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Recommendations for the

OPERATION OF MARINE TERMINALS

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National Fire Protection Association

International

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection. Its membership includes national and regional societies and associations (list on outside back cover) and over eighteen thousand individuals, corporations, and organizations. Anyone interested may become a member; the annual dues are $15.00. Full membership information is available on request.

This is one of a large number of publications on fire safety issued by the Association. All NFPA standards and recommended practices, including this text, are prepared by the technical committees of the NFPA and adopted at an Annual Meeting of the Association. They are intended to prescribe reasonable measures for minimizing losses of life and property by fire.

This text and most other NFPA standards and recommended practices are published in the **National Fire Codes,** a compilation of NFPA's official technical material, issued in seven clothbound volumes. Full information on the availability of these Codes and other NFPA publications can be secured from the Association.

Official NFPA Definitions

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations, or that which is advised but not required.

APPROVED refers to approval by the authority having jurisdiction.

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters. One foot = 0.3048 meters. One inch = 25.40 millimeters. One pound per square inch = 0.06805 atmospheres = 2.307 feet of water.

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The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The suitability of devices and materials for installation under NFPA standards is indicated by the listing of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada, the Factory Mutual Laboratories and the American Gas Association (gas equipment) test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

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OPERATION OF MARINE TERMINALS

NFPA No. 307 — 1961

These Recommendations for the Operation of Marine Terminals, prepared by the committee on this subject and endorsed by the Committee on Marine Fire Protection, were adopted in their present form in 1951 with amendments adopted in 1961 (see page 307–3 for prior editions).

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RECOMMENDATIONS FOR THE OPERATION OF MARINE TERMINALS

NFPA No. 307 — 1961

Foreword.

The National Fire Protection Association first adopted recommendations for the operation of marine terminals in 1937. The 1937 edition was prepared by a committee of the then Marine Section of NFPA. With the reorganization of NFPA marine activities in 1948, the reconstituted Committee on Operation of Marine Terminals undertook complete revision of the 1937 "Recommended Good Practice Requirements for the Operation of Marine Terminals" and the following recommendations represent the results of their labors. These recommendations were endorsed by the General Committee on Marine Fire Protection and finally adopted by the Association in 1951, following tentative adoption the previous year. The recommendations were thoroughly reviewed by the committee in 1961 and a number of amendments were adopted by the Association in that year.

CHAPTER 1. GENERAL INFORMATION.

10. Introduction.

101. The safeguarding of waterfront facilities is of major importance to the welfare of the country. In time of peace these facilities are essential if commerce is to be carried on in a normal manner. In time of war their role becomes vital to the security of the nation itself. Under emergency conditions there is no time for replacement of port facilities destroyed by fire. Thus, the responsibility for preventing destructive fires at marine terminals is a heavy one at all times and worthy of the best efforts of everyone whose daily life is associated with marine terminal operation whether at the level of management or day labor.

102. The following recommendations are intended as a guide to reasonable safeguards against fire without undue operational or economic handicaps. They are not intended to modify federal, state or municipal legislation which may apply

to marine terminals. Neither are these recommendations intended to apply to marine oil terminals which are covered by the NFPA Suggested Ordinance for Petroleum Wharves (No. 304L).

11. Definitions.

MARINE TERMINAL: A unit comprising one or more piers, wharves, docks, bulkheads, slips, basins, with appurtenant buildings, structures, roadways, railroad tracks, open storage space, and equipment, used for the transfer of persons or things between vessels (ships, barges and lighters) and land.

BULKHEAD BUILDING: A structure erected on the land side of the bulkhead line, generally forming the land end of one or more piers.

BULKHEAD WALL: A retaining wall of timber, stone, concrete or other material built along, or parallel to, navigable waters.

BULKHEAD LINE: The line established in navigable waters by Federal authority beyond which bulkheads and piers of the solid fill type cannot extend.

DOCK: A natural open or artificial closed basin in which vessels may remain afloat when berthed at a wharf or pier.

FIRE LINE: Pipe in a horizontal position on a pier or wharf which serves the same purpose as a standpipe in a multiple story building.

HAZARDOUS CARGO: Consists of explosives, other dangerous articles or substances which are subject to regulation in regard to transportation, storage, or use on vessels as defined in U. S. Coast Guard Captain of the Port Regulations.

PIER: A structure, usually of greater length than width, of timber, stone, concrete or other material and projecting from the shore into navigable waters so that vessels may be moored alongside for loading and unloading or for storage. A pier may be either open deck or shedded.

PIER HEAD LINE: The line established, in navigable waters, by Federal authority, beyond which piers and marine structures of any kind cannot extend.

SEGREGATED: Where the word "segregated" is used with reference to fire hazards and hazardous processes, it signifies a room constructed of 4-inch reinforced concrete walls, floor and ceiling (or equivalent); openings to be protected by Underwriters' Laboratories labeled fire doors, self-closing or automatic in operation.

SLIP: An extension, artificial or otherwise, of a navigable water into the space between adjacent structures, within which vessels may be berthed or moored.

TRANSIT SHED: A building in use with a pier or wharf, located on shore and used for temporary storage of merchandise in transit.

WAREHOUSE: Any building used as a storehouse for the safekeeping of merchandise.

WHARF: A structure of timber, stone, concrete or other material having a platform built along and parallel to navigable waters so that vessels may be moored alongside for loading and unloading, or for storage. A wharf may be either open deck or covered by a shed.

CHAPTER 2. FIRE ORGANIZATION.

21. Fire Warden. A competent man should be appointed as fire warden and placed in charge of all fire line and hose equipment, sprinkler equipment, first aid appliances and all other auxiliary fire extinguishing or protection equipment. He should be thoroughly instructed in the maintenance and operation of such equipment and become familiar with the location of all valves, alarm boxes, fire line hose stations, first aid appliances and auxiliary equipment. He should know the fire hazard characteristics of the merchandise in the terminal and the location of all merchandise that is exceptionally hazardous. He should enforce all regulations pertaining to fire safety, instruct employees in the proper use of fire alarm boxes and organize and supervise a fire brigade.

22. Fire Brigade. A fire brigade should be organized among the employees of the terminal. The Suggestions for the Organization, Training, and Equipment of Private Fire Brigades as recommended by the National Fire Protection Association (NFPA No. 27) should be followed. In some instances a small boat with a 500 gpm or 1,000 gpm pump and minor equipment would be of considerable value for use of the fire brigade.

23. Watchmen. Watchmen should be regularly employed. They should be able bodied men of normal intelligence and should be thoroughly instructed in the operation of fire alarm boxes, fire line hose equipment and first aid fire extinguishing appliances. They should be familiar with the location of all such equipment as well as other characteristics of the property relating to fire protection. Watchmen should be specifically instructed to notify the Fire Department immediately upon the discovery of fire and have the method by which they would

send the alarm definitely fixed in their minds by repeated drills. They should be impressed with the rule that they are not to attempt to fight the fire until after they have sent in the alarm.

CHAPTER 3. VESSELS.

31. Maneuverability. Ships, lighters, barges or other vessels should be moored in an orderly manner with forethought to their rapid removal in the event of fire, either on the pier or vessel.

32. Repairs. Repairs involving cutting, welding or other hot work while the vessel is at a marine terminal should be limited as far as is practicable. When performed, such work should be conducted in accordance with U. S. Coast Guard regulations and local ordinances under proper supervision and with all essential safeguards provided. Under no circumstances should cutting, welding or other hot work be performed on deck in proximity to open hatches.*

33. Explosives. Dangerous explosives, i.e., Class A explosives, Class B explosives, and forbidden explosives as defined by I.C.C. and U. S. Coast Guard regulations and blasting agents, should not be permitted in a marine terminal. Such explosives should be loaded and unloaded at special areas designated by authorities having jurisdiction. Class C explosives should be limited in quantity, temporarily stored on land areas rather than in transit sheds or on piers and removed from the terminal as soon as possible.

34. Harbor Pollution. It is generally unlawful to pollute a harbor. The regulations pertaining to this item should be strictly observed to avoid creation of a fire hazardous condition. Regulations usually prohibit the placing, discharging or depositing by any process or in any manner, of refuse, garbage, all kinds of timber, driftwood, dirt, ashes, sand, acids or any other refuse matter floatable or otherwise in slips or basins along the waterfront.

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*See Preventing Cutting and Welding Fires (No. 51A), informative pamphlet published by NFPA, 16 pp., 35 cents. Also Standard for the Control of Gas Hazards on Vessels to be Repaired (NFPA No. 306), 16 pp., 50 cents.

35. Refueling.

351. When vessels are refueled at a marine terminal, the number of barges or tankers should be limited to the minimum required for economical operation. Additional barges or tankers should not be brought to the terminal until those being unloaded are nearly empty. Unloaded fuel vessels should be removed from the terminal as soon as possible.

352. When vessels are fueled through pipe lines on a pier or wharf, flexible hose connections should be used and care taken to prevent leakage at joints.

353. All fuel lines should be pumped dry at end of fueling operation and care should be taken that no oil is discharged overboard when breaking connections.

CHAPTER 4. PIERS AND WHARVES.

41. General Description.

411. Piers and wharves of a marine terminal, according to past records, are especially vulnerable to fire. They may be considered as temporary warehouses for merchandise from the time such merchandise is unloaded from a vessel until it is removed by land carrier and, conversely, from the time it is brought to the pier or wharf by a land carrier until it is loaded on a vessel.

412. Piers and wharves of a marine terminal are the connecting link between land and water transportation systems. Their primary functions include furnishing shelter to vessels, stability of position during the loading and unloading process, facilities for storing and classifying freight, means for the quick and economical transfer of freight to vessels and cars or vehicles, and facilities for handling passenger traffic.

413. The merchandise passing over piers and wharves of a marine terminal consists of every conceivable kind of material, possessing all degrees of fire hazard, and frequently runs into very high values. Under ideal conditions the pier or wharf would act only as the facility for transferring merchandise from one vehicle to another, and the merchandise would pass over the pier or wharf without stopping. Obviously such a system would be impractical because of the impossibility of shippers or consignees meeting ship schedules exactly, and,

in respect to imports, the time necessary to clear goods through customs. A certain period is therefore allowed during which time the merchandise is actually stored upon the pier or wharf, awaiting the convenience of the owners, the shipper, consignee, or shipowner. This period should be reduced to a comparatively short time or the pier or wharf becomes the equivalent of a warehouse. Since the construction and operation of piers and wharves and of warehouses greatly differ due to the purposes they are intended to serve, the protection of merchandise against fire in a warehouse is superior to that provided by a pier or wharf. It follows therefore, that if merchandise is allowed to accumulate upon a pier or wharf, it will be more or less improperly stored and eventually may pass beyond a critical point. In case of fire, the loss would be excessive and far more than ordinarily anticipated.

414. During the period merchandise remains upon a pier or wharf it should be protected against loss by fire to the fullest extent practical. The Recommended Good Practice for the Construction of Piers and Wharves (NFPA No. 87) as recommended by the National Fire Protection Association, provide structural and protection details to reduce fire hazards of the piers and wharves themselves, but, in order to cover the subject, it is necessary to consider pier and wharf operation and management from a fire safety viewpoint in respect to their contents. Too frequently, thought is not given to this feature, and it is to cover this feature that these recommendations have been formulated. They are intended to provide a systematized method of pier and wharf operation and give consideration to fire prevention, all of which will help considerably in reducing fire damage on piers and wharves.

42. Cargo.

421. Cargo Placing. A definite system for placing cargo on piers should be established and instructions given to pier superintendents, dockmasters, stevedores and checkers as to how and where to put cargoes. Cargo spaces should be marked out on the deck of the pier by easily visible paint lines at least three inches wide and all cargo should be stored within these lines. When marking lines, the following aisle spaces should be provided:

(a) At least one "Main" aisle extending the entire length of the pier except where cargo is transferred direct to railroad cars and it is unnecessary to use trucks within the pier structure. The aisle should be as wide as conditions allow but should at least be of sufficient width to allow trucks to maneuver and pass one another.

(b) Other aisle spaces of adequate width should be established between cargo piles extending from the "Main" aisle to the pier sides. Aisles should be so arranged that in addition to separating the cargo piles, they will give ready access to sprinkler control valves, fire line hose stations, and first aid fire extinguishing equipment. Where deck openings for fire fighting purposes are provided, aisle space should be so arranged that as many of these openings as may be practicable are in the aisle and readily accessible for emergency use. Cargo piling should also take into consideration the need for ready access to such openings and only obstruct as few such openings as practicable.

(c) Two-foot aisle spaces should be maintained between cargo piles and the sides of the pier, fire walls or fire stops in enclosed piers.

(d) Piles of cargo should be as low in height, width and length as practical. When cargo is piled beneath trusses, beams, girders or other structural members of the pier, a clearance of not less than thirty-six inches should be maintained.

(e) The fire hazard of many combustible materials is increased when packaging is damaged or is not substantial. Operators should refuse to accept merchandise in such condition.

(f) Care should be exercised to assure that fire protection facilities such as automatic sprinklers will not be overtaxed in the event of fire due to the concentration and high piling and palletizing of combustible materials.

422. FIBERS. Sisal or other combustible fibers should be handled at piers or wharves protected by automatic sprinklers and in addition the following specific precautions should be taken:

(a) Cover all bales facing the main aisle with tarpaulins.

(b) The access to the fiber and to the aisles between the fiber stacks should be limited to the personnel handling the fiber and to the watchman.

(c) The fire line hose should be kept ready for instant use.

(d) All wire banded bales should be handled carefully and to avoid sparks should not be scraped along the deck.

(e) Bales of fiber that have broken open should be rebaled or removed from the pier or wharf immediately.

423. HAZARDOUS CARGO.

(a) When the quantity of cargo is large, piles of quick burning material should be interspersed as much as possible by piles of less combustible material.

(b) Cargo possessing particularly hazardous qualities in itself or that which may produce hazardous compounds or mixtures if it should come in contact with other materials, should be set apart. Such merchandise should be placed near the shore end of the pier in a location where it will be readily accessible to the Fire Department and where it may be quickly removed from the pier.

(c) Cargo known to be hazardous should not be accepted unless packed, marked and labeled as required under I.C.C. and U. S. Coast Guard regulations.

(d) Ammonium nitrate and mixtures thereof are shipped in a variety of forms and packaging, of varying degrees of hazard, and subject to various I.C.C., U. S. Coast Guard, and local regulations. Operators of marine terminals should use caution in identifying and accepting this material. Certain commodities shipped as "fertilizer" may contain high percentages of ammonium nitrate and should be handled accordingly.

(e) Radioactive materials should be stored in a specific conspicuously marked location either in transit shed or pier or on the land area. Shipments of radioactive material requiring special permit, special escort, or special handling by reason of high activity, excessive quantity per container or extreme weight of container, should be handled under specific instructions and should be removed from the terminal as promptly as possible. In the event of fire or accident involving radioactive materials, the Interstate Commerce Commission, U. S. Coast Guard, Atomic Energy Commission and shippers must be advised in accordance with their respective regulations and appropriate precautionary measures taken.

424. Deck Load. Under no circumstances should the weight of merchandise placed upon the pier or wharf exceed the specified floor load of the structure. Allowable floor loads should be conspicuously posted.

425. Skidding. Merchandise susceptible to water damage should be placed upon substantial skids so that it will be raised above the pier deck at least four inches. The use of pallets under cargo generally takes care of this suggestion.

426. Pallet and Dunnage Storage. Pallets and dunnage should be stored outdoors, so arranged as to avoid creating an exposure hazard to other property and to be readily accessible for fire fighting. If stored indoors, piles should be limited so that in a single fire area storage of idle pallets and dunnage will not exceed 16,000 cubic feet under automatic sprinkler protection or 8,000 cubic feet where such protection is not provided.

427. TIME LIMITATION OF STORAGE. Pier or wharf should not be used as a warehouse. Cargo possessing a distinct fire hazard should be removed as quickly as possible and preferably lightered to or from the vessel.

428. SEPARATION OF PASSENGER AND FREIGHT SERVICE. Where piers are used for both passengers and cargo, the movement of passengers in or near any cargo area should be regulated to eliminate any additional fire hazard and passengers should be subject to the same "No Smoking" rule as terminal personnel.

43. Maintenance.

431. MAINTENANCE OF STRUCTURE. Piers and wharves having combustible substructures should be inspected at periodic intervals to determine the condition of the substructure members. Any such members when found to be infected with rot, shattered, split, or otherwise readily susceptible to fire should be repaired or replaced.

432. MAINTENANCE OF FIRE PROTECTION EQUIPMENT.

Detailed information relative to the care and maintenance of fire protection equipment will be found in the following standards recommended by the National Fire Protection Association:

Care and Maintenance of Sprinkler Systems (NFPA No. 13A)

Standard for the Installation, Maintenance and Use of Central Station Protective Signaling Systems (NFPA No. 71)

Standard for the Installation, Maintenance and Use of Proprietary, Auxiliary, and Local Protective Signaling Systems (NFPA No. 72)

Standard for the Installation of Standpipe (Fire Line) and Hose Systems (NFPA No. 14)

Standard for the Installation, Maintenance and Use of Portable Fire Extinguishers (NFPA No. 10)

(a) Fire protection equipment should not be used for any other purpose.

(b) Covers for nozzle openings in the pier deck for use of substructure fire protection equipment should be kept in good order so that they will not stick when speedy removal is essential.

(c) Special periodic inspections should be made beneath the deck to determine conditions relating to fire prevention and protection in the substructure. Heavy incrustation of oil should be removed from all combustible members. Floating combustible debris should be removed. Fire protective devices such as automatic sprinklers, nonautomatic sprinklers, piping, fire stops, mono-

rails, etc., should be carefully examined and promptly repaired, if repairs are necessary.

433. HOUSEKEEPING.

(a) Piers and wharves should be kept free of rubbish and waste materials. Such materials should be kept in metal containers which should be removed at sufficiently frequent intervals to prevent dangerous accumulations. Particular attention should be directed to keeping clean the depression between tracks, areas under stairways, special rooms and enclosures and all out of the way places. Ashes should be wet down in the ash pit immediately after being drawn from the fire and placed in metal cans which should be removed as quickly as possible. Smoke pipes should be thoroughly cleaned at least once each year, preferably in the spring.

(b) Trusses, girders and other structural members should be cleaned regularly to eliminate accumulations of flammable dust. Such cleaning should preferably be done by the vacuum method.

(c) Sampling of merchandise by consignees should be restricted to a minimum and should be carried on under the supervision of a competent representative of the pier or wharf operator. Care should be taken to see that all packages are securely closed after sampling and that the material sampled has not been disturbed in a way that may cause fire. Refuse caused by sampling should be removed immediately.

(d) Substantially constructed approved metal waste cans with self-closing covers should be provided in all lamp rooms, rigging rooms, garages, at electric motors, winches, engines and other locations where there is likely to be an accumulation of oily waste. The waste in these cans should be removed daily and disposed of in a safe manner.

44. Common Hazards.

441. SMOKING.

Smoking should be strictly prohibited on any portion of the pier, wharf or in the bulkhead shed except in locations specifically designated as smoking areas and approved by the authorities having jurisdiction. Numerous NO SMOKING signs should be displayed throughout prohibited areas.

442. LIGHTING.

(a) Lighting by electricity is recommended, with all equipment installed in accordance with the National Electrical Code (NFPA No. 70). If use of portable equipment is essential, electric battery operated equipment is recommended.

(b) Kerosene oil lamps should not be used on structures where combustible fibers or similar combustible merchandise is handled. Where used, lamps should be hung or supported by noncombustible supports and should be so located as not to be endangered by trucking or handling of cargo. Only metal body lamps should be used near shelving and partitions. All lamps should be enclosed by lanterns (mill type) of substantial construction. Tops of lanterns should be not less than eighteen inches below the ceiling. Lamps should be inspected, filled and cleaned daily and by daylight only. Storage of oil and filling and cleaning of lamps should preferably be done in a lamp house off the pier structure.

443. HEATING.

(a) Heating by steam or hot water is recommended.

(b) Boilers should be installed and other safeguards provided in accordance with the NFPA Recommended Good Practice for the Construction and Protection of Piers and Wharves (No. 87).

(c) Hot air heating is not recommended, unless of the indirect type with heating coils in the delivery end of the blowers. Hot air furnaces should be installed and protected the same as provided for boilers in the preceding paragraph. Where blowers are used, the installation should conform to the NFPA Standard for the Installation of Residence Type Warm Air Heating and Air Conditioning Systems (No. 90B) in so far as applicable.

(d) Stoves (coal) are not recommended. When used, all coal stoves should be properly supported on iron legs, and placed not less than 36 inches from combustible material unless such materials are protected by substantial metal shields with 4-inch air spaces, in which case the clearance may be reduced to 18 inches. In structures having combustible floors all coal stoves with legs 6 inches or more in height should be set on a sheet of metal extending not less than 12 inches on all sides; in such locations when the legs are less than 6 inches high a course of 4 inches of hollow tile in cement mortar should be laid on the metal shield described above.

(e) Stove pipes should be riveted and substantially supported, and have a clearance of at least 18 inches to all combustible material. When stove pipes pass through combustible roofs or partitions, they should be protected by double metal ventilating thimbles at least 12 inches larger in diameter than the pipe. Stove pipes should not pass through concealed spaces.

(f) Gas radiators and gas heated steam radiators, when installed, should be supplied through metal pipe or metal tubing in accordance with the NFPA Standard for the Installation of

Gas Appliances and Gas Piping (No. 54). They should be located at least 12 inches from all combustible material, unless such materials are protected by metal, with not less than 2-inch air space, in which case the distance may be reduced to 6 inches. When the design of the radiator is such as to cause the floor to become heated, a protection of not less than $\frac{3}{16}$-inch asbestos mill board held between 2 sheets of 29 U. S. gage sheet metal should be provided. An approved metal screen or shield should be placed in front of each radiator.

(g) Any electric heater installed should be of approved design and the installation should be in accordance with the National Electrical Code (NFPA No. 70). A clear space of at least 12 inches should be maintained between electric heaters and all combustible material. An approved metal screen or shield should be placed in front of each radiator.

(h) Unit heaters should be installed carefully in piers and wharves protected by automatic sprinklers if premature operation of sprinklers is to be avoided. Details relating to necessary precautions will be found in NFPA Standard for the Installation of Sprinkler Systems (No. 13).

(i) Portable heaters should not be used.

(j) Where combustible materials are protected in various ways from the heat of stoves, stovepipes, gas radiators, electric heaters and similar heat-producing equipment, the clearances called for in the foregoing paragraphs may be modified accordingly. For further details, see Table of Clearances, with specified forms of protection, as published in NFPA Standard for Residence Warm Air Heating (No. 90B), Oil Burning Equipment (No. 31) or Gas Appliances (No. 54).

444. POWER.

Details relating to power should be in accordance with the NFPA Recommended Good Practice for the Construction of Piers and Wharves (No. 87).

45. Special Hazards.

451. SPECIAL PROCESSES.

(a) Special processes involving the use of volatile solvents should be prohibited.

(b) Ripening or coloring of fruits or vegetables, cleaning of cocoa bean or other sweepings and fumigating should not be carried on upon the pier or wharf unless the process is properly segregated and under the protection of automatic sprinklers.

452. Automotive and Railroad Equipment.

(a) Trucks and Automobiles. Transient trucks and automobiles should be allowed to remain on piers and wharves only long enough to load and unload cargo. Trucks or automobiles in noticeably poor mechanical condition including those exhausting carbon sparks or dripping gasoline or oil should not be permitted on a pier or wharf. The number of vehicles permitted upon the pier or wharf at one time should be limited to a predetermined number and such vehicles should not be permitted to block the main aisle. They should be turned as soon as possible so that they will face the land end of the pier and can be driven off the pier in the event of emergency. The motors of trucks should be stopped while being loaded or unloaded. The replenishing of the fuel supply or the draining of the fuel supply, or making repairs should be prohibited upon the pier or wharf. Any truck or automobile whose fuel supply has become exhausted should be towed from the pier.

(b) Tractors, Fork Lift Trucks and Dock Cranes.

1. Tractors, etc., operated by internal combustion engines which are part of the pier and wharf equipment, should be of approved construction and should be preferably stored in separate detached garage buildings. Where such tractors, etc., are stored on a pier they should be at the shore end of the pier and properly segregated. The floor of the segregated area should be free from pits and depressions and have a slope to outside drain ashore. Entrance to the segregated area should be preferably from outside of the pier.

2. When not in use, tractors, etc., should be stored in the garage or segregated area. Each vehicle should be provided with an extinguisher approved for Class B and Class C fires. Open flames such as forges, welding apparatus and oxygen for cleaning carbon from engines should not be used. Gasoline should not be used for cleaning but kerosene and similar fluids may be used for this purpose. Tractors, etc., should not be fueled or refueled on a pier or wharf, and any tractor, etc., whose fuel supply is exhausted should be towed from the pier or wharf in order to replenish the supply of fuel. For guidance in respect to such vehicles on matters not specifically treated herein, reference should be made to the NFPA Standard for the Use, Maintenance and Operation of Industrial Trucks (No. 505).

3. Tractors, etc., operated by electric motors and which are a part of the pier and wharf equipment, may be stored on the pier or wharf provided the area in which they are stored is

properly segregated. Each vehicle should be provided with an approved fire extinguisher. The battery charging plant should be installed in accordance with the National Electrical Code (NFPA No. 70).

(c) LOCOMOTIVES.

1. Locomotives, either steam or diesel driven, should be prohibited from entering upon the pier or wharf. The handling of cars should be effected by the use of a sufficient number of additional cars so as to make it unnecessary for locomotives to enter upon the pier or wharf. Cars should not be allowed to remain in the openings of fire walls or fire divisions longer than the time actually necessary for the manipulation of the cars, and the cars should be kept coupled.

2. Locomotives operated within the area of a marine terminal wherein combustible fibers or lumber is stored should be fitted with approved and properly maintained spark arresters.

3. Diesel driven locomotives should not be fueled within the boundary of a marine terminal except at a properly located and designed fueling station acceptable to the authorities having jurisdiction.

(d) Cars containing hazardous commodities not permitted for shipment over a pier or wharf of a marine terminal should not be permitted within the boundaries of a marine terminal.

453. OIL AND LAMP ROOMS.

(a) Oil and lamp rooms should be detached from pier where possible or if on a pier should be located at the land end where practicable and properly segregated. Door sills should be raised at least 4 inches from floor and ramped. Window or vent openings should be provided having an area equal to at least 5 per cent of the floor area of the segregated area; these should be of thin glass and if possible, in the ceiling. If in outer wall, they should not be placed below a cargo door but may open overhead into a vertical concrete shaft with a wall at least 4 inches thick extending 3 feet above the roof. Any ventilating openings wherever located should be so arranged as to open properly and completely in event of fire by means of an approved heat actuated device.

(b) Oil and lamp rooms should be designated by suitable signs. All oil should be stored in the oil and lamp room in approved metal tanks with hand pumps attached, and arranged so

that the overflow will drain back into the tank. The supply of oil should be limited to the minimum requirements but in no case should it exceed 5 barrels. The flash point of the oil stored or used should not be less than 100 degrees F. Only sand or similar noncombustible material should be used as an absorbent for spilled oil. Filling of lamps should be done by daylight only.

454. Rigging Rooms. Rigging rooms should be limited in use to the storage and repair of rigging only and should be properly segregated. Stocks of oakum, jute, etc., should be the minimum necessary for current work. Such baled stocks should be stored so as to allow 20 per cent for swelling of the bales in case these become wet. All loose oakum, jute and similar materials should be kept in and distributed from metal or metal lined bins. Any stock of paints, oils and thinners ordinarily kept in the rigging room should be limited to five gallons. All such stock should be kept in tight metal cans. Benzine, gasoline and similar volatile liquids should be limited to 2 gallons and such volatile liquids should be kept in approved safety cans. The rigging room should be placed in charge of one man who should be held responsible for the housekeeping, general care and cleanliness.

455. Carpenter Shop. All carpenter work should be done in a properly segregated room provided for this purpose. Where impossible to repair crates, cases, barrels, etc., in the carpenter shop, work should be limited to assembling and nailing parts together; all planing and cutting of the material should be done in the carpenter shop. Woodworking machines which produce more than one barrel of shavings or sawdust per day should be connected to a blower system installed in accordance with the NFPA Standard for the Installation of Blower and Exhaust Systems (No. 91). Waste materials should be swept up daily, placed in approved metal containers and removed from the carpenter shop at frequent intervals.

(a) Glue pots should be heated in water containers preferably by steam or electricity. When electrically heated, they should be in accordance with the National Electrical Code (NFPA No. 70). Gas is not recommended for this purpose but where used, the heater should be enclosed in casings of noncombustible material with adequate vent holes near the top openings for lighting the burners. Burners should have fixed connections. Air intakes, gas pipe and connections should be made in the side of the casing at least one inch above the bottom of same. There should be no openings in the bottom. The construction of the glue pots should be such that no water or glue can get into the casing, or in any way interfere with the operation of the burner.

456. PACKAGING AND RECOOPERING. All packaging should be done in a properly segregated room provided for this purpose. Incidental recoopering should be conducted at a safe distance from other cargo working areas. Refuse materials resulting from recoopering should be promptly removed.

(a) When only a small amount of packing and repacking is necessary, the packing material should be kept in a standard bin. If the amount of packing material required exceeds the capacity of one bin, a properly segregated room should be provided. At piers and wharves handling fruits where large quantities of packing materials are necessary, such materials should be stored in a properly segregated room provided for the purpose and the material should be kept in original bales until used. The care of all packing materials should be in charge of a designated man who should limit the amount taken from the bale to that actually required. Sawdust (for absorbing moisture) should be kept in bags in water-tight bins and after use should be immediately removed from the premises in metal rubbish barrels for disposal or collection.

457. OFFICES AND TRADE ROOMS. The use of offices and trade rooms should be confined to office purposes, and the sale and storage of stocks which have been damaged or uncalled for. The storage of goods which are of a hazardous nature should be prohibited in trade rooms. Such stocks should be removed from the pier.

(a) Office record rooms should be located where possible in detached buildings. When located on piers they should be properly segregated. All filing racks and cases should be of metal. No portable lamps should be used except hand electric lamps.

(b) All clothes lockers provided on a pier or wharf should be constructed of metal or other noncombustible material and should be located in the rest room.

458. INCINERATORS. Incinerators should be constructed as recommended in the NFPA Standard for Incinerators (No. 82). They should preferably be located in a detached building on shore. When installed on a pier or wharf they should be located in rooms properly segregated. The entire floors and supports of such rooms should be of noncombustible material. The incinerator should be set so as to have at least a two-foot clearance to any wall.

459. FLAMMABLE LIQUIDS. Gasoline and other flammable liquids should not be stored or handled except as follows:

(a) On piers and wharves not used for passenger and freight service and complying with provisions of the NFPA Suggested Ordinance for Petroleum Wharves (No. 304L).

(b) Paint, solvents and other flammable liquids in substantial sealed I.C.C. containers handled as cargo.

(c) Fuel oil having a flash point of above 150 degrees F. piped for bunker supply.

(d) Incidental use of flammable liquids as provided in preceding paragraphs.

CHAPTER 5. OUTDOOR STORAGE.

50. General Description.

501. Outdoor storage is recognized as standard practice for certain commodities which by reason of their bulk cannot ordinarily be placed in storage buildings. In general, materials of high value should not be stored outdoors if suitable storage buildings in accordance with recognized standards are available.

502. Outdoor storage, however, may be preferable to storage in combustible buildings lacking adequate fire protection in the case of materials not subject to undue damage or deterioration from exposure to the weather, and not particularly susceptible to ignition by sparks or flying brands.

503. Where materials which normally would be stored in buildings are stored outdoors in temporary emergencies, special precaution should be taken for their safeguarding. They should be moved to safe storage warehouses as soon as possible.

504. The introduction of containers or large vans, in connection with "roll on-roll off" type operations, or special container ship operations, requires large areas for the temporary storage of empty and loaded containers. The storage of containers should be orderly with adequate aisles for access for fire fighting purposes. Special attention should be directed to containers carrying hazardous cargo and to refrigerated or heated containers requiring gasoline or liquefied petroleum gas as fuel. Refueling should be conducted in accordance with the NFPA Flammable Liquids Code (No. 30) and NFPA Standard for the Storage and Handling of Liquefied Petroleum Gases (No. 58).

51. Site. In selecting a site for outdoor storage, preference should be given to locations having adequate municipal fire

and police protection; adequate public water systems with hydrants suitably located for protection of the storage; good drainage; adequate all weather roads for fire department use; and remoteness from buildings of combustible construction or from other combustible storage which might constitute an exposure hazard.

52. Piling.

521. Materials should be stored in unit piles as small in height and area as is consistent with good practice for the material stored.

522. Aisles should be maintained between individual piles, between piles and buildings and between piles and the boundary of the storage site. Aisles should be as wide as practicable to reduce the danger of spread of fire from pile to pile and to permit ready access for fire fighting, emergency removal of material or for salvage purposes.

53. Housekeeping. The entire storage site should be kept free from unnecessary accumulation of combustible materials. Weeds and grass should be kept down and a regular procedure provided for the periodic cleanup of the entire area.

54. Fire Protection.

541. Provision should be made by some suitable means for promptly notifying the public fire department or private fire brigade in case of fire or other emergency. In some cases it may be desirable to zone and number each zone so that when the need for emergency service is required, the caller can properly identify the area, a copy of the zoning plan to be filed with fire and police companies.

542. Water barrels and pails or other appropriate first aid fire extinguishing equipment should be placed at strategic points throughout the storage area so that one or more first aid fire extinguishing units will be quickly available for use at any point. Where the climate is such as to involve the danger of freezing, suitable non-freezing solutions should be used.

543. Provision should be made to permit direction of an adequate number of hose streams on any pile or portion of the storage area that may be involved in a fire. Unless adequate protection is provided by a municipal fire department, sufficient hose and other equipment should be kept on hand at the storage property suitably housed and provision should be made for trained personnel constantly available to put it into operation.

544. Hydrants and all fire fighting equipment should be accessible for use at all times. No temporary storage should be allowed to obstruct access to fire fighting equipment and any accumulation of snow should be promptly removed.

55. **Fencing.** The entire property should be surrounded by a fence or other suitable means to prevent access of unauthorized persons. An adequate number of gates should be provided in the surrounding fence or other barriers so as to permit ready access of fire apparatus in case of fire.

56. **Watch Service.** Standard watch service should be provided and properly maintained throughout the yard storage area when in use as such.

Attention is directed to the value of strategically placed watch towers and flood lights where a watchman stationed at a point of vantage can keep the entire property under observation.

57. **Covers.** Tarpaulins used for protection of storage against the weather should be of flameproofed material listed as standard by Underwriters' Laboratories, Inc., or other nationally recognized testing agency.

CHAPTER 6. TRANSIT SHEDS.

60. In so far as they are applicable to transit sheds, the foregoing suggestions for piers and wharves should be observed.

CHAPTER 7. WAREHOUSES.

70. For full information on warehouse protection and storage practices, see NFPA Recommended Safe Practices for General Storage (No. 231).

71. Management Responsibilities.

711. The supervision and maintenance exercised by the management of a warehouse are outstanding factors in the security of the warehouse and the merchandise stored. Good housekeeping, proper maintenance of the building and building equipment such as first aid fire appliances and sprinklers, the control of smoking and the proper piling of merchandise are all items that are dependent upon the management.

712. Warehouses frequently contain a high concentration of values. The mere storage of most merchandise presents a hazard of a very low order. The movement of merchandise into or out of the warehouse, the common hazards of the warehouse building such as lighting and heating and the exterior exposures should be the only hazards identifiable with warehousing. If the storage of merchandise is combined with manufacturing or other business, additional hazards are introduced that place the concentrated value of the merchandise in storage in unwarranted jeopardy.

713. In so far as is practical warehouses should be used only for storage purposes. They should not be combined with manufacturing or other use unless completely separated from such use by a standard fire wall without communications.

72. Common Hazards.

721. SMOKING. Smoking should be strictly prohibited within the warehouse and NO SMOKING signs should be posted at frequent intervals conspicuously located.

722. LIGHTING.

(a) Only incandescent or fluorescent lighting should be used for general illumination. Lights should preferably be installed over aisle spaces or where they will not be subject to mechanical injury when merchandise is moved. All lights should be provided with substantial wire guards. Lights should be located at the ceiling and rigidly connected directly to receptacles without fixtures. Pendent lights and portable extension lamps should never be used. Where dust conditions exist, lighting equipment should be installed in accordance with Article 500 of the National Electrical Code (NFPA No. 70).