal exempted the Great Lakes. Why? Because Great Lakes vessels all are equipped for multichannel bridge-to-bridge communications. All have not only FM multichannel sets, but also U. S. vessels have, in addition, VHF equipment. The multichannel radiotelephone communication system of the Great Lakes has proven to be a great asset in furtherance of the safety of navigation.

The unique aids to navigation employed on the lakes, such as the separate courses and the radiotelephone communication system, have contributed immensely to the enviable record of safety achieved on the Great Lakes. Indeed, the shipping lanes of the Great Lakes have long been regarded the safest in the world. This fact has come about only because of sound navigation practices and the enactment of intelligent laws suited to navigating conditions on the Great Lakes. Specifically, I refer to the Great Lakes Rules of the Road.

The Great Lakes Rules of the Road found their inception in a series of nine rules promulgated in 1871 by the old Board of Supervising Inspectors which was then charged with the administration of the navigation and vessel inspection laws. These original rules were a codification of many existing practices prevalent on the lakes and rivers. The original rules required compulsory passing signals, provided for the danger signal, the bend signal and overtaking signals, all of which are in use on the Great Lakes today. By statute, lake vessels in 1871 were already required to carry, in addition to side lights, a central range of two white lights.

In 1895 the White Law was enacted which prescribed special statutory rules governing navigation on the Great Lakes. This was a deliberate and advised act on the part of the Congress. Navigators, vessel operators and admiralty lawyers were consulted in the preparation of the rules. The particular requirements of navigation on the Great Lakes were carefully considered. The report of the Commissioner of Navigation for the year 1895 stated:

> "At the instance of the Lake Carriers' Association representing nine-tenths of the American shipping on the Great Lakes, Congress at the last session passed a law establishing a body of rules to prevent collisions on the Great Lakes and connecting waters as far east as Montreal. Its chief point of difference from the International Rules is the application of the usual course-indicating signals by steam vessels to foggy and thick weather and the consequent necessary change of the usual danger signal in a fog from one blast to three. The bill was favored by nearly all the masters and pilots of lake vessels and by a large majority of owners."

The Commissioner then stated that these Great Lakes Rules "were carefully drawn to meet the peculiar conditions of the navigation of the lakes and the narrow channels connecting them."

The fact that the Great Lakes Rules differ in many respects from the International Rules is not because the rules of the lakes developed in a hodge-podge fashion, as has been suggested in some quarters. The departure from the International Rules with respect to passing signals and the fog signal was a recognized and deliberate act by the framers of the Great Lakes Rules. Experience dictated their decision. The International Rules were made primarily for the sea, and did not make adequate provisions for many of the situations which commonly arise on the Great Lakes.

Further, many provisions of the International Rules are a result of compromise and do not necessarily provide the best rule in a particular set of circumstances. Often nations will not accede to a particular requirement of the rules unless recognized by their own citizens through long practice and usage. For example, although passing signals were mandatory on the lakes as early as 1871, no provision was made in the International Rules for such signals until 1890. Neither the danger signal nor the bend signal found its way into the International Rules until 1948. Until then, too, the carrying of an after-range light was optional. Under the 1960 International Rules the danger signal is still optional. I think it important to point out that the Great Lakes Rules are the result of agreement between the two countries, the U. S. and Canada.

With the influx of overseas flag vessels into the Great Lakes following the opening of the St. Lawrence Seaway, failure of many of these vessels to observe the Great Lakes rules and practices soon led to compulsory pilotage requirements in certain designated waters. In other waters of the Great Lakes, however, compulsory pilotage is not required, if an officer of an overseas flag vessel is certified as qualified for such waters. This has led to the issuance by Canada of the so-called "B" certificate.

Needless to say, the requirements for obtaining a "B" certificate do not approach the requirements of a registered United States or Canadian Great Lakes pilot and this, we believe, is a serious deterrent to safety. The number of overseas flag vessels involved in collisions in the open lakes in recent years and in certain narrow approaches before reaching pilotage waters amply demonstrate this fact.

There are, of course, those who advocate that the failure of certain overseas vessels to observe Great Lakes Rules and Practices justifies amending the Great Lakes rules to conform to the International Rules. It is assumed that, because the rules of navigation would then be uniform, safety of navigation would be improved. Nothing could be further from the truth.

In terms of volume of cargo and density of traffic, the shipping lanes of the Great Lakes traffic are the busiest in the world. The continuous procession of upbound and downbound vessels day and night through the narrow connecting channels requires special aids. In 1964, for example, there were a total of more than 16,000 upbound and downbound passages through the Detroit River. Of these, American and Canadian Great Lakes vessels accounted for 14,106 passages while overseas vessels made only 1,950 passages. Why, then, should the special rules of navigation, including special aids such as separate courses and the radiotelephone communication system, be abandoned when such rules have proven themselves, insofar as the safety of navigation is concerned?

They have had the flexibility necessary to accommodate to channel improvements and increasing size of vessels. I think it pertinent to note that at the last annual meeting of the Navigation Committee of Canada's Dominion Marine Association, it recommended that the Great Lakes Rules be extended below Montreal as far as Escoumains, replacing International Rules in that section of the St. Lawrence River.

Fortunately, the United States Coast Guard has recognized the merit of the Great Lakes Rules of the Road, and while that organization advocates greater unification of all navigation rules, its proposal for unification contains appropriate exceptions designed to preserve the essential characteristics of the system of navigation followed on the Great Lakes. Nevertheless, our Association believes, as I know virtually all Great Lakes masters do, that present-day Great Lakes rules should remain intact, whether or not this is done by preserving the present White Law or incorporating that law as a specific exception to any unification proposal.

Gentlemen, you are indeed engaged in most worthwhile endeavors, doing all in your power to prevent injuries to personnel in the course of their daily work in the maritime business. Your efforts have helped to make U. S. flag ships the safest in the world for our seamen. I think this result is in conformance with and a tribute to our national policy. My concern today has been with the safety of the ship herself. in navigating the fresh water highways of the Great Lakes.

We are not rigid or unbending in our appraisal of suggested improvements, but evaluate them in the light of past experience and their possible future implications. Insofar as this process is concerned, we are convinced that our Great Lakes rules and navigation practices must be retained.

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	022.36-9	9	Electrical Equipment	.45	.40
	022.36-10	10	Food & Beverage, Meat Packing, Tanning & Leather Products; Trades & Services	.75	.60
	022.36-11	11	Glass & Ceramics; Rubber	.75	.60
	022.36-12	12	Industrial Subject Sessions; Associations	1.00	.90
	022.36-13	13	Labor	.75	.60
	022.36-14	14	Marine	.75	.60
	022.36-15	15	Metals	.45	.40
	022.36-16	16	Mining	.75	.60
	022.36-17	17	Motor Transport; Transit	.75	.60
	022.36-18	18	Occupational Health Nursing	.45	.40
	022.36-19	19	Petroleum	.75	.60
	022.36-20	20	Public Utilities	.75	.60
	022.36-21	21	Pulp & Paper; Printing & Publishing	.75	.60
	022.36-22	22	Railroad	.45	.40
	022.36-23	23	School & College	1.00	.90
	022.36-24	24	Traffic	.75	.60
	022.36-25	25	Wood Products; & Textile	.75	.60
	022.36-26	26	Early Morning Sessions	.45	.40
	022.36-27	27	Public Safety	.75	.60
	022.36-28	28	Home Safety	.75	.60
	022.16		COMPLETE SET OF 28 VOLUMES $12.15		

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