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†As elected by delegates in Congress Session

TUESDAY AFTERNOON SESSION
October 5, 1943

Presiding: Byron O. Pickard, Chief Safety Engineer, Waterfront Employers Association of the Pacific Coast, San Francisco.

The Security of Vessels in Port

CAPTAIN NORMAN B. HALL
Chief, Port Security Division, U. S. Coast Guard, Washington, D. C.

In order to obtain maximum security and efficiency, the Port Security activities of the Coast Guard have been closely coordinated with the work of other government and private agencies directly or indirectly concerned with similar problems. In Washington we maintain close liaison and cooperation with the Army and Navy, the Department of Justice, the Office of Petroleum Administrator for War and the Office of Civilian Defense, as well as with private agencies such as the National Safety Council, the American Petroleum Institute, the Bureau of Explosives, the National Board of Fire Underwriters, the National Fire Protection Association and others. We have also encouraged the Captains of the Port to coordinate their activities with those of other agencies in the various ports, and in several there have been established formal coordinating committees consisting of representatives of all public and private agencies whose work relates to the protection of ports and shipping. Our object has been to remove all friction and unnecessary duplication; and to insure that all available personnel and facilities are assigned in such manner as to insure their maximum utilization and the optimum security of our ports and vessels.

Security and Efficiency

In instituting port security measures, the Coast Guard has always attempted to balance two factors: the first is the need for thorough and effective port security measures. We have recognized, however, that the need for maximum security must be balanced against another factor, which is the need to maintain the output and efficiency of ports and their facilities at a maximum. Our security measures have been designed to insure a proper balance between these two factors. Our object has been to attain the maximum possible security, without impairing the operation of our vessel and port facilities.

Today, no person is permitted on a vessel or waterfront facility unless he possesses a Coast Guard identification card. In addition, all operators of waterfront facilities have been urged by the Coast Guard to institute pass systems. A simple yet effective system has been suggested by the Coast Guard and adopted by large numbers of operators.

To prevent person from approaching waterfront facilities and vessels from the waterside, the Coast Guard has relied upon two measures. First, it has maintained constant small boat patrols of all harbor areas. Secondly, all boats must obtain movement and departure licenses from the Captain of the Port. We have found that the combination of the Coast Guard identification card system and the vessel license system enables us to maintain a substantially effective control of the approach of persons to vital facilities from the waterside, as well as from the landside.

Combating Fire

Injury to vessels and port facilities may result from accident, negligence or sabotage. Irrespective of the cause, however, the most common and dangerous means of injury is by fire. Realizing the necessity of combating fires if adequate port security is to be maintained, the Coast Guard has been taking steps to prevent fires and to combat and limit any waterfront fires which may occur. In every port, waterfront facilities have been surveyed by Coast Guard officers to determine the existence of fire hazards. In almost every case, these hazards have been voluntarily

corrected. With this increase in the number and scope of Coast Guard surveys, the existence of fire hazards is rapidly being corrected.

The fighting of waterfront fires has long been handicapped by lack of fireboats in most ports and harbors. In order to correct this need, the Coast Guard now operates a fleet of over 250 fireboats, each with a pumping capacity of over two thousand gallons a minute. It is not the intention of the Coast Guard to relieve local fire-fighting authorities of their responsibilities, but only to work in cooperation with them in the protection of waterfront premises.

Of course, the war has greatly increased the volume of explosives shipped through American ports and supervision of the loading and unloading of explosives is, likewise, a function of the Coast Guard. The Captains of the Port have strictly supervised the loadings, in order to insure that every necessary precaution is taken.

Standardized Regulations

All of the measures of which I have spoken perform the dual purpose of safeguarding our waterfront facilities and safeguarding vessels while in port. But ships, by their very nature, require that certain special protective measures be taken. Prior to January of this year, many agencies had issued regulations for vessels in port, while the Captains of the Port had established local regulations to handle this problem. As a result of these varying and sometimes conflicting regulations, Masters going into the different ports were often confused as to the measures they would be required to take for the protection of their vessels. The Coast Guard, therefore, determined to issue standardized regulations for the protection of vessels in all American ports; and to issue them in such form that Masters would be conversant with the basic security measures they would be required to take.

The regulations for the security of vessels in port have been promulgated under the authority of the so-called Espionage Act which provides criminal penalties for their enforcement. Their purpose is to insure the safety of vessels in port and they apply to all vessels, foreign and domestic, in all ports of the United States. While they furnish the basic minimum requirements for the security of vessels, it should be noted that, when special circumstances arise, the Captain of the Port may require additional measures to be taken or may waive any of their provisions. I should also like to point out that these regulations do not relieve the masters, owners, operators, or agents of vessels of their primary responsibility for their security but, on the contrary, place upon them the responsibility for carrying out the basic measures required by these regulations.

Summary of Provisions

Let me, briefly, summarize for you a few of the salient provisions of these regulations. First, it should be noted that we divide all vessels into two categories; those which are in service and those which are out-of-service; and different regulations are provided for those in the out-of-service group. Vessels in service are further sub-divided according to their gross tonnage, but most of these regulations are applicable to all vessels over 1,000 gross tons.

All vessels in port, except those out-of-service, are required to maintain at all times a crew of officers and men equivalent to a regular deck and engine room sea watch, not including day men. These officers and men are required to be on the alert and to maintain efficient and continuous watches and inspections. In addition to the members of the crew, additional guards are required. These are of three kinds: ship guards, cargo guards and fire guards, each class performing the type of duty indicated by its title. The types of persons which may act as guards are specified in the regulations and they must be certified and approved by the Captains of the Port. Their necessary equipment and their duties are set forth in detail.

To prevent unauthorized access to vessels, these regulations provide that no person may be permitted aboard unless he possesses: (1) A Coast Guard identification card or other means of identifica-

tion satisfactory to the Captain of the Port; (2) an acceptable pass, issued by the operating company or by the Master of the vessel; and (3) a legitimate reason for being aboard at the time that entrance is sought. It is our view that by preventing unauthorized entrance to vessels, the possibility of injury is substantially mitigated.

In order that a vessel may be prepared for any possible emergency situation that may arise, the regulations provide that steam pressure should be maintained or, if that is not possible, that the ship's fire-fighting system be connected with its shore system and its switchboard connected with a shore source of electric power. In addition, vessels are not permitted to be without means of propulsion for over 24 hours, unless the approval of the Captain of the Port has first been obtained. Decision as to what fires shall be maintained when loading dangerous cargo is made by the Master and the terminal superintendent. Further requirements of these regulations are that mooring lines shall be tended and that emergency towing hawsers shall be available, fore and aft, should it become necessary to move the ship. Requirements are specified for the lighting of vessels and for compliance with blackout and dim out regulations.

Other regulations deal with the control of lighters and vessels alongside, with the removal and disposal of refuse, with supervision of the handling and transfer of cargo, and with prohibitions against the discussion of ship's business and prohibitions against smoking, under specified conditions and in various sections of the ship.

Detailed inspections are required by the ship's officers of the vessel and of shore protection facilities. In this manner, fires and other sources of danger are caught in their incipient stages, while the officers and men charged with the protection of the vessel learn of the available means of combating fire and other possible sources of injury. To further assist in combating any situation which may arise, the Master and Chief Engineer are required to instruct their crews concerning these regulations and the use of available apparatus.

Responsibility for Compliance

The basic responsibility for the compliance with these regulations is placed in the Master, owner, operator, and agent of the vessel. The Coast Guard, however, assists them in every possible way and takes necessary measures to insure that their responsibility is fulfilled. In this connection, Coast Guard inspections are made at frequent intervals and standard inspection reports are completed for each vessel by Captain of the Port personnel and by the personnel of the British Security Coordination for British vessels coming under their cognizance. Through these regulations, we have installed a *uniform* ship security program in all ports and, by these inspections and enforcement, we assure that they are substantially complied with. It is our belief that compliance with these regulations has resulted in safeguarding vessels against dangers of injury resulting from accident, negligence, subversive activities or other causes.

Perhaps I can demonstrate the results of care in the handling of ships and articles going through our ports by giving you a few brief figures concerning explosives. You may have read recently that during the month of July, American and British Air Forces dropped approximately 35,000 tons of explosives upon enemy installations on the continent of Europe. The destructive effect of these you can visualize for yourself. During that same month, over 45,000 tons of explosives were shipped aboard vessels from one American port. Think of the disastrous effect which mishandling of this cargo, so vital to the war effort, would have had upon this port. Yet, through the care which we have exercised in the supervision and protection of this cargo and the ships carrying it, no loss of any kind occurred. That is an example of the effectiveness of our ships' safety measures.

I am sure you all have noticed that the newspaper accounts of the recent bombing raids which our air force have carried out against the Ports of Naples, Genoa, Messina, Tunis, Bizerte and Tripoli have all mentioned that the principal attacks were upon the docks, wharves and shipping in those ports. Earlier in the war, the Nazis blasted Plymouth,

Liverpool and other British ports. Of course, the purpose of these raids was to prevent supplies from being loaded or unloaded and to destroy shipping; for the destruction of these waterfront facilities and vessels will as effectively delay or prevent the obtaining of supplies as will the destruction of vessels while in transit. We must bear this lesson in mind and recognize that any injury to our ships in port will, in the same manner, prevent essential supplies from reaching our men abroad and our Allies. Merely because our harbors are not subject to bombardment, does not mean that we need not protect them from injury resulting from accident, negligence or sabotage. We must take every possible step to protect them from injury from any cause.

The Coast Guard's activities in this field have been such that I can report to you at this time that there has been no serious injury to any vessel in American ports in over a year and a half, since the Coast Guard undertook fulfillment of this responsibility.

Explosives and Military Ammunition on Board Vessels

WILLIAM T. BUTLER
Special Assistant, U. S. Coast Guard, Washington, D. C.

Safety in transportation of explosives consists of the observance of many minor precautions. In providing safety in the handling and stowage of explosives or ammunition you have but one chance. Therefore, so-called minor precautions in this instance assume the proportions of major precautions. There are three primary elements evaluated equally in the Coast Guard plan of providing safety of cargoes of explosives: sabotage, fire and carelessness.

Sabotage is protected against by prior checking of both personnel and the physical conditions of loading facilities and the vessel. Longshoremen, winchmen, carpenters and their supervisors engaged in handling explosives are required to possess a Coast Guard identification card and an explosives handling permit card. To secure the identification card a person must submit an application setting forth essential personal history and be fingerprinted. This application is carefully checked. The issuance of an explosives handling permit card is predicated upon possession of an identification card and, in addition, the applicant must be sponsored by a stevedoring company or other acceptable authority and must show a knowledge of the art of handling and stowing explosives.

Before a vessel proceeds to an explosives-loading anchorage or pier, it is given a general inspection. The pier receives a general inspection and military guards are at posts protecting all approaches to the pier. The holds of the vessels are thoroughly searched before commencing to load the cargo of explosives. Each draft of packages is checked both at the railroad car door and upon its arrival in the hold of the vessel. Damaged packages are not permitted to be placed on board a vessel.

The second element, fire, is guarded against by the inspection of the vessel's own facilities, such as its boilers, the condition of the boiler and engine room bilges, operation of galley stoves, the screening of the smoke stack and galley smoke pipe. Rubbish is not permitted to accumulate upon the vessel. Tugs and barges having legitimate business requiring them to come alongside the vessel are checked to be certain their smoke pipes are screened and, in some instances affecting living arrangements on barges, it is required that the fires be doused. Smoking is not permitted and persons are not permitted to have matches or mechanical lighters in their possession. Coast Guard fireboats are ofttimes stationed alongside the vessel or pier. At some explosives-loading terminals, a Coast Guard towboat is stationed in readiness to withdraw a vessel in event of fire occurring on the pier or adjacent thereto; and in a great many instances, portable fire pumping units with

stand-by Coast Guard crews are stationed at these piers.

The third element, carelessness, is difficult to control. Men engaged day after day in handling explosives, although realizing fully the danger in this occupation, lapse into carelessness. Through its explosives-loading details, the Coast Guard protects against this human trait by constantly supervising the handling and stowage of the explosives. Guards comprising the detail are assigned at the railroad car door and on the barges that bring the explosives alongside the vessel. Roving deck guards on the vessel keep a watch to see that winchmen do not get careless. They are required to observe the cargo gear and inspect such gear frequently to guard against failure. It is the duty of the members of this detail to prevent the operation from becoming perfunctory, which is carelessness under another descriptive name.

Coordination

Activities of the Army, Navy and Coast Guard in the transportation of explosives are thoroughly coordinated. Liaison contacts operate daily in an effort to provide maximum security for vessels and ports. Local port and municipal authorities are consulted with reference to application of local ordinances or regulations and in determining policy. Insofar as is practicable, Coast Guard regulations pertaining to explosives are not construed as preventing the enforcement of local regulations, provided such regulations are not inconsistent or in conflict with federal regulations or result in setting up a hindrance to the prosecution of the war. Uniformity of control between rail, motor vehicle and vessel transportation of explosives is maintained by a close cooperation between the Bureau of Explosives and the Coast Guard.

Explosives and Ammunition as Cargo

Merchant vessels before taking on cargo consisting of explosives are required to:

(1) Secure a permit from the Captain of the Port. The application for this permit must be accompanied by a manifest of the explosives and other dangerous articles to be loaded on board the vessel and a preliminary cargo stowage plan showing where it is proposed to stow this cargo.

(2) Construct the type magazine required by the regulations.

(3) Remove all debris from magazines, holds in which explosives are to be stowed and from the decks of the vessel.

(4) Submit the vessel for a general inspection for compliance with the explosives regulations.

After proceeding to the explosives-loading anchorage or pier it is required that:

(1) The Captain of the Port permit to take on explosives shall be kept available.

(2) An officer or other person, as required by the regulations, be designated as in charge of the vessel.

(3) The person in charge of the vessel shall, in company with the Coast Guard officer in charge of the loading detail, inspect the vessel's cargo handling gear and the slings, trays, nets and other equipment furnished by the stevedore.

(4) The officer in charge of the vessel always shall be available while explosives are being taken on board.

(5) At the completion of the work period, the officer in charge shall inspect the hold and have all means of ingress closed off, including the covering of hatches with tarpaulins.

The assignment of a Coast Guard detail to supervise the handling and stowage of explosives does not relieve the owner, charterer, agent, master or any other person of his responsibility under the regulations.

Authorized Locations for Loading and Unloading

Merchant vessels are not permitted to take cargoes of explosives on board or to discharge such type of cargoes except at locations authorized for this purpose by the Captain of the Port. There are four types of locations set up for such purposes:

First: Explosive anchorages which are located in remote areas within the harbor. Any type of explosives or ammunition

may be loaded or unloaded in an explosive anchorage.

Second: Explosives-loading piers. These are piers that have been especially constructed for this purpose or existing piers that are sufficiently isolated from all other waterfront facilities as to provide a safe distance separation in event of an explosion occurring. At these explosives-loading piers any type of explosives or ammunition may be loaded or unloaded from a vessel.

Third: Ammunition-loading piers. These are piers selected because of their location apart from vital port facilities and so separated from adjacent structures as to afford maximum protection, calculated in accordance with the risk involved in loading or unloading the particular type of ammunition. At these piers only those types of military ammunition that are specifically permitted by the provisions of the regulations may be loaded on or unloaded from a vessel.

Fourth: Small-arms ammunition loading. Any pier designated by the Captain of the Port may be used for the transfer of small-arms ammunition. Small-arms ammunition is defined as that type of ammunition used in pistols, revolvers, rifles, shot guns, or in machine guns having non-explosive bullets, and usually consists of a paper or metallic cartridge case, the powder charge and bullet being all in one assembly. In designating these loading areas, the Captain of the Port gives consideration to the wishes of local authorities.

Repairs to Vessels Transporting Explosives

A vessel having on board explosives as cargo shall not proceed to a ship repair plant or enter upon a drydock or marine railway or otherwise undertake repairs, except as permitted by the regulations. Essentially, it is provided that no repairs other than emergency repairs to the vessel's main propelling plant or auxiliaries thereto, or the boilers or auxiliaries thereto shall be undertaken, while having on board any explosives as cargo. It should be noted that the emergency repairs are limited to the extent that the emergency can only involve the vessel's main propelling plant or boilers or their auxiliaries, and it is further limited in that the explosives referred to are on board the vessel as cargo. Welding or cutting operations other than those required by the foregoing emergency repairs may be carried on provided the Captain of the Port issues permission therefor. Exempt from this prohibition are the explosives which may be on board the vessel in the form of ammunition for defensive armament or the required supply of distress signals, rockets, flares, and powder for the ship's Lyle gun. Vessels that have just discharged any cargo consisting of explosives shall not have any repairs undertaken in the holds until all precautions are taken to see that no residue of cargo is left to create a hazard.

Summary

From the point of view of safety of our vessels, security of our essential port facilities and adjacent to our ports, it behooves everyone of us to be safety-minded at all times in the handling and transportation of these highly dangerous types of cargoes. The regulations governing explosives or other dangerous articles on board vessels, especially the section devoted exclusively to the transportation of military explosives and ammunition, were drawn up by the Coast Guard in collaboration with transportation and ordnance personnel of both the Navy and the Army.

It cannot be denied that there may be other safe methods of handling and stowing explosives, but the regulations as outlined in this discussion represent a consensus of opinion and the specific provisions thereof must be observed until they are amended. It is believed that maximum safety and security to vessels and our port facilities so essential to the success of our war effort will be realized, if all concerned observe the spirit and letter of the regulations.

Preparation of Tank Vessels Prior to Alterations or Repairs

C. A. NEUSBAUM
Assistant Director, Standard Inspection Laboratory,
Standard Oil Development Co., New York City

The prevention of personal injuries and damage to property has always been a serious problem in the alterations and repairs of tank vessels. The cleaning of the tank and compartments of a tank vessel and the testing of the atmosphere within these tanks and compartments are technical problems regularly encountered when such vessels are used for transportation of crude petroleum and its products.

Toxic Effect of Petroleum Vapors

Vapors given off by crude petroleum, gasoline and other petroleum products cause anaesthetic effects when inhaled and, unless precautions are taken, such effects may be encountered by workers during the cleaning operations.

The toxic effect of gasoline vapors in various degrees of concentration is illustrated by data from the U. S. Bureau of Mines Technical Paper No. 272.

Flammability of Petroleum Vapor-Air Mixtures

Petroleum vapors are highly flammable, and considerable care is required to prevent the occurrence of fires or explosions. When mixed with the proper amounts of air these vapors form explosive mixtures. The explosive mixture range of gasoline in air, for example, is generally accepted to be from 1 to 6 per cent by volume. The lower figure corresponds to the minimum amount and the higher figure to the maximum amount of gasoline vapor capable of producing a flammable mixture. The vapor concentration below which the mixture will not burn is called the "lower explosive limit" and the vapor concentration above which the mixture will not burn is called the "upper explosive limit." For some of the more volatile hydrocarbons, such as commercial propane, the upper explosive limit is 9.5 per cent. The explosive range for natural gas is 4.8 to 13.5 per cent. Although explosive limits have been established definitely for a number of hydrocarbons, it must be remembered that petroleum products seldom are handled as pure hydrocarbons. It is essential, therefore, to consider the lowest and the highest explosive limits of the hydrocarbons of any products or mixtures being handled.

Hydrogen Sulfide

Other gases associated with petroleum products also are toxic if breathed in sufficient quantity. Hydrogen sulfide, the most prominent of these gases, is contained in some crude oils and is present also in some unfinished refinery distillates as a result of reaction at high temperature and pressure. Hydrogen sulfide is harmful, and even fatal, in relatively small concentrations It is especially hazardous because of its paralytic effect on the sense of smell, making detection by odor impossible. The U. S. Bureau of Mines has found that a concentration of 0.01 per cent in air will produce irritation of the eyes and other physical disturbances upon exposure for two minutes, with increasingly harmful results upon continuous exposure. Exposure for two minutes in a concentration of 0.07 per cent has resulted in death. Hydrogen sulfide also is explosive in concentrations from 4.3 to 46.0 per cent in air.

Oxygen Deficiency

The atmosphere within clean tanks which have been closed tightly for some time is frequently deficient in oxygen due to rusting of the metal of the tanks. Such tanks, therefore, should not be entered until they have been ventilated thoroughly. Normal air contains about 21% oxygen. Air which contains less than 16% will not safely sustain life.

Early Safety Measures

A detailed study of the methods employed prior to 1922 in the cleaning of tanks and compartments of tank vessels and the testing of the atmosphere within these tanks and compartments brought out the fact that too little attention was

paid to cleaning and too much dependence put on the analysis of the atmosphere within the tanks.

It seems desirable to point out two fundamental principles which apparently were not universally recognized prior to 1922. The first is that a certificate of safety is worthless unless the inspector has entered the tank or compartment in question and has examined it carefully for deposits of oil and/or sediment which may generate vapor. Without such an examination, the analysis of the atmosphere means nothing more than that the tank is safe for a man to enter at the time of testing. The practice of taking samples by means of a sampling tube or sampling bottle lowered from the deck seems entirely inadequate, except for preliminary information.

The other fundamental principle is that the maximum permissible content of petroleum vapor is fixed by its effect on men inhaling the atmosphere, rather than by the lower limit of the explosive range. The lower explosive limit of different hydrocarbons varies, but 1.0 per cent is perhaps a representative figure. On the other hand, it is stated that petroleum vapors in concentrations of 0.3 per cent* or more are intoxicating to some people on exposure for 30 minutes or longer, so that the actual danger limit is far below the explosive limit. It has been experienced that men are able to work in tanks for indefinite periods when a maximum of 0.2 per cent of petroleum vapor calculated as pentane is enforced as a limit.

Cleaning Procedures

The recommended procedure for cleaning is the Butterworth method in which hot water is applied mechanically by means of special equipment. The personnel employed for cleaning operations has increased to one captain who acts as supervisor, 3 certified chemists, 6 foremen, 5 pump men, 3 timekeepers and a group of casual laborer who are experienced tank cleaners, ranging in number from 50 to 75.

It is impossible to specify arbitrarily that a tank of a given size shall be steamed or machine washed a certain number of hours, since the amount of steaming or washing required varies with the nature of the oil which was carried last, the atmospheric conditions, and other factors. The intensity and duration of each process rests, therefore, wtih the judgment of the supervisor and the chemist, and is governed by the conditions and circumstances which necessitate such cleaning.

Butterworth Method

With the Butterworth Method, heated water is directed upon the interior surface of tanks by means of high pressure streams from two revolving nozzles. The nozzles are geared to turn simultaneously and slowly in all planes, horizontal to vertical, so that the water streams from the nozzles are directed upon the entire interior surface of the tank.

As soon as the cargo is pumped out, steam is forced through the heater coils and steam smothering lines. If condensed steam comes through the heater coils clear, indications are that the lines are satisfactory. If steam fails to come through or if the condensate is oily, it is evident that the coil is ruptured and that cleaning is necessary before a certificate can be issued for the compartment in which the questionable coil is located. Smothering lines are steamed for approximately ten minutes. Butterworth machines are next placed in the cargo tanks through special openings or through hatches if the vessel is not equipped with such special openings. Generally two machines are operated at the same time, one in each of two main, wing or summer tanks. The hatch and ullage covers are closed but not dogged down. During the period of washing, which normally take from 1½ to 2 hours per tank, the ship is held at a slight list if necessary to speed the drainage of the tanks to the suction. The cargo pumps are operated slowly to withdraw from the tanks the refuse oil and hot water resulting from the washing operation. For most efficient cleaning operation, the water is heated to a temperature of approximately 175° F. The water is supplied at a pressure of approximately 175 pounds per square inch from the vessel's deck fire lines.

After the tanks have been washed sufficiently, the Butterworth machines are removed and the tanks ventilated by means

of wind sails, Venturi tubes or air blowers lowered into the tanks through the hatch, or by steam gas suckers installed in the ship's deck discharge lines. When the atmosphere within the tanks has cooled sufficiently for men to enter, a sample of it is obtained by means of a sampling tube or sampling bottle lowered from the deck and analyzed for toxic or combustible gases. If the atmosphere is found to contain not more than 0.2 per cent gas by volume, the supervisor in charge of cleaning enters the tanks to make a preliminary survey before men are sent into the tanks with hand hose to wash toward the suction any sediment or scale left in various parts of the tank. Sediment which is not pumped through the suction line is removed manually. A careful watch is maintained over the men doing the work.

Manual Method

When Butterworth machines are not available, the approximate time required for steaming is estimated on the basis of previous cargoes. After the heater lines are blown, the hatch covers and ullage holes are closed but not dogged down. Steam at a line pressure of about 75 pounds is allowed to enter the tank through the smothering lines for the period of time considered necessary to sufficiently soften and loosen oil and sediment on the bulkheads, beams, etc., so as to permit removal with streams of hot water. Upon completion of the steaming, the hatch covers are thrown open and wind sails, air blowers or steam gas suckers are used as described above for purpose of expelling gases and steam. When the tanks have cooled sufficiently, a preliminary test of the atmosphere within is taken.

If the gas content is more than 0.2 per cent by volume, further ventilating or steaming and ventilating are required. If the gas content is 0.2 per cent or less, men equipped with hand hose descend the ladders slowly, washing down the top, sides and beams as they go. The water used for washing is at an approximate temperature of 100° F. and at a pressure of about 50 pounds. A convenient means of supplying hot water for washing is provided by a "Y" connection which introduces steam into a nozzle on the fire line and provides a positive regulation of temperature. A careful watch is maintained from deck for the safety of the men below. When the top, sides and beams have been washed thoroughly, work is commenced on the bottom. Starting at the forward outboard corner of the tank, the oil and sediment are washed toward the suction from which point they are removed to a barge or a slop tank ashore by means of the ship's pumps, which are kept in operation throughout the entire washing period. Any material which is not removed through the suction line is removed manually.

Final Inspection

After all tanks and compartments in question have been washed and cleaned in accordance with either of the above methods, the main pump room bilges are cleaned. Next, water is pumped through all ship's cargo lines and discharged into the slop line. After pumping for a predetermined period, the water is discharged on deck where it is examined by the chemist, the chief officer and the supervisor in charge of tank cleaning. If the water is clear, the cargo lines are considered to be cleaned. Whenever possible, depending on the shifting of ballast, valves are left open to air out the cargo lines.

The tanks then are entered and inspected by a certified chemist; and, if found to be cleaned to his satisfaction and if the gas content is 0.2 per cent or less, a certificate is issued stating the tanks (reported individually) are either "Safe for Men and Fire" or "Safe for Men—Not Safe for Fire."

Repairs Remote from Cargo Tanks

Whenever a vessel must be dry docked for a survey on account of a seriously damaged bottom or for repairs confined solely to work on the rudder, propeller, tail-shaft or other parts remote from the cargo compartments, such tanks may be smothered with steam and sealed prior to the vessel's arrival in the shipyard. In case it is found necessary to do any work in and/or around any of the tanks, the tanks in question are cleaned by either the Butterworth method or the manual method and certified as heretofore described.

Combustible Gas Indicator

Various types of indicators have been used in the past for the detection of petroleum vapors to insure that the atmosphere is non-toxic and to guard against fires and explosions. All have employed basic principles, such as diffusion, volume change on combustion, or heat of combustion. Of course, the last type seems most suitable for the petroleum industry because of the wide variety of gases which are likely to be encountered.

WEDNESDAY AFTERNOON SESSION

October 6, 1943

Presiding: W. C. Garbutt, Casualty Manager, Pittsburgh Steamship Co., Cleveland, Ohio.

War-Time River Safety

By JOHN E. JULI
Safety Supervisor, Dravo Corp., Pittsburgh, Pa.

The growth of river transportation has brought about the necessity for a large scale safety program and this need has been met by various agencies. The safety problems are unique, inasmuch as they deal with the vagaries of nature.

Success in the operation of river fleets must be attributed in a good measure to the outstanding work of the U. S Engineers. Rivers must be made safe for navigation and we regard this agency with deep respect for the good they have accomplished. They have performed a yeoman service in dredging, clearing rivers of obstructions, construction of locks, dams, inspection of boats and safety equipment, reports on river stages and many other features that tie in so vitally with the successful and safe operation of river fleets.

The U. S. Coast Guard now patrols all the rivers on a 24-hour basis and their work in preventing sabotage and making periodic inspections of crews of the towboats has been a valuable help in the plant security and safe operation of all war plants situated along the river.

With the aid of these two agencies, it remains for the individual operator to cooperate to the fullest extent.

If you were privileged to go aboard a towboat, you would be impressed with the appearance of the interior. The towboat serves a dual purpose in providing a place to work and also a place to live. The engine rooms are well maintained and kept spotless. All machinery is painted in a three-dimensional scheme, which is a forward step in safety, as well as enhancing the working conditions. The living quarters of the crew, the stairways, the pilot house and the most remote corner of the boat are clean and well-lighted. The skipper and his crew take great pride in their housekeeping. There is a keen rivalry between the crews of the various fleets, and they do everything in their power to make the boat and their quarters a pleasant place in which to live.

The skipper of the boat is the executive officer and he is assisted by licensed pilots who must know the river throughout its length. The skipper spends considerable time in making up his tow in a safe manner, eliminating as many duck ponds and notches as possible, thereby creating safer working conditions.

The successful operations of a fleet depends on the proper type of employees hired. This is quite a problem, due to the number of river men leaving for other employment. A skipper of a boat attempts to hire a man who has spent part of his life near the river. The man must pass the physical requirements of the Medical Department before he is permitted to report for work. He then is placed in charge of an experienced man—the mate or engineer. Various hazards in operation are pointed out to him and he receives careful instructions on safe practices on boats. He attends safety zone

meetings which are held at the end of each trip, if possible, at which time many river problems are discussed and remedied. We make good use of slide sound films at these meetings, because we firmly believe that visual education is an outstanding feature in the success of any accident prevention program.

Because of the limited medical facilities, first aid training is given to members of the crew. A large percentage of our men and women have completed the American Red Cross and the U. S. Bureau of Mines course in first aid. Life saving, fire and safety drills are held aboard the boat to better acquaint the crew with the proper thing to do in an emergency. Members of the crew are reminded on the use of Kapok life vests in working on or over the water. When you consider the hazards connected with river work, such as fogs and floods, it is extremely important that a man receive as much training as possible.

Safety plays such an important part in the war effort that everything possible should be done by the safety engineer to continue the safe operation of this means of transportation in order that it might continue to play its full part in the successful conclusion of the conflict in which we are now engaged.

Objective Statistics Plot Our Course

By A. H. SCHRODER
Safety Director, Freeport Sulphur Company, Port Sulphur, Louisiana

By objective statistics we mean those statistics which break down the accident into all of its major and contributive causes and furnish us with a detail of the background of the incident. This complete breakdown is a monotonous detail but is productive of much information for the safety director. The detail of the information uncovered is hardly that which would be furnished to management and work supervisors, but the conclusions reached through this medium are definite and should be used in steering the safety program in its entirety.

In 1938, it being desirable to pursue a more objective program of safety work, and effort toward a complete statistical breakdown on accidents was made by our company. Information made available by means of these figures was used in the direction of work supervisors in their accident prevention efforts and served as a guide for safety inspections and committees. A point of particular interest in these figures for the pre-war years is their consistency; all curves followed a definite pattern and gave positive information for continued objective work. During 1941 a trend of change was detected, and 1942 showed considerable divergence which is continuing during 1943.

Accident Causes Changing

An attempt to recommend steps to correct the conditions which obtain in the changing picture of accident causes will not be made here, as all of us are familiar with the steps necessary for accident prevention. It is essential, though, that we be aware that the picture is changing, so that we may accent those parts of our program which tend to correct the new angles that may be uncovered by a complete analysis. The analysis sheet of the Standard Injury Reporting System, obtainable from the National Safety Council, is an excellent starting point for a program of breakdown for cause.

There exists today a distinct need for safety directors to be able to make an exact comparison of present day accidents to pre-war experience, in order that trends in the causes may be uncovered and corrections made in programs for continued effective prosecution. The factors which, when loaded statistically, are of particular importance are: occupation, agency of injury, mechanical cause, what employee was doing, type of accident, location of injury, character of injury, age, seniority, hour of injury, day of week, etc. Comparison of curves on occupations reveals an increase in the number of accidents suffered by skilled journeymen, foremen and operators. This increase is most serious now that skilled men are at a premium and should give us

particular concern. Increased overtime work, the higher pressure of work today and worry undoubtedly contribute to this condition.

Mechanical Equipment Should Be Thoroughly Inspected

A review of figures covering the agency of injury reveals that the activities of inspecting safety committees should be concentrated on mechanical equipment which in the rush of present activities is not receiving the servicing and maintenance it did during the pre-war years. Lack of overhaul of hoists and similar equipment is a point for concern for safety director. An increase is noted in the purely mechanical causes, the factor which is largely attributable to the failure of equipment; whereas, in the pre-war years, a greater percentage of accidents was due to personal fault. The type of accident is also greatly affected by the mechanical factors. The character of injuries suffered is changing as older men are becoming more numerous in the more hazardous occupations. We are suffering today an alarming increase in fractures and severe back strans, which must be blamed on the increased age of employees. Where a younger man would suffer little injury in an accident, it will be found older men suffer an increase in the number of fractures and severe strains. However, the conclusion reached is that although the older men suffer more severe injuries their over-all frequency of injuries is lower.

The use of the hour of injury factor for detection of fatigue showed a distinct change when compared to the pre-war years. Accidents in the pre-war years had two approximately even peaks, morning and evening. The change appears to be a flattening of the morning peak and a distinct increase in the evening, which could also be attributed to the advanced age of labor.

Need for Cause Coding

In our search for means to wage an effective fight against the rising toll of industrial accidents too few of us have taken the time and trouble to build our program structure on the solid rock of cause coding. We can uncover any factor needed for program guidance through this medium. Accident statistics mean to many safety directors, even those of many years' experience, simply a record of the number of lost-time injuries and the number of days lost. Cause coding is the objective type of statistical effort which enables us to give positive direction to those who must do the actual preventive work. Foremen and supervisors have production jobs which need full-time attention and can hardly be expected to give to their accident problems the time needed for a complete breakdown for cause; nor can they be expected to have the skill, openmindedness and training necessary for an accurate analysis. This is the primary responsibility of the safety director.

Seemingly, it would not be entirely conjectural to conclude that the greatest fundamental difference between the small groups with their comparatively bad experience, together with the larger employers who do not enjoy a good experience, and the industrial plants which have continually been successful in their accident prevention work lies in their inability to accurately foretell where, when, and how their accidents will occur. Knowledge of this nature can be derived only from complete cause coding. Management, when furnished with concrete recommendations, backed with definite cause data, can usually be depended on to take steps in the right direction. We must, however, be in a position to prove our contentions.

Analysis Is Essential

The conclusion reached is that an analysis of accident details is most important in the direction of safety work. It is the only sure guide to objective and positive prosecution; and information gathered is of continued use in after years when charted to show trends and disclose the need for positive revision in program detail. Our war years show a definite trend of change in type, age, character, severity, etc. Unless we are in a position to get this information from reliable statistics, we cannot make the needed changes and be certain of results. Certainly, objective statistics plot our course.

Safety Aboard a Lake Freighter

JOHN W. McGIFFIN
Supt. of Safety, Canada Steamship Lines, Ltd., Montreal, P. Q., Canada

The safety department of the Canada Steamship Lines was organized in 1938. A survey was made of past accident records and the management was amazed at the number of personal injuries which had occurred each operating season; but more amazed at the sums of money that had been paid out for medical aid, hospitalization and compensation. Since the organization of the safety department our annual costs attributable to personal injuries have been reduced on an average of 66% and the first year showed a reduction of 75%. Safety has paid wonderful dividends to the company in the financial sense, as well as giving great satisfaction from a humanitarian viewpoint.

With all lake freighters being built on the same general principles, a hazard which exists on any one vessel is likely to be common to them all. This entails great difficulty, as well as quite an expenditure, in getting all hazards corrected as speedily as possible. In our case, with our head office in Montreal and our vessels operating all over the lakes, a great deal must be handled by correspondence or by a heavy program of travel.

A survey of past accidents shows that the causes of personal injuries on lake freighters break down generally as follows:

1. Falls.
2. Eye Injuries.
3. Handling mooring wires.
4. Handling hatch covers or strongbacks.
5. Handling gangplanks and toeplates on package freighters.
6. Working around engines.
7. Galley accidents.

To eliminate falls all ladders leading to engine room are regularly checked. Any that are found to be too steep are removed and replaced by stairways of the proper angle with standard risers and treads. The same procedure is followed for ladders leading to the bow deck from the spar deck.

Ladders into cargo holds are kept in constant state of repair. Damaged or missing rungs are replaced as rapidly as possible. On bulk carriers these ladders are a real source of danger as they are easily damaged by unloading buckets and must be watched most carefully. The same precautions are taken with all other ladders that are found on a laker.

Good housekeeping on board ship is considered of paramount importance in connection with the prevention of personal injuries due to slipping and falling. Decks must be maintained in a neat and ship-shape manner. Leaking packing glands on deck winches make for a slippery deck, especially as the fall weather approaches with its freezing temperatures.

One of the most essential requirements for the avoidance of accidents due to falls aboard ship is good lighting of passageways, holds, storerooms and other enclosed spaces. Lighting is provided to reflect dock hazards, and all such hazards are painted white to serve as a danger signal. We also cover mooring wires with pieces of split hose painted white, and after dark a red lantern is placed beside them. The split hose serves two useful purposes. First, it protects clothing from grease that always covers the lines and secondly, calls the attention of the unwary to the hazard.

Handling hatch covers and strongbacks is another fruitful source of personal injury. A man should never be allowed to go upon the fore and aft beams or thwartship beams of a hatch for the purpose of adjusting the gear for removing them. The removal of hatch covers and strongbacks should always be under the supervision of a deck officer or other competent person. After hatch covers and tarpaulins are in place, members of the crew not be allowed to walk over them.

Eye injuries can be almost completely controlled on lake steamers by the use of goggles; their use is indicated in chipping and scraping, when boiler tubes are

being blown, combustion chamber cleaned, boilers or fires cleaned, and many other instances. We are very strict regarding eye injuries and goggles are considered by crew members as an integral part of their working clothes.

Our safety program starts with having a doctor on a retainer at practically every port of call on the Canadian side of the lakes. In other words, a steamer is never more than about ten hours from a doctor. We do not have compulsory physical examinations, but leave it to the discretion of the master and chief engineer to see that men who are physically unfit are not engaged.

The master and chief engineer also see that every man supplies himself with the proper clothing. If necessary, advances are given so that men can properly equip themselves. Crew members must have a serviceable pair of boots. The wearing of slippers or sneakers it not tolerated. Serviceable gloves are also required for certain jobs. Inspection of all crew members is made regularly by the master to see that boots are properly laced. This precaution has more than proven its worth in the reduction in the number of sprained ankles on the part of the forward crew and burned feet on the part of the firemen. The inspection also looks for sloppy apparel that might catch in moving machinery and the advantages of close fitting garments are impressed upon crew members.

From this point on the safety program is under the guidance of the first mate and 2nd engineer. This has worked very successfully and their safety record is discussed along with other qualifications when they are considered for promotion. Green men and older hands alike are regularly coached on the safe way to perform the various jobs on shipboard. Safety meetings are held once a month under the guidance of the master.

Interest in safety is maintained by our merit flag competition. This contest originated in 1939, and interest has increased each year. Monthly bulletins of steamer standings are issued, and I am pleased to say that we have eleven steamers that have yet to report a lost time injury since the contest started. These vessels have each operated over one thousand accident free days. From this you can see that the competition has been very keen.

I would now like to draw your attention to what was once the greatest single cause of fatalities on our lake fleet, especially ships of canal zone. As you are aware, a lake vessel in the course of a season will make a great many docks and canal locks. Much of this is done at night, and each docking and locking through the St. Lawrence canal system entails putting at least three men rapidly ashore, in order to take the lines. In the past this had been accomplished by means of a "monkey line." This "monkey line" was well named, as a deckhand required great personal strength and the agility of a monkey if he were to land safely. The old time landing boom was about fifteen to twenty feet in length and swung outwards from the spar deck. At the end of the boom was the "monkey line," a rope, the length of which depended upon the steamers draft and the height of the dock the men were to be landed upon. At regular intervals in this rope were knots to prevents a man sliding down the rope too rapidly after he was swung out over the intervening water between the ship side and the dock. In many cases, these knots only served to break the deckhand's grip as he hung suspended, and many fatalities occurred because men swung out too soon, lost their grip and dropped into the water to drown or be crushed between the ship and the dock.

The new method of using the landing boom puts the responsibility for the safety of the men to be put ashore squarely on the deck officer on watch at the time. All landing booms today must be at least twenty-eight feet long. This boom is supported by and braced to a revolving upright, extending from the spar deck to the bow deck. On the revolving upright at arm level on the bow deck is a handle for swinging the boom. This is operated by the deck officer on watch at the time. The "monkey line" has been replaced by a 7/8 inch manilla line which runs along the underside of the boom and passes through a block at both ends of the boom. To the outboard end of the line is attached an 18 inch metal rod which supports a wooden seat. The metal rod enables the

man after landing to quickly flip seat out from between his legs. The inboard end of the line passes through a block then over a cleat. Several turns of the line are always taken around the cleat.

On the end of each landing boom a light has been installed, the rays of which are directed downward and brightly illuminate the surface on which the deck hands have to land. Since putting these rules into effect in 1938, the most serious accident reported to date has been a sprained ankle.

You all know that the success of safety work depends upon the support received from company management, and in this regard I would like to say that the interest and support of our management has been excellent.

Safety aboard a lake freighter is a broad subject, but possibly you are now aware of some of the problems with which we are confronted each operating season.

With lake freighters performing such an important role in the transportation system of both the United States and Canada, it is imperative that the present manpower shortage is not aggravated by avoidable personal injuries. This challenge is being met. Lake freighters are carrying record cargoes of ore and coal cargoes vital to our war program.

THURSDAY AFTERNOON SESSION
October 7, 1943

Presiding: D. L. Hartnett, Regional Safety Consultant, U. S. Maritime Commission, Philadelphia, Pa.

The Control of Fumes in Shipyards

WILLIAM E. LAWRENCE
Safety Engineer, New York Shipbuilding Corp., Camden, N. J.

Many articles have been published on this subject, including miles of statistics; however, I am sure that every shipyard in this country today has acquired knowledge through experience and information unselfishly passed on by pioneers in ship welding until it is assumed that everyone knows the most satisfactory fume elimination is that of ventilation by exhaustion.

Extensive experiment during the past decade with different types of equipment proved that the surest method was to remove the trouble at its source. Blowers and exhausting devices were developed accordingly, with satisfactory results. Respirators fitted with metal fume filters will give some protection when fume concentrations are low.

In common with other shipyards and heavy industries, much care is being exercised by plant medical staffs in routine re-checks and re-examinations of workers exposed to welding fumes. In so far as we know, we still can honestly state that we have not had one case of lasting or permanent ill effect to anyone associated with welding, tacking, burning or heating.

New Method and Precautions

You may be interested to hear of a development new to us at our plant. It may be new to some of you also. I refer to carbon arc burning in connection with smoothing off the large countersunk heads of tap bolts in armor plate decks. These heads were formerly chipped and ground off flush with the deck plates. This was a long, tiresome, rough and costly job. By the use of the carbon arc, they are burned off so that only a small amount of grinding is necessary, thus cutting the time and labor to a minimum. (5/16" carbon, 400 amps., 7000° F.)

Of course, the fume and dust hazard had to receive special consideration. This was accomplished by the use of a compressed air jet, which blows the slag and carbon residue into exhauster funnels located at the ends of two 3" metallic flexible tubes with powerful portable ex-

hausters at the outlet ends of these same tubes. This equipment is skidded easily along the deck as required and is kept close to the job at all times, even eliminating the necessity for the use of respirators.

Seasonal Hazards

Many other fumes must be controlled in shipyards. One of the seasonal hazards in our own plant will have to receive attention before the advent of cold weather, which is just around the corner. Men will build fires in any kind of a receptacle in spite of safety men and supervision, and will use fuel, such as charcoal or coke, without stopping to realize the danger involved and the necessity for proper ventilation. The resulting carbon dioxide and carbon monoxide gases are both deadly and create oxygen deficiencies.

We recently issued a notice in connection with this hazard and posted it conspicuously. It stated that if any fire pots were found on ship contracts, plant protection men should immediately contact a safety inspector and be governed by his decision as to the removal of same.

Fumes From Fires

I think we should mention the danger of fumes from fires in ships on the ways, while under construction, and in the water after launching. Many of the fires may be trivial but there is always the possibility of men being trapped by smoke and toxic fumes and unable to get out from below decks. This is when the trained safety inspector or a good watch force man comes into the picture. He must quickly don a mask, hook on a life rope and go down to make sure everyone is out. He must be followed as closely as possible by another man with a powerful electric lamp. If any deficiency of oxygen is suspected, an oxygen breathing mask must be worn. Ventilation must be provided at once, smoke and fumes must be exhausted and a fresh supply of air blown in.

Much could be added about the maximum allowable concentration for carbon monoxide and carbon dioxide, but the main point to remember is that carbon monoxide is the number one poison killer, both in industrial and non-occupational life, following close upon auto accidents as a cause of death. It is true that wherever there is smoke you may suspect carbon monoxide.

By all means take no chances. Don't wait for a chemist's report on the samples of air from suspected areas. Ventilate! Constant alertness on the part of watch force men and safety inspectors is an absolute necessity to combat such hazards. The education of the men by their supervisors and the use of warning posters is recommended, but above all, ventilation by exhaustion and the introduction of a fresh supply of air is imperative under these dangerous conditions. Several narrow escapes from death have been experienced in shipbuilding due to the thoughtlessness of the men and not because of ignorance. They forget to think.

Insulation Materials

The use of insulation cement, if it contains toxic solvents such as carbon tetrachloride, is a menace to workmen unless precautions are taken to properly safeguard them under such hazardous conditions. A large shipyard recently experienced such conditions which were brought to the attention of the plant health committee and the management. The result was that the entire supply was re-distilled and a substitute safe solvent provided, thus eliminating the hazard without loss of material. This demonstrates again that careful planning will assure safety with production, always a winning pair.

The use of water repellent asbestos insulation has recently replaced some types of material formerly used in ship work. For protection against dust or possible asbestosis from such material, it is recommended that both on ships and in shops, or where the material is prepared, it be dampened and that dust respirators be worn, also that special ventilation be provided. Periodic medical examination of those exposed to such hazards is also necessary.

Sand Blasting and Plating

Sand blasting and shot blasting, with its silicosis hazard, can be done safely if provision is made for standard sand blast rooms or cabinets. Special ventila-

tion must be provided, with frequent inspections of all equipment by an experienced safety inspector or supervisor. This check-up must never be neglected.

Regular periodic examinations, including X-rays, are mandatory. The least suspicion of a leaking face piece can be easily detected by the operator and should be reported at once to the safety department for immediate correction. If an operator begins to eat sand, he will realize at once that his equipment is not safe.

Fumes and dust from friction saws in shops are easily removed by proper exhaust ventilation and should be carried by ducts from the machine to dust collectors out of the shops if possible.

Plating room fumes, with modern ventilating systems now available, are no longer a problem in any up to date shipyard. A few years ago, however, a different story could be told.

Recent changes in painting specifications on naval vessels have provided for the use of zinc chromate which, although perhaps not particularly toxic, must be considered when sprayed in small compartments. Respirators are advocated along with safe ventilation. When working in large shops where large plates are sprayed, after they are placed in racks from the pickling tanks, the use of air line respirators is recommended, as these areas are too large for efficient exhaust ventilation. However, crane operators handling material in such locations, especially above pickling tanks, should be provided with respirators. Fans may be placed in the crane cabs to blow fumes and vapor away from the operators.

Protection must be furnished for any job in which dust fumes or smoke from any subsance containing lead is breathed daily, for example; when welding, cutting, burning, shrinking or straightening where material is metal, coated with paint containing lead. Special ventilation, using local exhaust hoods or tubing kept not less than 8" from the job and drawing 200 c.f.m. discharged where the contaminated air will not be breathed, is satisfactory.

In ship construction two types of ventilation are used, local exhaust to remove fumes at the point of origin and general ventilation to supply fresh air to confined working spaces.

Lacquer spraying, if done in approved booths, properly ventilated, presents no greater problem. When cleaning compounds are being used, chemical cartridge respirators will give protection if concentrations are low.

The use of proper extinguishers on different type fires must be considered. Fumes from the use of the wrong ones may cause the death of persons improperly instructed. Periodic demonstrations by those responsible should be made for the benefit of firemen, watch force men, and safety inspectors. The use of instructive posters and bulletins is also advised.

Fumigation of refrigerator spaces in ships practically ready for delivery is important. Precautions must be taken to safeguard men whose duty it is to open and ventilate such spaces after fumigation. They must wear all-service gas masks while installing temporary ventilation equipment and, if a deficiency of oxygen is suspected, an oxygen breathing apparatus must be used.

Cooperation of Management and Employees

An important item in ventilation of ships under construction is to impress management with the necessity for co-operative planning by the engineering department and drawing rooms for the early installation of as much of the ships permanent ventilation system as possible, especially in engine and boiler rooms. Present construction of naval vessels practically prohibits the use of temporary ventilation units, due to the inaccessibility of such spaces and the impossibility of bringing in fresh air, especially after they are closed in.

The importance of the availability of trained ventilation men must be considered. Their services are vital in the avoidance of delays in maintaining continuous production. The elimination of fumes by their alertness to such hazards and inconveniences will help to minimize absenteeism and assure delivery of ships ahead of schedule, thus assuring a quicker victory.

We must not forget the importance of organized first aid crews trained in the use of inhalators, resuscitators and approved methods of artificial respiration. These crews with portable emergency equipment must be available and ready to act at a moments notice.

Perhaps one of the most important methods of impressing employees, especially new ones, with the idea of danger from respiratory and other hazards is through safety instruction in orientation classes before they start to work. This is being done in many industrial plants with marked success. We believe that such a program will be of vital interest to those who have had no previous shipyard experience.

Before closing I want to mention the ventilation standards as recommended in the U. S. Navy Department—U. S. Maritime Commission, "Safety and Industrial Health Manual in Contract Shipyards" a recent issue, and the "1021 Answers to Industrial Health and Safety Problems" published this year by Occupational Hazards, Inc. They are most helpful and timely publications and should be available to everyone connected with safety programs in any industry.

Crane Safety

LIEUT. COMDR. L. F. KENGLE, U.S.N. (Ret)

A survey of the information at hand on crane safety shows that there is a wealth of material on this serious subject. It has been exhaustively studied and reported. As you know, standards of safety have been set up by the American Society of Mechanical Engineers, by the Bureau of Yards and Docks of the Navy Department, by the National Safety Council, by the American Standards Association, by the states in their Industrial Accident Commissions and by the insurance carriers for private concerns. It should be apparent then, that since these extensive standards cover the design of the structure and the safety of the mechanical equipment and protective devices, cranes may be acquired, redesigned and overhauled with a maximum of assurance that from the items of design every known hazard to health and safety will be eliminated.

Criticism of Present Rules

From the above sources there may also be gained a well-rounded set of rules covering inspection and test. Not only is this information available from these sources, but methods of reporting, checking and inspection can be set up, so that positive assurance may be had that these minimum standards will be maintained throughout the life of the equipment. These rules cover the vast majority of all crane operations. The only criticisms that may be leveled at these rules are: First, in the simplification of the rules so they may be easily understood by all operators; secondly, in the adequacy of the rules to cover all incidents; third, in the standardization of the equipment used; and, fourth, in providing weight indicators to supplement on the part of the operators.

It requires judgment to make the rules fit into one's own crane problems. It is recommended that they be perused thoroughly, so that sets of rules and instructions may be made out for each activity with extraneous material eliminated from the instruction books issued to the operative personnel.

Basis for Discipline

We find it is better to base your discipline on a violation of a rule rather than upon an incident. This establishes in the minds of the operating personnel a realization of the significance of a published rule or regulation. Although the violation of a rule may not result in an accident, the continued violation of a published rule will eventually lead to a serious incident. After an incident of serious nature, its effect has a disciplinary aspect. If the rules are adequate, concise, and understandable and are complied with by personnel, no incident can occur.

I believe that if we will check all of our

crane accidents we will come to the conclusion that there existed an error in judgment on the part of the operator or rigger, or both.

Judgment Based On Training and Experience

It has been said that judgment is based upon training and experience. How much training it takes to overbalance the lack of experience and how much experience it takes to mature training varies with the individual. In order to bring these two items into phase, we have established certain rules in our activity. First is a semi-annual physical examination for all crane operators in which muscular coordination is checked and vision made a specific requirement. This is particularly essential in assuring ourselves that every crane operator has depth perception.

I believe the next step should be to establish in the minds of every operator the sincere interest management has in accident prevention. This must be established before you can expect them to take your rules and regulations seriously and it does not become a popular thing with the operators to break the rules.

It is recommended in some crane specifications that all levers be so arranged that they will move in the direction in which the crane load moves. This should be elaborated upon so they will be placed in every piece of equipment in the same relation to each other. This is borne out by an experience we had in one among sixty locomotive cranes, in which the throttles were opened with forward and backward movement of the throttle lever. This contributed to a minor incident where, in an emergency, an operator accustomed to a forward moving throttle was operating a locomotive crane with a throttle operating by opposite motion and by habit opened instead of closed his throttle.

Neatness and Organization

The cleanliness, neatness and organization in shops and throughout the yard where crane operations are carried on leads to cleanliness in crane cabs. Careful attention to making the access ladders meet with all of the standard safety requirements impresses upon the operator the item of safely going to and from his work. At every crane access ladder and every operating crane cab, we have provided two small signs: one illustrating the standard crane signals with the notice that these are the signals to be recognized and obeyed, and the other sign is a short set of safety rules.

Crane operators are required to relieve each other at levels other than the crane itself and the crane energy must be removed before leaving the cab. A careful inspection is to be made by the relieving operator after relieving. He is impressed continually with the rule that he is to accept signals from a single individual, the rigger in charge of the operation, and in the case of locomotive cranes, that he is not to move his crane until the crane pilot or safety man has cleared him, is present and aware of his responsibility. These we recommend as essential in the establishing of safe habits.

Fire extinguisher equipment is maintained in the cab and is regularly inspected. To prevent panic in event of power failure, aerial bombing, or fire, every overhead crane is provided with a knotted rope, well secured in the cab, so that every operator may abandon his crane in any of the above events.

Inspections

Our crane inspections are complete and periodic and careful records are made. Both the rigger in charge and the crane operator make reports to a relief of every extreme strain and this is also reported by memorandum to the responsible authority. The management's concern for this is such that the responsible seniors respect these reports and subject the equipment to a rigid inspection and test, if indicated, for every reported incident.

Weight Indicators Used

We are using a hydromatic weight indicator that can be put in the dead end of all boom crane lifting cables, matched up with a boom length indicator of rigid construction. These weight indicators were bought at a cost of $500 each. These were so successful and were so readily accepted by the operators that the manufacturer

was asked to design similar equipment for use on all hammerhead cranes and all floating cranes. No failures have been reported and no particular care has been necessary on any of this equipment for the several months it has been in use. This item alone takes out of the hands of the operator, the operating personnel and the rigger the excuse for overloading and the excuse for errors in judgment. There have been no crane incidents to any of the equipment thus provided and, based upon previous experience, in the six months that these have been in operation, they have paid back over five per cent of their cost.

We have locomotive diesel crane inspection cards of the check-off type, wherein an inspector covers every item to be checked and indicates the date and the condition, with remarks. This report is recorded. These forms vary with the cranes, types and motive power. There are special forms for steam propelled, diesel propelled and electrically propelled crane equipment.

Summary and Recommendations

Summarizing these thoughts, I leave with you as not having been thoroughly explored in other published information.

One, the standardization of the location of the movements of the control levers for the various types of equipment, so that you may change an operator from one piece of equipment to another and he will find himself in familiar surroundings. It is recommended to the American Standards Association that serious thought be given to the distances, the size and the lever movements and that their directions be standardized on all new equipment. In the larger plants, where frequent exchanges are made between operators and these exchanges cannot be eliminated, it is suggested that serious thought be given to the feasibility of changing all existing equipment to meet these recommended standards.

Second, the rules should be simplified and the responsibility placed squarely on the shoulders of the rigger and operator, not jointly but specifically and individually, for the safe operation of their cranes; and that no extraneous material be placed in the rules issued to these operators.

Third, every crane incident, even of minor nature, should be thoroughly investigated by a responsible administrative head as a basis to effect sound correction. This has not been indicated in any of the literature I have found.

Fourth, a substitute for judgment and experience for the new operator should be provided by giving him positive load indicators, matched with indicators showing load capacities. These will also give assurance to the experienced operator of his own judgment or estimation of the load being handled and will induce the supercautious to handle heavier loads, factors in the saving of time or its equivalent, production.