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UNITED STATES DEPARTMENT OF LABOR
Frances Perkins, *Secretary*

BUREAU OF LABOR STATISTICS
Isador Lubin, *Commissioner* (on leave)
A. F. Hinrichs, *Acting Commissioner*

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Shipyard Injuries and Their Causes 1941

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Prepared by
Division of Industrial Accident Statistics
Max D. Kossoris, Chief

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Letter of Transmittal

UNITED STATES DEPARTMENT OF LABOR,
BUREAU OF LABOR STATISTICS,
Washington, D. C., October 20, 1942.

The SECRETARY OF LABOR:

I have the honor to transmit herewith a report on the occurrence and causes of industrial injuries to shipyard workers in the United States during 1941. This report was prepared in the Division of Industrial Accident Statistics by Frank S. McElroy and George R. McCormack.

A. F. HINRICHS, *Acting Commissioner.*

Hon. FRANCES PERKINS,
Secretary of Labor.

Bulletin No. 722 of the
United States Bureau of Labor Statistics

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SHIPYARD INJURIES AND THEIR CAUSES, 1941

Summary

DISABLING work injuries cut heavily into essential manpower in the shipbuilding industry during 1941. A survey of the industrial injuries which occurred in 93 shipyards revealed that, for every million man-hours worked, 27 workers were disabled. About 0.6 percent of these injuries resulted in death or so incapacitated the workers as to make them unfit for further industrial activity; 4.9 percent left the injured workers with lesser permanent impairments; and 94.5 percent resulted in temporary disabilities lasting an average of 17 days each.

While shipbuilding workers are injured more frequently than factory workers generally, the shipyards have been able to hold their frequency rates below those in the particular group of industries that have the most comparable processes.

The most hazardous operations in the industry were those connected with erection on the ways, in which department the actual assembly and fitting together of the many parts comprising the hull of a ship takes place. These operations averaged 40.4 disabling injuries for every million man-hours worked. Other departments in the group with relatively high frequency rates almost invariably were closely related to and subject to many of the hazards of hull construction. The operating departments having the lowest injury-frequency rates were nearly all concerned with fitting-out operations.

The electrical departments of the reporting yards did not have a particularly high injury frequency, but as evidenced by their high ratio of 1 death in 70 injuries, the probability that an injury would result fatally was much higher in those units than in any of the other operating department groups.

Generally speaking, it was safer to work in the very large shipyards than in the smaller plants. When grouped according to size of plant, the average frequency rates for the reporting yards varied almost directly from a high of 48.9, for yards of the smallest size, to a low of 17.4, for yards of the largest size. When considered geographically, the average frequency rates of yards on the Atlantic Coast, particularly in the South Atlantic area, were considerably lower than the average for any other region. The North Atlantic area, however, had the highest proportion of serious injuries among the various regions.

To supplement the general information supplied to the Bureau for the year 1941 by the large group of 93 shipyards, a detailed analysis was made of the individual records of 3,196 injuries, which occurred during the year in 11 of these yards. The detailed data were analyzed to determine the time of injury, the age of injured persons, the kinds of injuries experienced, and the causes of injury.

The detailed analysis indicated that injuries generally occurred less frequently in the summer months than in the fall, winter, or spring. Regular day-shift workers experienced a greater volume of injuries on Mondays than on any other weekday. Second- and third-shift injuries, however, reached peak volume on Fridays and Wednesdays. The shift-hour pattern of injury occurrence showed the peak of day-shift injuries to be in the third working hour, with a second and lesser peak appearing in the eighth hour. The evening and night shifts, on the other hand, had their greatest volume of injuries in the first working hour.

The limited volume of information available regarding the age distribution of shipyard workers gave some support to the common theory that injuries to older workers tend to be more severe than those experienced by younger persons. The evidence regarding the frequency of accidents by age of worker was inconclusive.

Injuries to the lower extremities were far more common than injuries to other parts of the body. Head injuries accounted for 21 percent of the total number of disabling injuries. In spite of the fact that nearly three-fourths of the head injuries consisted of eye cases, this group of injuries produced by far the greatest proportion of deaths among the cases for which such details were known. Finger injuries produced the greatest proportion of permanent partial disabilities. Abdominal injuries generally were the most severe kind of temporary injuries.

The most prevalent types of disabling injuries were strains, sprains, and bruises; cuts and lacerations; fractures; and burns or scalds. Skull fractures accounted for about 40 percent of the fatalities for which full details were available, and amputations, mostly of fingers, accounted for over half of the permanent partial disabilities. Hernia cases, requiring an average of 51 days for recovery, were the most severe type of temporary injuries.

Accidents in which workers were struck by falling, flying, or moving objects produced more injuries than any other type of accident. Fatalities, however, resulted most frequently from falls from one level to another. Permanent partial disabilities resulted most frequently from accidents in which the worker was caught in, on, or between objects.

The metal parts from which ships are constructed constituted the leading agency with which injuries were associated, followed by flying particles, hand tools, and working surfaces. Accidents of the "struck by" type accounted for a majority of the injuries connected with each of these agencies, except working surfaces. Accidents involving working surfaces, on the other hand, were largely falls or slips.

The serious problem of housekeeping in shipyards is indicated by the fact that hazardous arrangement or procedure was a factor in over half of the accidents analyzed. This element of hazard was prominent in practically every division of the accident type and agency classifications.

Among the unsafe acts of persons, which contributed to the occurrence of injuries, that of taking an unsafe position or posture was most frequently involved in the accident cases analyzed. This type of unsafe procedure, which includes such specific acts as lifting with bent back, standing under suspended loads and exposure to falling or sliding objects, was prominent in all of the operating departments of the shipyards and was one of the leading causes of nearly all of the various types of accident.

Better supervision and intensified educational programs to stress

safety fundamentals undoubtedly would do much to reduce the injury toll in shipbuilding. A great many of the reported injuries resulted directly from the violation of elementary safety principles, such as failure to wear goggles in the performance of chipping, reaming, and riveting operations; failure to wear hard hats when exposed to falling objects; failure to warn workers in craneways before moving crane loads; running in congested areas; and improper use of tools or equipment. Nearly all of the reporting yards make some personal safety equipment available and recommend its use in particular occupations. Relatively few, however, make its use mandatory. Most of the larger yards maintain full-time safety departments, but even among these yards there were few which reported any organized method of instructing the supervisors and rank and file workers in safety fundamentals beyond a very limited lecture delivered at the time of the worker's initial employment.

Scope and Method of Survey

The industry record, 1941.—The general section of this study is based upon summary reports received by mail from 93 shipyards, which were in actual operation throughout the major part of the year 1941. In order to secure as high a degree of comparability as possible in the types of operations and hazards included in this survey, the definition of shipbuilding as applied in this study has been somewhat modified from that regularly applied in the Bureau's annual surveys of injuries in all industries. In the regular annual surveys shipbuilding is defined[1] as the construction and repair of vessels of 5 gross tons or over. In this study, however, only yards which customarily construct or repair vessels of 150 feet or more in length have been included. The coverage of this study, therefore, is more limited than that of the annual survey, but the data are more uniform and comparable. None of the United States Navy Yards have been included.

The analysis applied in this section of the study is designed to indicate the relative frequency of injuries (a) in the various departmental divisions of the shipbuilding industry, (b) in shipyards of various sizes, and (c) in shipyards of various regions of the country.

Detailed section.—The detailed section of the study is based upon the original injury records of 11 shipyards which made their records available for analysis and transcription by Bureau agents. The yards cooperating in this part of the study were widely distributed. Two were in the North Atlantic area, two in the South Atlantic area, two in the Gulf area, four in the Pacific area, and one in the Great Lakes region. Each of these yards was engaged in the construction of comparatively large steel vessels. One yard was relatively new. The others had each experienced a tremendous expansion in recent years, but were all long-established units of the shipbuilding industry. The combined records of these yards included the details of 3,196 injuries which had occurred during 1941. As far as possible the same types of detail were taken from the records of each yard. In some instances, however, the particular details requested were not available. For this reason the number of cases analyzed in respect to particular accident factors varies considerably. All parts of the analysis, except that relating to injuries by age of worker, are based upon data from at least 9 yards. The analysis of these injuries follows the "American

[1] According to the Standard Industrial Classification, prepared by the Division of Statistical Standard of the U. S. Bureau of the Budget.

Recommended Practice for Compiling Industrial Accident Causes," approved by the American Standards Association, August 1, 1941.

The analysis applied in the detailed section of this study was designed to indicate (a) the time of injury occurrence, (b) the relationship between injuries and the age of workers, (c) the kind of injuries that occurred, and (d) how the injuries occurred.

The Industry and Its Hazards

Shipbuilding, as an industry, includes both the construction and repair of vessels. The yards or establishments comprising the industry range from small plants employing only a few workers to huge establishments employing more than 10,000 workers apiece. Generally the large yards are highly integrated plants, including within their organizations many sizable groups of manufacturing processes which are commonly considered as industries in themselves.

The actual construction of hulls upon the ways parallels the erection of structural steel for large buildings or bridges, and is subject to all of the hazards associated with building work, such as falls, or falling materials, and to all of the dangers associated with welding, riveting, and the handling of heavy materials. Fitting-out activities, which are commonly started before the hull leaves the ways and are finished in the fitting-out basin after launching, closely resemble the finishing operations involved in building construction, and are subject to similar hazards.

The fabrication of shapes and subassemblies is largely carried on in specialized shops within the yards. Employees of these shops, however, are frequently exposed to construction hazards, since much of their work must be done at the point of installation on or in the vessel. This is particularly true in fitting-out and repair work. Within the shops, workers are exposed to the variety of hazards associated with the particular industries which their activities represent. The yard departments vary considerably both in name and function from plant to plant, but commonly include units such as a machine shop, a woodworking shop, a fabricating shop, a paint shop, a foundry, a forge shop, a sheet-metal shop, and a mold loft.

In addition to the hazards normally existing in the industry, many new dangers to the lives and limbs of shipyard workers have arisen from the unusual operating conditions now prevalent. The great expansion of the industry has introduced large numbers of new and inexperienced workers into the yards. Many of these new employees had never before worked in any industrial establishment and were entirely unfamiliar with the hazards of their new occupations. Moreover the increasing opportunities for skilled workers throughout industry generally has resulted in a rising quit rate, thus depriving the shipyards of many of the experienced workmen upon whose advice and example much of the safety training for new men must depend. Highly indicative of the serious problem created by this situation was the comment of one safety engineer, who remarked, "The greatest hazard in this industry is the lack of trained supervisors." The growing necessity for rapid production also introduced an increased tempo of activity, crowded working conditions, and overtime work, all of which are commonly associated with increased possibilities for injury.

In comparison with other manufacturing industries, shipbuilding

has generally had a somewhat higher injury-frequency rate than the average for all manufacturing industries. It has, however, consistently held its frequency rate at a lower level than that of building construction, and below those in the forging, foundry, and fabricated structural-steel industries. Most of the large yards maintain safety departments, and these departments must be given much credit for their success in holding the average rate for the industry below that of the other major industries having comparable activities. In 1941, however, the average injury-frequency rate for all shipyards which reported to the Bureau for both 1940 and 1941 advanced 20 percent over that of the previous year.[2]

The Industry Record, 1941 [3]

On the average, there were about 27 disabling injuries for every million employee-hours worked during 1941 in the 93 shipyards included in this study. These injuries resulted in death or permanent total disability for 1 out of every 2,900 workers in the reporting plants; in permanent partial disability for 1 out of every 375; and in temporary disability, involving an average of 17 days lost time, for 1 out of every 19. Considering only the actual time lost by injured persons who were eventually able to return to work, the lost time in these plants averaged 1,051 man-days for every 1,000 workers. When the standard economic time charges for deaths and permanent impairments are included, the total economic cost of injuries in these plants rises to a total of 5,787 man-days for every 1,000 workers.

THE OPERATING DEPARTMENTS

Injury frequency.—The mechanical and construction departments, comprising the operating divisions of the industry, included 79 percent of the total labor force in the reporting yards and accounted for 85 percent of all injuries. As a group, these departments averaged 29.3 disabling injuries for each million man-hours worked.

Nearly a fourth of all the workers in the reporting shipyards were regularly employed in the industry's most hazardous department, erection upon the ways. It is interesting to note, however, that the frequency rate for this department, 40.4, was slightly lower than the national average frequency rate for building construction (41.8) [4], and considerably lower than the average rate for the more analogous heavy-engineering construction industry (68.0).

Excepting only "erection upon the ways," the departmental organization of the reporting yards varied widely. Of the other types of departmental units, only the welding departments accounted for as much as 10 percent of the total employment. The blacksmith or forge shops were generally small, but they produced the second highest average frequency rate (36.5). Also in the high-frequency group were the boiler shops (33.7), the fabricating shops (33.7), the carpenter shops (32.8), and the welding departments (32.5). It was impossible to distribute the injuries charged to these departments according to the place at which the accident occurred. Since each of these departments is closely connected with erecting operations and much of their work must be done upon the vessels, however, it is reasonable to assume that the high injury rates in these divisions

[2] See report Industrial Injuries in the United States During 1941, based upon the Bureau's annual survey, covering industrial injuries in all industries (Monthly Labor Review, September 1942, p. 501).
[3] Based upon summary reports from 93 shipyards. See appendix, table 1.
[4] See Monthly Labor Review, September 1942.

reflect not only shop hazards as such, but also considerable exposure to the greater general hazards prevailing upon the ways.

In the small number of yards which reported the operation of foundry departments, there was an average of 29.6 disabling injuries per million employee-hours of foundry work. This rate was much lower than the national average of 47.0[4] for commercial foundries. The machine shops, most common of all the departmental units, had an average frequency rate of 21.2. Although all of the work of machine installation is done outside the shop, the workers in that department held their frequency rate to 20.9. Paint-shop employees, who also must work upon the hull, had a frequency rate of 20.8.

The operating departments in the lowest frequency-rate group were nearly all concerned with fitting-out operations. The pipe and sheet-metal shops had average rates of 17.2. The copper shops and the joiner shops had 15.7 and 15.5 injuries per million hours worked, respectively, while the electrical shops averaged 14.7, and the pattern shops averaged 10.3. The lowest average frequency rate among the operating departments was that of the mold lofts, 4.7.

Resultant disabilities.—Although the electrical departments, as a group, had a relatively low injury-frequency rate (14.7), as compared with the other operating divisions, the chance of an injury resulting fatally in these departments was nearly double that of any of the other departmental groups. One in every 70 disabling injuries experienced by the electrical workers resulted in death, compared with a record of about 1 in 125 for the carpenter shops, the machine shops, and the paint shops. Fatalities averaged about 1 in 167 disabling injuries in erection on the ways, but totaled less than 1 in 200 in the other departmental units.

Permanent partial injuries were relatively most frequent in the sheet-metal shops. More than 1 in every 10 of the disabling injuries reported in these departments produced some form of permanent impairment. The joiner shops, with an average of 1 permanent partial impairment in every 11 disabling injuries, and the carpenter shops, with an average of 1 in 12, however, had only slightly better records.

Cases involving the loss of one or more fingers were most frequent among the permanent partial disabilities charged to each of the operating departments. The more serious permanent disabilities involving the loss of a hand, arm, foot, or leg, occurred in the ratio of 1 in every 3 cases of permanent partial disability in the pipe and joiner shops; 1 in every 4 in the machine shops and machine-installation departments; and 1 in every 5 in the fabricating, erection on the ways, and sheet-metal departments. Serious eye cases, involving the loss of sight in one eye, averaged 1 in every 9 permanent partial disability cases in the sheet-metal shops, 1 in 12 in erection on the ways, and 1 in 16 in the machine shops. Surprisingly, the only cases involving permanent impairment of hearing were reported as occurring to employees of the welding department, which reported no permanent eye cases.

Temporary injuries generally were more severe in the woodworking shops than in any of the other departmental units. On the average, 34 man-days were lost for each temporary disability in the carpenter shops, and 25 man-days for each temporary injury in the related activities of the joiner shops. Temporary disabilities in the welding

[4] See Monthly Labor Review, September 1942.

departments, on the other hand, resulted in an average time loss of only 12 man-days.

SERVICE, MAINTENANCE, AND MISCELLANEOUS DEPARTMENTS

Frequency.—The service and maintenance departments, as a group, accounted for 14 percent of the total employment in the reporting yards, but were charged with only 7 percent of all the disabling injuries. The comparatively low average frequency rate of 12.6 for the group, however, reflected more the relative infrequency of injuries in the clerical, administrative, and drafting departments than it did a true picture of safety conditions in all departments of the group. Among general laborers the frequency rate (31.0) was above the average for the operating departments, and the rates for the maintenance (23.8), plant protection (22.9), transportation (24.2), and yards (26.1) departments were only slightly below the average in the operating departments. Administration and drafting are commonly considered to be activities subject to the same hazards as clerical work. In shipbuilding, however, the frequent necessity for employees in administrative and drafting jobs to visit the points of operations brings them into contact with many of the outside hazards. As a result, the frequency rate for administrative workers (3.8) was double that of the clerical group (1.9); and the average rate for drafting departments (2.3) was over 20 percent higher.

Activities, reported as miscellaneous and unclassifiable, many of which probably would form part of the operating group, included 7 percent of the total employment and 8 percent of all injuries, resulting in an average frequency rate of 29.8.

Resultant disabilties.—The possibility of an injury resulting in a serious disability was considerably higher in some of the service and miscellaneous departments than in any of the divisions of the operating group. Fatalities occurred in the high ratios of 1 in every 49 disabling injuries in the yards departments, 1 in 63 in the general labor departments, and 1 in 72 in the maintenance departments.

Permanent partial disabilities similarly resulted from a high proportion of the injuries experienced in these departments, reaching the very high ratio of 1 in every 8 in the yards departments, and were only slightly lower in the maintenance departments. Temporary injuries likewise tended to be rather severe in some of these departments. Employees of the administrative and toolroom departments, who were temporarily disabled, lost an average of 25 days each, while those of the general labor departments lost an average of 23 days each.

Frequency by Size of Yard[5]

In shipbuilding, as in many other industries, the large establishments generally are safest. The average frequency rates for the 93 shipyards included in this study, when grouped according to size, varied from a high rate of 48.9 for yards having fewer than 250 employees to a low average of 17.4 for the largest yards with 10,000 or more employees. In sharp contrast to the averages, however, 10 of the 34 yards in the smallest size group, and 1 in the 500–1,000-employee group, operated throughout the year without a single disabling injury.

The more intensive specialization of work that is possible in the larger yards may help to account for their better safety record. The

[5] See appendix, table 2.

individual worker has a better chance to become familiar with the hazards involved in his job when the range of his duties is limited.

Another factor that accounts for the superior safety record of the larger shipyards is the greater attention devoted to safety in these yards. In fact, the effect of organized safety activity within the various plants is nowhere more apparent than in this comparison of accident frequency by size of shipyard. Few of the small yards maintain safety departments or fully equipped first-aid stations. As a result, the safety programs of these plants are limited at best to part-time activities on the part of supervisors who may have had no specific safety training. Similarly, the immediate availability of skilled first aid or medical attention, which prevents many minor injuries from becoming lost-time cases, lends considerable advantage to the larger plants in a frequency-rate comparison.

Typical of the most effective safety and medical programs are the following brief outlines of the organizations within two of the largest yards.

Yard A: Yard has a safety department consisting of 4 full-time engineers. All new employees are given a safety lecture before going to work. Safety is stressed in all training courses. All injuries are investigated and analyzed statistically. Safety goggles are supplied and required to be worn for all welding, grinding, chipping, and drilling operations. A small hospital and 2 first-aid clinics, staffed by 5 doctors and 16 nurses, are maintained within the plant. The frequency rate for this yard was 11.1.

Yard B: A full-time safety engineering department is maintained. All new employees are given a safety lecture. Safety representatives are appointed among the workers in each department. Weekly plant and departmental safety meetings attended by worker delegates are held. Every lost-time accident is investigated and analyzed statistically. Employees who normally wear glasses are required to have safety lenses. Safety goggles or glasses are required in all eye-hazard operations. Safety shoes are required in the steel mill and recommended elsewhere. Three first-aid stations, staffed by a doctor, 3 first-aid men, and 4 nurses, are maintained in the yard. Serious cases are treated in a yard hospital, staffed with 8 doctors and a number of nurses. The 1941 frequency rate for this yard was 20.4.

Geographic and Operational Distribution [6]

On the average, disabling injuries occurred most frequently in the yards exclusively engaged in new construction, and least frequently in those engaged only in repair work. The latter group, however, was composed mainly of relatively small establishments, which were not equipped to undertake major hull repairs, and were, therefore, not subject to the comparatively great hazards connected with work upon the ways.

As a group, the 11 reporting yards located in the Gulf area had a much higher average frequency of injuries (50.1) than those of the other regions. The 20 yards reporting operations on the Pacific coast averaged 36 disabling injuries per million hours worked, while 13 yards in the Great Lakes area averaged 35.8. The Great Lakes yards, however, were generally much smaller establishments than those of the salt-water regions. The North Atlantic group, which included a

[6] See appendix, table 3.

considerable number of the very large yards, and which accounted for 57 percent of the total man-hours reported in the study, had an average frequency rate of 22.6. As a group the 10 yards reporting from the South Atlantic area had an average frequency rate (15.7) lower than the average for any other region. Their individual rates, however, ranged from 0 to a very high rate of 83.1.

The North Atlantic area, with an average of over 8 cases of death and permanent disability among every 100 disabling injuries, had the highest proportion of serious injuries among the various regions. The Great Lakes area, however, with 1 death in every 90 disabling injuries had the highest fatality record.

Time of Injury

MONTHLY RECORD [7]

The year 1941 was one of continuous expansion in the 9 shipyards which furnished detailed monthly information. The number of employees and the monthly total of employee-hours worked in these yards more than doubled in the period from January to December. Reflecting much credit on the safety organizations of these particular yards, the volume of injuries in these plants did not increase at a much higher rate than did employment, as might well have been expected, but rather expanded at practically an equal rate. The monthly frequency rates for these yards, therefore, showed a surprisingly narrow variation. It is highly significant, however, that the frequency rates generally were lower in the period from May through August, when weather conditions were best for outdoor work, than they were in the winter, spring, and fall months. Similarly, the proportion of injuries resulting in death and permanent impairments reached its lowest point in the same period of good weather.

DAILY RECORD [8]

The distribution of 2,429 injuries, which occurred in 11 shipyards, indicates that cumulative work fatigue, of the type which builds up day by day and is not completely overcome in the normal rest periods between workdays, was not an important contributing factor in shipyard accidents during 1941, despite the increased speed of operations and longer hours which characterized the industry during that year.

The volume of injuries on the regular day shift was much greater on Mondays than on any other day of the week, lending some support to the occasionally expressed theory that recreational pursuits on a day off are frequently more fatiguing than the day-to-day routine of heavy work to which workers have accommodated themselves. It is possible too, that even one day of dissociation with the hazards of daily work may be sufficient slightly to lessen the skill with which those hazards are avoided. The relative volume of injuries to first-shift workers declined successively on Tuesdays, Wednesdays, and Thursdays. Fridays showed a slight increase, hardly great enough to be significant. Saturdays showed a sharp decline, mainly as a result of the fact that Saturday was not a full workday for all employees.

The second, or evening shift, did not have a Monday peak of injuries. Tuesday injuries on this shift were more numerous than those occur-

[7] See appendix, table 4.
[8] See appendix, table 5.

ring on Mondays, Wednesdays, or Thursdays, but were less numerous than the Friday cases. Full employment upon the second and third shifts was not common during 1941 in the shipyards surveyed, and the total number of injury cases reported for these shifts was relatively small. The distributions for the evening and (particularly) for the night shifts, therefore, should be evaluated as being based upon rather small samples.

SHIFT-HOUR OF INJURY OCCURRENCE [9]

The time-of-occurrence pattern, revealed by the distribution of 2,262 injuries reported in 11 yards, shows a striking similarity between the second and third shifts and a striking dissimilarity between these shifts and the regular day shift. On the day shift, injuries were most frequent during the third working hour; were least frequent in the fifth and sixth hours; and rose practically to third-hour volume again in the eighth hour.

The evening and night shifts, on the other hand, had their greatest volume of injuries in the first hour. The number occurring in the second and third hours declined somewhat, but remained relatively high. In the fourth hour the volume dropped decidedly, probably reflecting the reduction in activity during lunch periods. In each of the following three hours the number of cases remained relatively constant, but at a level below that of the second and third hours. In the eighth hour of both of the late shifts the number of injuries again fell to approximately the lunch-hour level. The high concentration of injuries in the first three hours of these shifts appears to indicate that many of the late-shift workers are not fully rested and properly alert to the hazards of the plants when they report for work. In considerable measure this condition may be due either to the difficulties of securing the full benefits of sleep during daylight hours, or to the fact that workers on these shifts must secure their recreation and attend to their personal affairs before going to work, rather than after work as is customary for day workers.

Injuries and the Age of Workers

A general distribution by age was available for only one of the shipyards visited. No general comparison to indicate whether or not age is an important factor in injury frequency could therefore be made. It was possible, however, to distribute 3,102 injuries, occurring in 11 yards, on the basis of the age of the injured persons and to indicate the types of resulting disability. [10]

Although these data neither support nor weaken earlier findings,[11] which indicated that older workers are less likely to experience injuries than are younger workers, they do lend support to the previous conclusion that injuries to older persons are likely to be more serious than those experienced by younger persons.

The average time required for recovery from temporary disabilities increased directly with the age of the injured persons, particularly in the age groups above 30, and most pronounced in the age groups above 40. Specifically, the average recovery period for those of less than 30 years of age was about 15 days; for those of 30 to 40 years of

[9] See appendix, table 6.
[10] See appendix, table 7.
[11] See Relation of Age to Industrial Injuries, in Monthly Labor Review, October 1940 issue (p. 789), or Bureau of Labor Statistics pamphlet Serial No. R. 1191.

age it was 17 days; and for those of 40 and over it was 19 days or longer. It is also pertinent in this connection that, among the injuries studied, there was an abrupt rise in the proportion of cases resulting in death and permanent disability as the age of the injured persons went above 35.

For one very large yard it was possible to obtain a distribution of employees according to age, as of January 15, 1942.[12] Although the indications obtained from an age distribution for only one yard are insufficient as a basis for any general conclusions, it seems apparent that age was not a great factor in the general accident picture of this yard; disabling injuries occurred with practically the same frequency in all age groups. Occupational differences, particularly those resulting from the tendency to place older persons in positions requiring least activity, however, could not be taken into account in this comparison.

Kinds of Injuries Sustained

PART OF BODY AFFECTED [13]

Injuries to the lower extremities—toes, feet, and legs—accounting for 37 percent of the injuries for which details were available, were far more common than injuries to other parts of the body. Head injuries, of which nearly three-fourths were eye cases, accounted for 22 percent of the total number of disabling injuries; injuries to arms, hands, and fingers accounted for 20 percent; and injuries to the trunk accounted for 17 percent.

Leg, foot, and toe injuries were consistently prominent throughout the various operating departments. Eye injuries occurred with some frequency in nearly all of the operating departments, but reached outstanding proportions in the welding and erection on the ways divisions. In these two operating units, eye cases comprised 19 and 22 percent, respectively, of all disabling injuries. Head injuries, other than those affecting the eyes, were also relatively frequent in the welding departments, where they totaled about 10 percent of all disabling injuries, and in the paint shops, where they amounted to 15 percent. Injuries to the chest, back, or abdomen occurred in nearly all of the operating departments, but were of high relative importance only in the paint shops and pipe shops.

As the number of disabling injuries available for analysis in the service and maintenance departments was comparatively small, the proportionate distribution for these departments cannot be considered very stable. It is of interest, however, to note that for these departments as a group 25 percent of all disabling injuries were foot cases, 20 percent were leg cases, 14 percent were finger cases, and over 12 percent were back cases.

Head injuries, other than eye cases, produced by far the greatest proportion of deaths (7 in 200), but resulted in relatively few permanent partial disabilities. In direct contrast, over 27 percent of the disabling finger injuries resulted in permanent partial impairment.

The most serious temporary disabilities were those resulting from abdominal injuries. On the average, these cases each required 34 days for recovery. Temporary leg and arm disabilities also had comparatively long average recovery periods (22 and 21 days, respectively)

[12] See appendix, table 8.
[13] See appendix, tables 9 and 10.

reflecting largely the extended recuperative periods required in major fracture cases. Temporary eye disabilities, on the average, required less time for recovery than did temporary injuries to any other part of the body.

NATURE OF INJURY [14]

Of the 3,175 disabling injuries classified by nature of injury, 96 percent fell into 4 general classifications. In the operating departments as a group, 36 percent of all disabling injuries were strains, sprains, or bruises; 36 percent were cuts or lacerations; 15 percent were fractures; and 8 percent were burns or scalds. Relatively similar proportions prevailed in most of the major departmental divisions. The welding departments, however, had a much higher than average proportion of burns, and a lower than average proportion of fractures, while in the carpenter shops and machine shops the reverse situation prevailed. Cuts and lacerations constituted distinctly more than average proportion of disabling injuries in the blacksmith shops, the boiler shops, and the machine installation departments. Amputations were relatively most important in the fabricating shops, joiner shops, and sheet-metal shops.

The nature-of-injury pattern in the service and miscellaneous departments was generally comparable with that of the operating departments. Notable, however, was the fact that 45 percent of the disabling injuries charged to the transportation departments consisted of fractures.

Resultant disabilities.—Six of the 15 fatalities included among the 3,183 disabling injuries, for which both the nature of injury and the extent of disability were known, were the result of fractures of the skull. Amputations accounted for over half of all the permanent partial disabilities. About 4 percent of the fracture cases and slightly less than 2 percent of the cuts and lacerations also resulted in permanent partial disability.

Hernia cases generally required much more time for recovery than any other type of temporary injury (51 days on the average). Fractures, with an average of 37 days lost per case, constituted the second most serious type of temporary injury. The majority of the temporary injuries, including burns and scalds, cuts and lacerations, strains, sprains, and bruises, and cases of occupational disease, however, all had an average recovery period of about 13 days.

Nature of injury and part of body affected.—Nearly three-fourths of all the eye injuries were cuts or lacerations, which might well have been prevented through the use of safety goggles. Nearly all of the remaining fourth were burns, largely inflicted by radiations from welding apparatus. Of the head injuries, other than to eyes, about half were cuts and lacerations, a fourth were bruises, and about 14 percent were skull fractures.

Injuries to the lower extremities were largely of three general types—cuts and lacerations; strains, sprains, and bruises; and fractures. Strains, sprains, and bruises predominated among the leg and foot injuries, accounting for about half of the cases affecting each. Cuts and lacerations represented a considerably greater proportion of the leg injuries (39 percent) than they did of the foot cases (24 percent). On the other hand, fractures occurred with greater relative frequency (18 percent) among the foot injuries than among the leg injuries (10

[14] See appendix, tables 11, 12, and 13.

percent). In direct contrast to the relatively low proportions of fractures among the leg and foot cases, two-thirds of the toe injuries involved fractures. Most other toe injuries were cuts and lacerations (18 percent) or strains, sprains, or bruises (15 percent).

Finger injuries were largely (46 percent) cuts and lacerations, but included a high proportion of amputations (18 percent) and fractures (23 percent). Cuts and lacerations similarly predominated among injuries to the hands (44 percent), although fractures (16 percent) and sprains and bruises (29 percent) together accounted for a larger proportion. More than 1 in every 5 arm injuries (22 percent) were fractures; 32 percent were cuts and lacerations; and 35 percent were strains, sprains, or bruises.

Injuries to the trunk were largely strains, sprains, or bruises. Of all the chest injuries, however, 22 percent involved fractured bones; and more than a fourth of the abdominal injuries were hernia cases.

Infection following an injury was relatively uncommon except among the cases of cuts or lacerations to the extremities. Its high incidence among injuries of this type, however, is very indicative of the tendency to ignore what appear to be minor cuts and scratches. As a group, the cases of cuts and lacerations which developed infection produced an average time loss of 13 days each, compared with an average of 12 days each for those without infection. This difference in average time lost is highly emphasized when it is recognized that prompt and efficient first aid probably would have prevented the infections, and thereby would have kept many of these injuries from becoming lost-time cases.

Causes of Injury

TYPES OF ACCIDENT [15]

About 46 percent of the 3,139 disabling injuries for which details were available resulted from the injured persons' being struck by falling, flying, or moving objects. In each of the operating departments, except the mold lofts, accidents of this type occurred more frequently than any other disability-producing type of accident. Slips on level surfaces and overexertion, accounting for 16 percent of the injuries, constituted the second most prominent accident type, and similarly occurred in substantial numbers in practically every department.

Falls from one level to another, accounting for 11 percent of all injuries, and falls on the same level, accounting for 5 percent of the injuries, were relatively common in all of the departments which normally participate in work on the ways or in the vessels, but were particularly prominent in the electrical shops, paint shops, and machine-installation departments.

Contact with extreme temperatures (which produced about 4 percent of the injuries) occurred most frequently, as might be expected, in the foundry and welding departments. Accidents of the "caught in, on, or between" type, accounting for about 3 percent of the injuries, were most prevalent in the blacksmith shops, fabricating shops, joiner shops, machine shops, and sheet-metal shops. The inhalation of noxious fumes or gases in improperly ventilated work spaces, such as inside tanks or hold compartments, and the absorption of harmful radiations, particularly from welding apparatus, accounted for

[15] See appendix, tables 14 and 15.

another 3 percent of the injuries. These types of accidents occurred most frequently to workers in the welding and erection on the ways departments.

In the service and maintenance departments as a group, accidents of the "struck by" type were the most productive source of disabilities. A very high proportion of the injuries experienced by employees of the administrative and yards departments, however, resulted from falls, slips, and overexertion. Reflecting the necessity of handling heavy material and of working on and around closely and irregularly piled material in the stock yards and on the ways, cases of slips and overexertion similarly were frequent in the general labor departments.

Fatalities occurred with much greater frequency in the case of falls from one level to another than in accidents of any other type. Permanent partial disabilities, a very large proportion of which were cases of lost fingers, occurred in the exceptionally high ratio of 1 in every 5 disabling injuries resulting from accidents of the "caught in, on, or between" type, and with relatively high frequency in accidents of the "struck by" and "striking against" types. Similarly, accidents in which workers were caught in, on, or between objects produced the most severe temporary disabilities, although those resulting from falls from one level to another were also generally quite severe.

AGENCIES CAUSING ACCIDENT [16]

Metal stock, including such items as the plates, rods, angles, and shapes from which ships are constructed, constituted the agency most closely involved in 27 percent of the injuries for which information as to agency of causation was available. More than half of the accidents in this group were of the "struck by" type. Also prominent among the metal-stock accidents were slips and overexertion and accidents of the "striking against" type.

Flying particles, mainly metal particles dislodged in welding, chipping, drilling, or riveting operations and grit blown through the outdoor working area of the yards by the winds prevailing in coastal regions, were the second most prominent injury agency, being involved in 10 percent of all the injury cases. In most cases these were eye injuries, which the use of goggles might have prevented. The resulting disabilities, however, were generally of a temporary nature, and, on the average, involved relatively short recovery periods.

Hand tools and working surfaces similarly were the agencies involved in relatively large proportions of the cases analyzed (8 percent each). The hand-tool accidents were largely of the "struck by" type. A large proportion of the accidents involving working surfaces on the other hand were falls or slips, particularly the staging accidents, which were largely falls from one level to another.

Among those accidents in which ship hulls under construction figured as the agency, accidents of the "striking against" type were most frequent, although falls, slips, and overexertion, and "struck by" accidents were each responsible for a considerable number of injuries. Ladder accidents were mainly falls, slips, or occurrences of the "striking against" type. Of the accidents in which lumber was classed as the agency, more than half were of the "struck by" type, 23 percent were the result of slips and overexertion, and 13 percent were of the "striking against" type.

[16] See appendix, tables 16 and 17.

Injuries in which cranes were involved produced the largest proportion of deaths related to any of the outstanding individual agencies. Generally these were accidents in which the injured person was struck by the materials being lifted or moved by the cranes. The mechanical agencies, i. e., machinery, engines and pumps, hoisting apparatus, and conveyors, generally were prolific producers of permanent partial disabilities. The most severe temporary injuries, involving an average recovery period of 30 days, were those resulting from crane accidents. Those temporary injuries for which the agency was characterized as "radiations from welding apparatus" (i. e., cases of welders' flash) were on the average the least serious disabling injuries ascribed to any of the various agencies.

UNSAFE MECHANICAL OR PHYSICAL CONDITION [17]

Serious problems in housekeeping are ever present in the shipbuilding industry. In work upon the ways much of the relatively limited space around and inside the vessel is necessarily occupied by staging. Similarly the necessity of keeping hatchways, and often portions of the deck itself, open for the delivery of material and equipment to the inside of the ship, limits the amount of space available for work or placement of materials. The air lines and cables connecting with every riveting hammer and every piece of welding apparatus extend in every direction over and through the hull. As a consequence the walkways and working spaces in, on, and about the hull are generally restricted and cluttered with material and equipment despite the best of housekeeping efforts.

Under normal conditions the yard areas present fewer physical problems than the ways. The expanded activity of the yards in 1941, however, necessitated vast increases in the stocks of material for which yard space had to be found, and required corresponding expansion in the activities and personnel of the yard shops and departments. In most instances this expansion in yard activities had to be accomplished without an increase in yard space. The resulting crowding of material and workers created many new housekeeping problems in the yard areas, and intensified the injury hazards attributable to poor housekeeping.

The importance of the housekeeping problem in relation to the prevention of injuries is strikingly indicated by the fact that of the 2,075 injury cases for which details indicating the unsafe mechanical or physical condition were available, over half were related to hazardous arrangement or procedure, meaning in most cases, "poor housekeeping." Typical of the injury-producing accidents included in this category were those resulting from tripping over obstructions in walkways and work spaces, and striking against or being struck by materials projecting or falling into walkways and work spaces.

A substantial proportion of the accidents classified as "falls to different levels" were also related directly to these housekeeping shortcomings.

Defective agencies, including such items as damaged or worn tools, improperly erected staging, and deteriorated cables and slings, were responsible for 13 percent of all the injuries. Such unsafe conditions figured as a cause factor in more than a fifth of the accidents classed as falls and in somewhat lower, but still important proportions of the

[17] See appendix, tables 18, 19, and 20.

"striking against," "struck by," and slips or overexertion types of accidents.

Improperly guarded agencies, such as open gears on machinery, staging without rails or toeboards, and unmarked deck openings, produced another 12 percent of the injuries. These improper or nonexisting agency guards were also responsible for a considerable proportion of the accidents of the "caught in, on, or between" type, particularly those involving machinery as the agency, and a high proportion of those classed as "falls to a different level."

UNSAFE ACTS OF PERSONS [18]

Analysis of the unsafe personal actions which contributed to the occurrence of 2,337 disabling injuries in 11 shipyards revealed that the act of taking an unsafe position or posture was a factor in just about half of all the cases. Included in this general category are the specific acts of lifting with bent back or while in an awkward position, standing under suspended loads, exposure to falling or sliding objects, standing or passing too close to openings, riding in an unsafe position, entering unsafe enclosures, and approaching too close to hazardous activities of others. The accidents resulting from these unsafe acts accounted for three-fourths of the fatalities resulting from the injuries analyzed, and produced about one-third of the permanent partial disabilities.

Over 80 percent of the accidents designated as "falls on the same surface," and 65 percent of those resulting from falls to different levels, were directly associated with the act of taking an unsafe position or posture. Similar unsafe actions were involved in 62 percent of the accidents classed as slips and overexertion and in about half of those in which the worker struck against or was caught in, on, or between objects. Far from being the peculiar failing of employees in particular departments or occupations, these personal faults figured largely in the accidents charged to all of the shipyard departments. The obvious implication, therefore, is that a generalized educational program to call the attention of all employees to the hazards connected with these unsafe acts might go far in the reduction of shipyard injuries.

Failure to use safe attire contributed directly to the occurrence of about 9 percent of all the injuries. Such negligence included failure to wear goggles in the performance of chipping, reaming, and riveting operations; failure to use hard hats when working in positions of exposure to flying or falling objects; failure to wear safety shoes or gloves when regularly assigned to the work of handling heavy, rough, hot, and awkward material; and the wearing of loose clothing around moving machinery. Accidents resulting from these unsafe acts were particularly prominent in work on the ways, in the blacksmith shops, in the fabricating shops, in the machine shops, and in the welding departments. Among the various accident types, failure to use safe attire was most important as a contributing factor in the types designated as inhalation, absorption, or ingestion, striking against, struck by, or contact with extreme temperatures.

Similarly, using unsafe equipment, using hands instead of equipment, or using equipment unsafely were factors in the occurrence of about 20 percent of all the injuries analyzed. These unsafe practices, arising largely from a lack of proper care or safety knowledge, were

[18] See appendix, tables 21, 22, 23, and 24.

relatively common in all shipyard departments and produced a substantial number of the injuries charged to each of the general accident types. More than half of the injuries related to the use of hand tools, and an important proportion of those in which the agencies involved were given as machinery, working surfaces, ladders, lumber, or metal stock, resulted either from using unsafe equipment or of using equipment unsafely.

Other types of unsafe acts, such as operating without authority, failure to secure or warn, operating or working at unsafe speed, and making safety devices inoperative, were not uncommon, but as a group accounted for only about 3 percent of the injuries analyzed. "Operating without authority" generally applied to the use of machines or mechanical equipment by persons other than the regular operators. "Failure to secure or warn," which resulted in a considerable volume of the "struck by" accidents, frequently involved such practices as the improper adjustment of slings, failure to block vehicles parked on inclines, failure to warn workers in the vicinity before lifting, lowering, or moving crane loads, and failure properly to post warnings regarding openings in walkways or work spaces or regarding hot substances and dangerous electrical contacts.

Operating or working at unsafe speed, including such specifically unsafe acts as running along congested walkways or upon scaffold platforms, resulted in a considerable volume of falls. The dangerous practice of making safety devices inoperative was most commonly connected with accidents involving machines, while unsafe loading or placing figured as a contributing cause in a substantial proportion of the injury cases involving lumber or metal stock.

Typical Shipyard Accidents

It is apparent from the foregoing analysis that many shipyard injuries result from the interrelation of several cause factors. Generally speaking, the elimination of any one of these interrelated factors will avoid the occurrence of an injury, which should be the preventionist's first duty. The achievement of immediate and effective results, therefore, depends to a considerable extent upon the preventionist first learning what factors are involved, and secondly, recognizing which of these factors can be most readily eliminated. To illustrate that the remedies in large measure are of common-sense nontechnical character, brief descriptions of a number of shipyard accidents were secured and typical examples of these were given individual consideration. The descriptions of these accidents, accompanied by suggestions as to the preventative measures, which might have avoided the occurrence of injury, are given below.

DESCRIPTION OF ACCIDENTS AND SUGGESTED METHODS OF PREVENTION [19]

1. An employee running across the gantry track stumbled and fell. His arm went into a trolley box and contacted a 440-volt line.—Electrocution.

(a) *The trolley box should have been enclosed or suitably guarded.*
(b) *Employees should be continually warned against unnecessary running.*

2. After removing chains from a hoisting block on gantry crane, employee stood under block. The limit switch on the crane failed, causing cable to tear loose from block, which fell on employee.—Fatal.

[19] In the analysis of these accidents, selected as typical of those reported, the authors had the assistance of H. G. Desjardins, associate safety engineer, Division of Shore Establishments, U. S. Navy Department. The analysis was made from cards to which the descriptions of accidents had been transcribed s as not to reveal the identity of reporting establishments.

(a) *Employees should never be permitted to remain under crane when the block is raised either with or without a load.*
(b) *The crane operator should not have hoisted the block to the limit switch.*
(c) *It should be standard practice to test limit switches twice daily—at the beginning of the shift and at midday.*

3. Operator, unable to see employee, swung crane. Employee was caught between counterweight and brake staff.—Fatal.

(a) *Crane operators should not move crane until signal is given by crane follower, who should see that everyone is clear.*
(b) *An audible warning signal should be sounded before crane moves.*
(c) *A painted sign "Danger—Keep Off" should be placed by the brake staff and the supervisors should see that its warning is obeyed.*

4. Employee was using a stationary grinder with the guard raised. The guard fell, forcing his fingers against the emery wheel.—One finger amputated.

(a) *A fixed type of guard would have prevented this accident.*

5. Employee was making a time study as to the performance of a Morton Draw Shaper. Instead of going up steps at front of the machine and walking around on the platform to read the dials, he walked to the rear of the machine on the ground level, placing himself between the end of the ram and the platform. On the return stroke the ram crushed him against the platform.—Fatal.

(a) *Access to dangerous areas should be adequately guarded.*
(b) *This employee apparently was unfamiliar with the hazards and should have been given more training and closer supervision.*

6. A worker was tripped when he stepped on or near a welding line just as the welder pulled his line. He lost 72 days from the resulting knee injury.

(a) *Welders' lines should be cradled overhead to prevent tripping hazards.*
(b) *Welders should face their lines and watch carefully when pulling.*

7. Employee working inside hull was struck by a 30-pound piece of pipe, which fell through a deck opening. The pipe had an offset flange on one end making it impossible for it to roll. The pipe, however, had been placed over a welder's line. Probably someone pulled the welder's line, which caught in the flange and dragged the pipe to the opening.—Lost two fingers.

(a) *Material should never be placed upon welders' lines.*
(b) *Whoever pulled the line should have looked before he pulled, and should have stopped when he felt the resistance of the pipe.*

8. Men were placing cork insulation and were using a cork cement with which they were unfamiliar. The cement apparently contained carbon tetrachloride although the label simply stated "will throw off toxic fumes which are not poisonous, but will displace oxygen and cause nauseating effects to workmen." A number of the workers became sick and three died.

(a) *The fact that the cement contained carbon tetrachloride should have been printed upon the label or stenciled upon the container, with a warning to use only in well-ventilated spaces.*
(b) *However, the warning quoted should have impressed the workmen's supervisors sufficiently (1) to impel them to inquire what toxic substance was in the cement; (2) to warn the workmen that it was toxic; and (3) to see that the proper ventilation and respiratory protection was provided when the cement was used in confined spaces. In this instance the warning that the fumes would displace oxygen should have indicated that only respirators connected with an outside air supply would be safe.*

9. Employee borrowed an Ingersoll-Rand high-speed vane pneumatic grinder from another worker intending to continue and deepen the grooves in a one-half inch twist drill which had been broken off. He removed the small four-inch wheel and replaced it with a six-inch saucer wheel. When power was applied the wheel shattered and some of the flying parts struck the employee's head.—Fatal.

This was a case of using equipment unsafely, probably due to lack of knowledge on the part of the workman. A portable grinder should not have been used. The revolutions were in excess of the permissible speed for the six-inch saucer wheel and centrifugal force caused it to explode. Better training and close supervision over the use of equipment probably would prevent this type of accident.

10. After lunch, man sat on locomotive crane bed behind cab in violation of yard safety rule. Engineer turned cab parallel with track without signaling, crushing man between cab and coupling.

(a) *Engineer should not operate without signaling. He should be sure that the space around the crane is clear before moving.*
(b) *Men should not be permitted to violate safety rules. Discipline and general safety education might prevent many such accidents.*

11. A carpenter, who was assigned to remove the bracing supporting some heavy material in a freight car, started to repair a discarded stepladder for use in entering the car. To secure a firm work surface, he placed the ladder upon the crane-rail ties and then stood inside the rail to nail bracing strips on the ladder. The electric crane moved along the track and struck him in the back.—Fatal.

(a) *The crane should have had an audible, automatic warning signal and the crane cab should have been so arranged that the operator could have an unobstructed view of the track when moving the crane.*
(b) *The carpenter should have been trained not to expose himself to danger unnecessarily.*
(c) *The defective ladder should have been removed from the work place when it was first found to be defective.*

12. A hooker-on was holding one end of a crane load of channels attempting to guide the load into place. For some reason the load jerked. The sling chain nearest the hooker-on slipped, tilting the load, which pinned the hooker-on to the ground. Inspection revealed no defects in the crane mechanism or brake.—Fatal.

(a) *Crane loads should be guided with a rope, or with a long pole, not by hand.*
(b) *There should have been a spreader between the two sling chains, which would have prevented the chain from slipping regardless of how the load may have been jerked or swung.*

13. A crane operator was found dead in the cab of his crane after the lunch period. He was sitting in a chair, which was tilted backwards, with his head against an open switch.

Electric switches should be covered so that it is impossible to touch the contacts.

14. Operator of swing-saw was holding material with his hand in line with the drive belt and pulley. As he pulled the saw forward his hand became wedged between the stock and the revolving belt and pulley.—Severe friction burns on left hand.

The belt and pulley should have been completely enclosed.

15. Employee was chipping a steel plate with a hammer and cold chisel. A small piece of steel struck his eye.—Lost sight of eye.

Employees should be required to wear goggles on all chipping operations.

16. Welder's clothes caught fire, burning his arms and face. Injured was lying on his side working with hands raised above his body welding rivet holes in inner-bottom shell plates. Inner bottoms were about 3′ x 3′ x 3′. Apparently, he had been using an oxygen hose, left by a heater, for cooling and ventilating purposes, which accounted for the rapid spread of the fire.—Lost 185 days.

This employee had not been given proper training regarding the hazards of using oxygen as a cooling agent. Both supervisors and workmen should be repeatedly warned that the introduction of oxygen will spread fire, and if mixed with acetylene may be explosive. The use of burners' equipment by unauthorized persons for any purpose should be prohibited and the prohibition enforced.

17. Shipfitter leaderman was trying to pull plates together at stem of ship. Contrary to yard rules he built himself a scaffold without a hand rail. His pulling device parted, throwing him from the scaffold.—Fatal.

Bad supervision. All scaffolds should be built by designated crews of trained scaffold builders and inspected by the supervisor before being put into service.

18. While walking through unlighted space on ship, employee stepped into open trunk and fell 27 feet. Fractured skull.—Fatal.

The open trunk should have been guarded by a barricade with red warning lights.

19. Electrician was working on wiring between decks on ship. He stepped into hold and fell about 20 feet. Died 12 days later.

Supervisory failure to provide necessary barricade over hold. All openings should be guarded.

20. Men were taking plates off bottom of vessel in drydock. Plate stuck—men were told to stay clear as leader was going inside to knock it loose. Man disobeyed instructions and went under plate. When it came off, it hit him, fracturing lumbar vertebra.

(a) Failure on the part of the employee to carry out instructions of supervisor.
(b) The leader, knowing of the possibility of danger, should have remained on the outside while one of the workers went inside to knock out the plate.

21. A desk was being lowered to the bottom of vessel, through cargo hatch. Desk slipped from sling, and fell striking partition in vessel, which caused desk to bounce in under cargo deck where it struck workman. Man died with fractured skull. This man owned a safety hat, but was not wearing it.

Improperly adjusted sling. Suspended loads should not be swung over heads of workmen. A warning signal should have cleared the employee from the danger zone. The fact that the employee was not wearing his safety hat was of secondary importance in this case. It should, however, be mandatory that safety equipment be worn if it is issued.

22. Employee was working on the top of an 18-foot trestle repairing a light on the steam crane boom. A plank, which was nailed on top of the trestle, pulled out, causing him to fall to the pier.—Fatal.

Failure to provide substantial working platform. Workplaces should be checked by the supervisor before work is started.

23. The riggers were told to remove the launching timbers from underneath new steel hull. They were to run a line from the timbers through snatch blocks to the crane. Instead of using timber tongs to make a proper fastening of the line to the timbers, this man merely drove a steel dog into the timbers and attached the line to the dog with a bowline. When the strain on the line was taken up by the crane, the dog pulled out of the timbers, hooked him behind the left knee, knocked him down on his back, and dragged him several feet.—Fatal.

Inadequate supervision. The fasterings should have been checked and ordered corrected. The workman apparently had not received proper training.

24. Men were moving section of keel with improper gear. As crane lifted keel, clamps let go turning keel section over on employee's foot. Seven fractures resulting in partial stiffening of foot and ankle.

Supervisory failure to provide proper lifting gear.

25. Man was operating square shears (power). Tips of second and ring fingers, left, passed dog and underneath blade when lever was tripped.—Ends of fingers amputated.

All square shears should be provided with a guard located at front of blade.

26. Man was working out-feed end of Oliver ripsaw from which splitter had been removed. The stock kicked back pulling left hand into back of saw.—Severed tendon, little finger stiff.

A proper self-adjusting guard and splitter would have prevented the employee from coming into contact with the saw.

27. Sheet-metal worker, working on hull, returned to shop to have work punched. It was necessary for operator to change the punch on machine which made it necessary to remove guard and guide. Power belt is thrown off pulley by lever which extends toward operator and point of operation of machine. Employee became interested in procedure and leaned on stock bench with face about 1 foot from machine. For some reason the belt engaged the pulley, causing press to operate. The new punch assembly had not been locked in and plunger hit the semicircular female ring, causing it to fly out and strike worker in eye.—Loss of eye.

A locking device should have been provided to prevent belt shifter from moving over driving pulley.

28. Employee was placing weight box on assembly platform, using a hook from bridge crane on fixed sling on box, with another sling hanging loose from hook. When he released hook from box and signaled craneman to hoist away, the clamp on unused sling caught on under side of weight box, causing it to turn over against his leg.—Fractures and stiffening of joints.

Employee should have gathered all sling hooks together prior to giving the "hoist away" signal to crane operator.

29. Employee was on staging at side of ship and had removed goggles to clean them. A riveting gang 25 feet away was chipping off a burr from a rivet. A part of the burr flew and struck employee in eye and perforated eyeball, making it necessary to remove eye.

Failure on the part of the riveting gang to provide a barricade to retain flying chips.

30. Workman was setting in heads of spikes. A piece flew from head of set hammer and struck the workman's eye.—Loss of sight in one eye.

Failure to wear eye protection—goggles. Hammer head may have been slightly hard or chipped. It is advisable to check brittleness of hammers before they are put into service.

31. A handyman shipfitter was engaged in the erection of a bulkhead. The center line girder, measuring 8′x 8′ and weighing 2,368 pounds, had been previously placed in position and tack-welded to the bulkhead. Injured was working in a kneeling position at the corner formed by the junction of the girder with the bulkhead. His helper, working on the other side of the girder, suddenly sensed that the girder was moving. He shouted to injured who, in attempting to move backward out of the way, fell over some tool boxes lying behind him. As he fell the girder toppled over, crushing him beneath it.—Fatal.

Failure on the part of welders to properly tack-weld girder to the bulkhead. A lack of proper supervision and training is indicated.

32. Man was working between two weight boxes, welding stiffeners on section of bulkhead. Had been away from his work and, upon returning, evidently lowered himself to a sitting position by holding on top of weight box, pulling the box over on him, fracturing skull.—Fatal.

Failure on the part of employee to properly secure weight boxes.

33. Man working in copper shop melting rosin from air chamber was burned when the pressure built up in the chamber by misdirected heat caused remaining rosin to blow out. Concussion tore the clothing from man, splattering him from head to thighs with the hot rosin.—Lost 43 days.

A pressure-reducing valve in the air line would have prevented pressure from being built up in the chamber. The workman should have been warned of the hazard and should have been more closely supervised.

Appendix

TABLE 1.—*Injury rates and extent of disability, classified by department, for 93 shipyards, 1941*

Department	Number of units reporting	Percentage of total number of employees	Percentage of total number of employee-hours worked	Percentage of total number of disabling injuries	Percentage of injuries resulting in—			Injury rates [1]		Average days lost per temporary total disability
					Death and permanent total disability	Permanent partial disability	Temporary total disability	Frequency	Severity	
All departments	1,082	100	100	100	0.6	4.9	94.5	26.9	2.9	17
Operating departments	705	79	79	85	.5	5.0	94.5	29.3	3.0	17
Blacksmith shop	55	1	1	1	0	5.4	94.6	36.5	1.6	19
Boiler shop	31	1	1	2	.5	2.1	97.4	33.7	2.0	19
Carpenter shop	54	4	4	5	.8	8.1	91.1	32.8	5.5	34
Copper shop	15	1	1	(2)	0	7.9	92.1	15.7	.7	16
Electrical shop	54	4	5	3	1.4	4.9	93.7	14.7	1.9	17
Erection on the ways	64	23	23	35	.6	4.3	95.1	40.4	4.0	16
Fabricating	42	7	6	8	.1	6.8	93.1	33.7	3.0	14
Foundry	12	1	1	1	0	0	100.0	29.6	.7	24
Joiner shop	20	1	1	(2)	0	8.9	91.1	15.5	2.3	25
Machine installation	27	4	3	2	.4	5.9	93.7	20.9	2.1	14
Machine shop	68	8	8	7	.8	6.4	92.8	21.2	3.0	21
Mold loft	36	1	1	(2)	0	6.3	93.7	4.7	.2	23
Paint shop	53	3	3	2	.8	7.7	91.5	20.8	3.5	21
Pattern shop	28	(2)	(2)	(2)	0	0	100.0	10.3	.2	21
Pipe shop	52	6	6	4	0	6.1	93.9	17.2	2.0	20
Sheet-metal shop	40	4	4	2	.4	10.1	89.5	17.2	2.7	14
Welding	54	10	11	13	.4	2.3	97.3	32.5	1.8	12
Services and maintenance	256	14	14	7	1.5	6.5	92.0	12.6	2.1	19
Administration	42	2	2	(2)	0	5.1	94.9	3.8	.4	25
Clerical	48	6	6	(2)	0	0	100.0	1.9	(2)	16
Drafting	34	1	1	(2)	0	0	100.0	2.3	(2)	16
General labor	25	2	2	4	1.6	1.6	96.8	31.0	4.2	23
Maintenance	28	1	1	1	1.4	11.9	86.7	23.8	6.0	12
Plant protection	12	(2)	(2)	(2)	3.0	3.0	94.0	22.9	4.8	21
Toolroom	15	(2)	(2)	(2)	0	0	100.0	7.1	.2	25
Transportation	30	1	1	1	1.1	6.7	92.2	24.4	4.5	16
Yards	22	1	1	1	2.0	12.8	85.2	26.1	5.1	16
Miscellaneous	121	7	7	8	1.1	2.6	96.3	29.8	3.3	17

[1] The frequency rate is the average number of disabling injuries for each million employee-hours worked. The severity rate is the average number of days lost for each thousand employee-hours worked. The standard time-loss ratings for fatalities and permanent disabilities are given in Method of Compiling Industrial Injury Rates, approved by the American Standards Association, 1937.

[2] Less than 0.5.

[3] Less than 0.05.

TABLE 2.—*Distribution of injury-frequency rates for 93 shipyards, by size of establishment, 1941*

Item	Total	Size of establishments.						
		1 to 249 employees	250 to 499 employees	500 to 999 employees	1,000 to 2,499 employees	2,500 to 4,999 employees	5,000 to 9,999 employees	10,000 employees and over
Total number of establishments	93	34	7	11	17	13	7	4
Number of establishments having frequency rates of [1]—								
0	11	10	0	1	0	0	0	0
1–10	6	2	0	1	0	2	0	1
11–20	13	0	3	1	2	3	2	2
21–30	16	1	1	2	8	1	3	0
31–40	14	3	0	2	4	3	1	1
41–50	3	1	0	0	1	1	0	0
51–60	6	3	1	0	1	1	0	0
61–70	8	5	1	0	0	1	1	0
71–80	9	4	1	3	1	0	0	0
81–90	1	1	0	0	0	0	0	0
91–100	2	1	0	1	0	0	0	0
101 and over	4	3	0	0	0	1	0	0
Total number of employees—percentage	100	1	1	4	16	21	23	34
Total employee-hours worked—percentage	100	1	1	4	15	21	22	36
Total number of disabling injuries—percentage	100	3	2	5	18	25	24	23
Average frequency rate [1]	26.9	48.9	38.4	37.4	32.3	33.3	28.7	17.4
Average severity rate [1]	2.9	2.9	2.4	3.6	2.0	2.1	2.1	4.2

[1] See footnote 1, table 1.

TABLE 3.—*Injury rates and extent of disability, classified by geographic location and operation, for 93 shipyards, 1941*

Area and operation	Number of establishments	Percentage of total number of employees	Percentage of total number of employee-hours worked	Percentage of total number of disabling injuries	Percentage of injuries resulting in—			Injury rates [1]	
					Death and permanent total disability	Permanent partial disability	Temporary total disability	Frequency	Severity
Total	93	100	100	100	0.6	4.9	94.5	26.9	2.9
New construction	35	51	46	52	.6	6.9	92.5	30.7	3.9
Repair	26	5	6	5	1.0	5.9	93.1	22.4	3.6
Both repair and new construction	32	44	48	43	.6	2.4	97.0	24.0	1.9
North Atlantic area	35	54	57	48	.8	7.6	91.6	22.6	3.5
New construction	11	29	30	26	.7	12.0	87.3	22.9	4.5
Repair	11	2	3	3	1.0	10.9	88.1	17.9	4.3
Both repair and new construction	13	23	24	19	.9	1.9	97.2	22.7	2.1
South Atlantic area	10	11	12	7	.9	6.0	93.1	15.7	1.9
New construction	4	2	1	2	.4	1.2	98.4	66.4	2.5
Repair	4	[2]	[2]	[2]	4.3	0	95.7	27.9	9.1
Both repair and new construction	2	[2]	11	5	1.0	8.7	90.3	11.2	1.7
Great Lakes area	13	3	3	4	1.1	2.9	96.0	35.8	4.5
New construction	4	2	2	3	2.0	2.4	95.6	41.3	6.8
Repair	6	[2]	[2]	[2]	0	9.1	90.9	58.0	10.5
Both repair and new construction	3	1	1	1	0	1.4	98.6	26.2	.9
Gulf area	11	8	8	14	.4	1.9	97.7	50.1	2.3
New construction	5	5	4	9	.3	2.1	97.6	61.0	2.1
Repair	2	1	1	1	.8	1.7	97.5	31.0	3.4
Both repair and new construction	4	2	3	4	.5	1.2	98.3	39.1	2.2
Inland area [3]	4	1	1	1	0	.9	99.1	25.2	.3
New construction	3	1	1	1	0	.9	99.1	27.6	.3
Pacific area	20	23	19	26	.4	1.7	97.9	36.0	1.9
New construction	8	12	8	11	.6	1.9	97.5	38.3	2.6
Repair	3	2	2	1	.7	2.2	97.1	19.1	1.2
Both repair and new construction	9	9	9	14	.2	1.5	98.3	37.2	1.5

[1] See footnote 1, table 1. [2] Less than 0.5.
[3] Includes data for shipyards not shown separately because of insufficient coverage.

TABLE 4.—*Disabling injuries, classified by month of injury and extent of disability, for 9 shipyards, 1941*

Month	Percentage of average number of employees	Percentage of total employee-hours worked	Percentage of total number of disabling injuries	Percentage of injuries resulting in—			Injury rates [1]	
				Death and permanent total disability	Permanent partial disability	Temporary total disability	Frequency	Severity
Total	100	100	100	0.4	4.7	94.9	19.9	1.6
January	71	5	6	0	8.7	91.3	21.5	2.8
February	73	6	6	0	7.9	92.1	19.4	2.2
March	77	7	7	.9	2.7	96.4	21.2	1.9
April	81	7	7	0	11.2	88.8	21.1	1.8
May	87	7	6	0	5.5	94.5	16.4	2.4
June	86	7	7	0	2.8	97.2	18.5	.5
July	99	9	8	.8	2.3	96.9	18.5	1.3
August	106	9	8	0	1.6	98.4	17.8	.4
September	111	9	10	.6	3.7	95.7	21.6	1.4
October	125	11	11	.6	6.2	93.2	20.1	1.9
November	134	11	11	1.7	2.2	96.1	20.1	2.6
December	150	12	13	0	4.6	95.4	20.8	1.0

[1] See footnote 1, table 1.

TABLE 5.—*Distribution of disabling injuries in 11 shipyards, by shift and by day of week on which injury occurred, 1941*

Shift	Total number of disabling injuries	Percentage of disabling injuries occurring on—						
		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Total	2,429	2.3	18.1	18.1	16.6	15.1	16.4	13.4
Day	1,759	2.2	19.4	18.4	16.3	15.1	15.6	13.0
Evening	497	2.2	14.9	17.5	16.7	15.7	18.9	14.1
Night	173	3.5	14.5	16.8	20.2	13.3	16.2	15.5

TABLE 6.—*Distribution of disabling injuries in 11 shipyards, by shift and by hour of shift in which injury occurred, 1941*

Shift	Total number of disabling injuries	Percentage of disabling injuries occurring in—								
		First hour	Second hour	Third hour	Fourth hour	Fifth hour	Sixth hour	Seventh hour	Eighth hour	Other
Total	2,262	13.2	11.6	15.5	11.1	8.5	9.0	12.1	12.9	6.1
Day	1,588	11.0	10.7	15.4	12.0	7.5	8.1	12.8	14.5	8.0
Evening	495	17.2	13.7	16.4	9.5	10.9	11.1	10.5	8.9	1.8
Night	179	22.3	14.0	14.5	7.8	10.6	11.2	10.6	9.0	0

TABLE 7.—*Disabling injuries, classified by age of injured and extent of disability, for 11 shipyards, 1941*

Age group	Number of disabling injuries								Average days lost per temporary total disability
	Total		Resulting in—						
			Death and permanent total disability		Permanent partial disability		Temporary total disability		
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
Total	3,102	100	15	0.5	96	3.1	2,991	96.4	17
20 years and under	342	100	0	---	9	2.6	333	97.4	15
21 to 25 years	673	100	3	.4	20	3.0	650	96.6	14
26 to 30 years	583	100	5	.9	14	2.4	564	96.7	15
31 to 35 years	412	100	1	.2	11	2.7	400	97.1	17
36 to 40 years	351	100	4	1.1	11	3.1	336	95.8	17
41 to 45 years	274	100	0	---	11	4.0	263	96.0	23
46 to 50 years	211	100	0	---	10	4.7	201	95.3	19
51 to 55 years	137	100	2	1.5	7	5.1	128	93.4	24
56 to 60 years	70	100	0	---	0	---	70	100.0	27
61 to 65 years	35	100	0	---	3	8.6	32	91.4	37
66 to 70 years	12	100	0	---	0	---	12	100.0	22
71 years and over	2	100	0	---	0	---	2	100.0	32

TABLE 8.—*Employment and disabling injuries, classified by age of employees, for 1 large shipyard, 1941*

Age group	Number of employees	Number of disabling injuries	Age group	Number of employees	Number of disabling injuries
	Percent	*Percent*		*Percent*	*Percent*
20 years and under	15	11	46 to 50 years	4	5
21 to 25 years	28	29	51 to 55 years	3	2
26 to 30 years	19	22	56 to 60 years	2	(1)
31 to 35 years	13	12	61 to 65 years	1	1
36 to 40 years	9	12	66 to 70 years	(1)	(1)
41 to 45 years	6	6			

[1] Less than 0.5.

TABLE 9.—*Disabling injuries, classified by department and by part of body injured, for 11 shipyards, 1941*

Department	Total number of disabling injuries	Number of disabling injuries affecting—												
		Eye(s)	Brain or skull	Head—not elsewhere classified	Chest (lungs)	Back	Abdomen	Arm(s)	Hand(s)	Finger(s)	Leg(s)	Foot or feet	Toe(s)	Not elsewhere classified
All departments	3,179	468	96	113	157	263	118	161	205	294	495	468	203	138
Operating departments	2,867	459	86	108	141	224	112	143	191	259	439	400	178	127
Blacksmith shop	62	4	0	1	2	8	2	2	5	7	13	13	4	1
Boiler shop	68	6	4	2	2	5	3	5	8	7	14	7	4	1
Carpenter shop	167	4	7	7	12	12	8	9	11	10	32	25	19	11
Copper shop	7	0	1	0	0	0	2	0	0	2	1	0	1	0
Electrical shop	120	17	6	5	6	9	6	6	11	7	20	21	0	6
Erection on the ways	1,182	264	26	41	58	105	33	61	63	93	162	152	75	49
Fabricating	220	15	5	4	7	7	7	5	18	37	36	45	26	8
Foundry	9	0	0	2	0	0	0	2	1	0	1	3	0	0
Joiner shop	37	3	0	2	4	4	1	1	2	5	6	2	4	3
Machine installation	64	7	4	3	4	6	2	3	6	5	9	8	3	4
Machine shop	235	27	5	8	13	16	12	13	23	34	37	28	14	5
Mold loft	9	0	0	0	0	1	0	0	2	0	5	1	0	0
Paint shop	60	5	3	6	6	4	8	0	5	3	9	5	2	4
Pattern shop	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Pipe shop	142	18	4	7	9	15	11	9	5	14	19	19	6	6
Sheet metal shop	81	10	1	1	6	6	4	4	6	11	8	11	7	6
Toolroom	2	0	0	0	1	0	1	0	0	0	0	0	0	0
Welding	401	79	19	19	11	26	12	23	25	24	67	60	13	23
Service and maintenance	167	5	3	2	8	21	3	7	4	23	34	42	10	5
Administration	24	0	1	0	2	3	0	2	0	1	10	4	0	1
Clerical	7	4	0	0	0	0	0	0	1	0	1	1	0	0
Drafting	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General labor	32	1	1	1	0	6	1	1	2	8	1	7	1	2
Maintenance	1	0	0	0	0	0	0	1	0	0	0	0	0	0
Plant protection	3	0	0	0	0	1	0	0	0	1	0	1	0	0
Transportation	31	0	0	0	1	3	1	1	0	6	3	10	5	1
Yards	69	0	1	1	5	8	1	2	1	7	19	19	4	1
Miscellaneous	145	4	7	3	8	18	3	11	10	12	22	26	15	6

TABLE 10.—*Disabling injuries, classified by part of body injured and extent of disability, for 11 shipyards, 1941*

Part of body injured	Number of disabling injuries					Average days lost per temporary total disability
	Total		Resulting in—			
	Number	Percentage	Death and permanent total disability	Permanent partial disability	Temporary total disability	
Total	3,187	100	14	102	3,071	17
Eye(s)	468	15	0	6	462	7
Brain or skull	97	3	5	0	92	17
Head, not elsewhere classified	113	4	2	3	108	16
Chest (lungs)	157	5	0	1	156	16
Back	263	8	0	0	263	17
Abdomen	119	4	2	0	117	34
Arm(s)	162	5	0	1	161	21
Hand(s)	205	6	0	3	202	15
Finger(s)	295	9	0	80	215	16
Leg(s)	496	16	0	4	492	22
Foot or feet	470	15	0	0	470	18
Toe(s)	203	6	0	4	199	16
Not elsewhere classified	139	4	5	0	134	23

TABLE 11.—*Disabling injuries, classified by department and by nature of injury, for 11 shipyards, 1941*

Department	Total number of disabling injuries	Nature of injury								
		Amputations	Burns and scalds	Cuts, lacerations		Strains, sprains, and bruises	Fractures	Hernia	Industrial disease	Not elsewhere classified
				Without infection	With infection					
All departments	3,175	57	251	1,007	134	1,170	490	31	14	21
Operating departments	2,862	49	237	918	126	1,040	427	30	14	21
Blacksmith shop	62	1	1	21	6	23	8	1	0	1
Boiler shop	68	2	6	30	0	19	11	0	0	0
Carpenter shop	167	1	3	46	8	68	36	4	0	1
Copper shop	7	1	0	1	0	3	2	0	0	0
Electrical shop	118	3	5	35	6	51	17	1	0	0
Erection on the ways	1,181	8	86	398	44	435	178	10	11	11
Fabricating	221	10	11	83	6	71	38	2	0	0
Foundry	9	0	4	2	1	2	0	0	0	0
Joiner shop	37	5	1	12	1	13	5	0	0	0
Machine installation	63	0	1	24	5	23	10	0	0	0
Machine shop	234	8	8	76	17	75	47	3	0	0
Mold loft	9	0	0	1	2	6	0	0	0	0
Paint shop	60	1	2	12	4	28	11	2	0	0
Pattern shop	1	0	0	0	0	0	1	0	0	0
Pipe shop	142	2	15	42	0	61	19	3	0	0
Sheet-metal shop	81	6	3	27	3	27	12	1	0	2
Toolroom	2	0	0	0	0	1	0	1	0	0
Welding	400	1	91	108	23	134	32	2	3	6
Service and maintenance	167	5	3	50	5	69	35	0	0	0
Administration	24	1	0	5	0	15	3	0	0	0
Clerical	7	0	1	4	0	2	0	0	0	0
Drafting	0	0	0	0	0	0	0	0	0	0
General labor	31	2	1	12	1	9	6	0	0	0
Maintenance	1	0	0	0	1	0	0	0	0	0
Plant protection	4	1	0	0	0	2	1	0	0	0
Transportation	31	0	0	8	0	9	14	0	0	0
Yards	69	1	1	21	3	32	11	0	0	0
Miscellaneous	146	3	11	39	3	61	28	1	0	0

TABLE 12.—*Disabling injuries, classified by nature of injury and extent of disability, for 11 shipyards, 1941*

Nature of injury	Number of disabling injuries					Average days lost per temporary total disability
	Total		Resulting in—			
	Number	Percentage	Death and permanent total disability	Permanent partial disability	Temporary total disability	
Total	3,183	100	15	102	3,066	17
Amputations	57	2	1	56	0	----------
Burns and scalds	251	8	1	1	249	13
Cuts, lacerations—without infection	1,008	32	2	18	988	12
Cuts, lacerations—with infection	134	4	0	1	133	13
Strains, sprains, and bruises	1,174	37	2	6	1,166	14
Fractures	493	15	8	20	465	37
Hernia	31	1	0	0	31	51
Industrial disease	14	(1)	0	0	14	13
Not elsewhere classified	21	1	1	0	20	6

[1] Less than 0.5.

TABLE 13.—*Disabling injuries, classified by nature of injury and by part of body injured, for 11 shipyards, 1941*

Part of body injured	Total number of disabling injuries	Nature of injury								
		Amputations	Burns and scalds	Cuts, lacerations		Strains, sprains, and bruises	Fractures	Hernia	Industrial disease	Not elsewhere classified
				Without infection	With infection					
Total	3,178	56	251	1,008	133	1,172	492	31	14	21
Eye(s)	467	0	113	331	8	8	0	0	7	0
Brain or skull	97	0	1	43	0	31	22	0	0	0
Head—not elsewhere classified	113	0	18	61	2	23	8	0	0	1
Chest (lungs)	157	0	0	17	0	102	34	0	2	2
Back	262	0	2	10	0	237	13	0	0	0
Abdomen	119	0	2	6	0	76	5	30	0	0
Arm(s)	161	0	17	36	15	57	36	0	0	0
Hand(s)	203	0	21	68	22	59	32	0	1	0
Finger(s)	295	53	13	89	46	26	68	0	0	0
Leg(s)	496	2	24	169	25	227	48	0	1	0
Foot or feet	468	0	27	98	12	248	83	0	0	0
Toe(s)	203	1	0	34	3	31	134	0	0	0
Not elsewhere classified	137	0	13	46	0	47	9	1	3	18

TABLE 14.—*Disabling injuries, classified by accident type and extent of disability, for 11 shipyards, 1941*

Accident type	Number of disabling injuries					Average days lost per temporary total disability
	Total		Resulting in—			
	Number	Percentage	Death and permanent total disability	Permanent partial disability	Temporary total disability	
Total	3,139	100	15	102	3,022	17
Striking against	380	12	0	13	367	14
Struck by	1,412	46	6	65	1,341	16
Caught in, on, or between	87	3	1	17	69	31
Fall on same level	153	5	0	1	152	17
Fall to different level	355	11	6	2	347	26
Slip (not fall) or overexertion	508	16	0	2	506	18
Contact with extreme temperature	141	4	1	2	138	18
Inhalation, absorption, ingestion	96	3	1	0	95	6
Contact with electric current	3	(1)	0	0	3	11
Not elsewhere classified	4	(1)	0	0	4	26

(1) Less than 0.5.

TABLE 15.—*Disabling injuries, classified by accident type and by department, for 11 shipyards, 1941*

Department	Total number of disabling injuries	Number of disabling injuries caused by—									
		Striking against	Struck by	Caught in, on, or between	Fall on same level	Fall to different level	Slip (not fall) or overexertion	Contact with extreme temperature	Inhalation, absorption, ingestion	Contact with electric current	Not elsewhere classified
All departments	3,131	380	1,407	87	152	353	508	141	96	3	4
Operating departments	2,822	337	1,270	77	133	322	450	132	94	3	4
Blacksmith shop	62	6	39	4	0	1	10	1	1	0	0
Boiler shop	68	4	39	3	1	8	8	4	1	0	0
Carpenter shop	166	27	67	4	6	26	32	2	2	0	0
Copper shop	7	0	4	0	0	1	2	0	0	0	0
Electrical shop	118	14	40	4	10	26	20	3	0	1	0
Erection on the ways	1,157	110	567	15	62	143	175	28	55	1	1
Fabricating	220	37	119	12	3	7	30	7	5	0	0
Foundry	9	1	4	0	0	0	0	4	0	0	0
Joiner shop	36	7	15	3	4	3	4	0	0	0	0
Machine installation	63	9	25	2	3	13	10	1	0	0	0
Machine shop	235	32	103	18	14	17	43	7	0	0	1
Mold loft	9	5	1	0	0	0	2	0	0	0	1
Paint shop	59	11	16	2	6	13	10	1	0	0	0
Pattern shop	1	0	1	0	0	0	0	0	0	0	0
Pipe shop	142	18	58	2	11	9	30	11	3	0	0
Sheet-metal shop	80	15	32	5	2	7	15	1	2	1	0
Toolroom	1	0	1	0	0	0	0	0	0	0	0
Welding	389	41	139	3	11	48	59	62	25	0	1
Service and maintenance	165	20	76	6	12	21	27	2	1	0	0
Administration	24	1	6	0	3	7	7	0	0	0	0
Clerical	6	2	4	0	0	0	0	0	0	0	0
Drafting	0	0	0	0	0	0	0	0	0	0	0
General labor	32	3	16	1	2	2	6	1	1	0	0
Maintenance	1	0	1	0	0	0	0	0	0	0	0
Plant protection	4	1	1	0	1	1	0	0	0	0	0
Transportation	31	3	21	2	0	2	3	0	0	0	0
Yards	67	10	27	3	6	9	11	1	0	0	0
Miscellaneous	144	23	61	4	7	10	31	7	1	0	0

TABLE 16.—*Disabling injuries and resulting disability, classified by agency, for 11 shipyards, 1941*

Agency	Number of disabling injuries					Average days lost per temporary total disability
	Total		Resulting in—			
	Number	Percentage	Death and permanent total disability	Permanent partial disability	Temporary total disability	
Total	3,066	100	15	102	2,949	17
Boilers and pressure vessels	8	(1)	0	0	8	21
Chemicals	28	1	1	0	27	16
Conveyors	4	(1)	0	1	3	23
Electrical apparatus	17	1	0	1	16	25
Elevators	3	(1)	0	0	3	25
Engines and pumps	15	(1)	0	2	13	10
Flying particles	315	10	0	2	313	6
Hand tools	234	8	1	12	221	14
Hatchways, ropes, and cables	98	3	3	3	92	19
Hoisting apparatus	122	4	3	11	108	29
Cranes	101	3	3	8	90	30
Other	21	1	0	3	18	25
Hot substances	116	4	1	2	113	18
Ladders	77	3	0	1	76	26
Lumber	182	6	0	3	179	18
Machinery	199	6	1	26	172	18
Metal stock	808	27	2	23	783	18
Radiations from welding apparatus	70	2	0	0	70	5
Ship hulls	92	3	0	3	89	16
Vehicles	48	2	1	3	44	23
Working surfaces	255	8	1	3	251	22
Staging	65	2	1	1	63	26
Other	190	6	0	2	188	20
Other	375	12	1	6	368	20

[1] Less than 0.5.

TABLE 17.—*Disabling injuries, classified by accident type and by agency, for 11 shipyards, 1941*

Agency	Total number of disabling injuries	Number of disabling injuries caused by—									
		Striking against	Struck by	Caught in, on or between	Fall on same level	Fall to different level	Slip (not fall) or overexertion	Contact with extreme temperature	Inhalation, absorption, ingestion	Contact with electric current	Not elsewhere classified
Total	3,059	374	1,385	87	145	345	485	139	93	3	8
Boilers and pressure vessels	8	1	2	0	1	0	0	4	0	0	0
Chemicals	28	0	6	0	0	0	1	2	19	0	0
Conveyors	4	0	1	0	2	0	1	0	0	0	0
Electrical apparatus	17	2	2	2	3	2	3	2	0	1	0
Elevators	3	0	0	1	0	2	0	0	0	0	0
Engines and pumps	15	2	7	1	1	1	2	1	0	0	0
Flying particles	307	0	295	0	0	0	0	11	1	0	0
Hand tools	232	13	161	3	11	3	28	10	0*	1	2
Hatchways, ropes, and cables	98	12	7	3	12	41	23	0	0	0	0
Hoisting apparatus	122	2	101	9	1	4	5	0	0	0	0
Cranes	101	1	85	8	1	4	2	0	0	0	0
Other	21	1	16	1	0	0	3	0	0	0	0
Hot substances	116	1	12	0	0	0	0	103	0	0	0
Ladders	77	9	3	0	0	48	17	0	0	0	0
Lumber	182	23	96	3	10	9	41	0	0	0	0
Machinery	198	37	77	37	7	2	33	5	0	0	0
Metal stock	808	116	451	16	36	16	173	0	0	0	0
Radiations from welding apparatus	72	0	0	0	0	0	0	0	72	0	0
Ship hulls	92	42	15	1	3	20	10	1	0	0	0
Vehicles	48	3	24	4	1	11	5	0	0	0	0
Working surfaces	255	29	15	1	39	102	68	0	0	0	1
Staging	65	3	3	0	3	50	6	0	0	0	0
Other	190	26	12	1	36	52	62	0	0	0	1
Other	377	82	110	6	18	84	75	0	1	1	0

TABLE 18.—*Disabling injuries, classified by unsafe mechanical condition and extent of disability, for 11 shipyards, 1941*

Unsafe mechanical condition	Number of disabling injuries					Average days lost per temporary total disability
	Total		Resulting in—			
	Number	Percentage	Death and permanent total disability	Permanent partial disability	Temporary total disability	
Total	2,075	100	12	67	1,996	18
Improperly guarded agencies	249	12	3	23	223	27
Defective agency	275	13	4	13	258	19
Hazardous arrangement or procedure	1,162	56	4	27	1,131	18
Improper illumination	15	1	0	0	15	21
Improper ventilation	11	1	1	0	10	9
Not elsewhere classified [1]	363	17	0	4	359	10

[1] Includes cases involving no unsafe mechanical condition.

TABLE 19.—*Disabling injuries, classified by agency and by unsafe mechanical condition, for 11 shipyards, 1941*

Agency	Total number of disabling injuries	Number of disabling injuries caused by—					
		Improperly guarded agencies	Defective agency	Hazardous arrangement or procedure	Improper illumination	Improper ventilation	Not elsewhere classified [1]
Total	2,053	245	269	1,153	15	10	361
Boilers and pressure vessels	4	0	0	4	0	0	0
Chemicals	24	1	1	3	0	10	9
Conveyors	2	1	0	1	0	0	0
Electrical apparatus	12	1	2	8	1	0	0
Elevators	2	2	0	0	0	0	0
Engines and pumps	7	1	2	4	0	0	0
Flying particles	232	0	0	28	0	0	204
Hand tools	147	8	25	100	1	0	13
Hatchways, ropes, and cables	80	40	2	34	3	0	1
Hoisting apparatus	99	8	47	42	1	0	1
Cranes	84	6	38	38	1	0	1
Other	15	2	9	4	0	0	0
Hot substances	77	3	0	43	0	0	31
Ladders	37	4	9	19	0	0	5
Lumber	108	9	11	82	1	0	5
Machinery	150	56	17	69	1	0	7
Metal stock	544	24	41	435	1	0	43
Radiations from welding apparatus	29	5	0	4	0	0	20
Ship hulls	52	6	10	33	1	0	2
Vehicles	30	3	0	26	0	0	1
Working surfaces	171	38	62	65	1	0	5
Staging	48	18	23	7	0	0	0
Other	123	20	39	58	1	0	5
Other	246	35	40	153	4	0	14

[1] Includes cases involving no unsafe mechanical condition.

TABLE 20.—*Disabling injuries, classified by accident type and by unsafe mechanical condition, for 11 shipyards, 1941*

Accident type	Total number of disabling injuries	Number of disabling injuries caused by—					
		Improperly guarded agencies	Defective agency	Hazardous arrangement or procedure	Improper illumination	Improper ventilation	Not elsewhere classified [1]
Total	2,075	249	275	1,162	15	10	364
Striking against	234	22	27	167	1	0	17
Struck by	930	63	119	487	3	0	258
Caught in, on, or between	64	30	1	32	0	0	1
Fall on same level	114	4	25	79	2	0	4
Fall to different level	276	112	56	96	6	0	6
Slip (not fall) or overexertion	310	10	40	250	3	0	7
Contact with extreme temperature	93	3	6	42	0	1	41
Inhalation, absorption, ingestion	51	5	0	7	0	9	30
Contact with electric current	3	0	1	2	0	0	0

[1] Includes cases involving no unsafe mechanical condition.

TABLE 21.—*Disabling injuries, classified by unsafe act and extent of disability, for 11 shipyards, 1941*

Unsafe act	Number of disabling injuries					Average days lost per temporary total disability
	Total		Resulting in—			
	Number	Percentage	Death and permanent total disability	Permanent partial disability	Temporary total disability	
Total	2,337	100	12	86	2,239	18
Operating without authority, failure to secure or warn	30	1	0	8	22	14
Operating or working at unsafe speed	26	1	0	1	25	28
Making safety devices inoperative	20	1	0	5	15	26
Using unsafe equipment or equipment unsafely	472	21	1	35	436	17
Unsafe loading, placing, etc.	147	6	1	1	145	19
Taking unsafe position or posture	1,145	49	9	27	1,109	21
Working on moving or dangerous equipment	8	(1)	0	3	5	19
Distracting, teasing, fighting, etc.	4	(1)	1	0	3	7
Failure to use safe attire	201	9	0	3	198	7
Not elsewhere classified [2]	284	12	0	3	281	12

[1] Less than 0.5. [2] Includes cases involving no unsafe act.

TABLE 22.—*Disabling injuries, classified by department and by unsafe act, for 11 shipyards, 1941*

Department	Total number of disabling injuries	Number of disabling injuries caused by—									
		Operating without authority, failure to secure or warn	Operating or working at unsafe speed	Making safety devices inoperative	Using unsafe equipment or equipment unsafely	Unsafe loading, placing, etc.	Taking unsafe position or posture	Working on moving or dangerous equipment	Distracting, teasing, fighting, etc.	Failure to use safe attire	Not elsewhere classified [1]
All departments	2,331	30	25	20	470	147	1,144	8	4	201	282
Operating departments	2,102	28	22	18	424	127	1,018	8	4	191	262
Blacksmith shop	38	1	0	0	7	1	16	0	0	0	13
Boiler shop	46	1	0	0	14	2	21	1	0	0	7
Carpenter shop	137	1	1	1	33	15	70	0	0	0	16
Copper shop	7	1	0	1	1	2	2	0	0	0	0
Electrical shop	89	2	1	2	16	4	51	1	0	0	12
Erection on the ways	851	5	11	2	162	52	417	1	1	99	101
Fabricating	157	3	3	0	40	13	56	0	0	3	39
Foundry	7	1	0	0	0	0	6	0	0	0	0
Joiner shop	26	1	0	2	5	2	15	0	0	0	1
Machine installation	32	1	0	0	5	1	19	0	0	3	3
Machine shop	189	0	1	1	41	11	94	2	0	18	21
Mold loft	6	0	0	1	2	1	2	0	0	0	0
Paint shop	49	2	1	2	11	1	25	0	2	0	5
Pattern shop	1	0	0	0	0	0	1	0	0	0	0
Pipe shop	111	3	0	1	24	9	56	0	0	2	16
Sheet-metal shop	72	1	2	1	14	6	36	1	1	0	10
Toolroom	1	0	0	0	0	1	0	0	0	0	0
Welding	283	5	2	4	49	6	131	2	0	66	18
Service and maintenance	119	2	1	1	24	11	64	0	0	6	10
Administration	20	0	0	0	3	0	16	0	0	0	1
Clerical	2	0	0	0	1	0	0	0	0	0	1
Drafting	0	0	0	0	0	0	0	0	0	0	0
General labor	31	2	0	1	9	4	11	0	0	1	3
Maintenance	1	0	0	0	1	0	0	0	0	0	0
Plant protection	1	0	0	0	0	0	1	0	0	0	0
Transportation	21	0	0	0	2	3	14	0	0	0	2
Yards	43	0	1	0	8	4	22	0	0	5	3
Not elsewhere classified	110	0	2	1	22	9	62	0	0	4	10

[1] Includes cases involving no unsafe act.

TABLE 23.—*Disabling injuries, classified by accident type and by unsafe act, for 11 shipyards, 1941*

Accident type	Total number of disabling injuries	Number of disabling injuries caused by—									
		Operating without authority, failure to secure or warn	Operating or working at unsafe speed	Making safety devices inoperative	Using unsafe equipment or equipment unsafely	Unsafe loading, placing, etc.	Taking unsafe position or posture	Working on moving or dangerous equipment	Distracting, teasing, fighting, etc.	Failure to use safe attire	Not elsewhere classified [1]
Total	2,337	30	26	20	472	147	1,145	8	4	201	284
Striking against	246	2	2	3	39	2	136	0	0	8	54
Struck by	1,080	13	6	6	267	40	415	2	4	147	180
Caught in, on, or between	67	6	0	3	19	3	32	2	0	0	2
Fall on same level	109	0	1	1	11	1	90	0	0	0	5
Fall to different level	289	3	12	4	71	6	189	1	0	0	3
Slip (not fall) or overexertion	387	4	5	1	46	92	238	0	0	0	1
Contact with extreme temperature	100	2	0	1	13	3	32	2	0	32	15
Inhalation, absorption, ingestion	55	0	0	1	4	0	13	0	0	14	23
Contact with electric current	3	0	0	0	2	0	0	1	0	0	0
Not elsewhere classified	1	0	0	0	0	0	0	0	0	0	1

[1] Includes cases involving no unsafe act.

TABLE 24.—*Disabling injuries, classified by agency and by unsafe act, for 11 shipyards, 1941*

Agency	Total number of disabling injuries	Number of disabling injuries caused by—									
		Operating without authority, failure to secure or warn	Operating or working at unsafe speed	Making safety devices inoperative	Using unsafe equipment or equipment unsafely	Unsafe loading, placing, etc.	Taking unsafe position or posture	Working on moving or dangerous equipment	Distracting, teasing, fighting, etc.	Failure to use safe attire	Not elsewhere classified [1]
Total	2,316	30	25	19	471	143	1,137	7	4	198	282
Boilers and pressure vessels	4	0	0	0	2	0	2	0	0	0	0
Chemicals	25	0	0	1	2	2	12	0	0	5	3
Conveyors	4	0	0	0	1	1	1	1	0	0	0
Electrical apparatus	14	0	0	1	3	1	7	2	0	0	0
Elevators	3	1	0	0	1	0	1	0	0	0	0
Engines and pumps	8	1	0	0	3	0	4	0	0	0	0
Flying particles	236	0	0	2	5	0	20	0	0	134	75
Hand tools	195	5	1	0	109	3	58	0	1	5	13
Hatchways, ropes, and cables	85	1	0	0	11	6	66	0	0	0	1
Hoisting apparatus	109	6	0	1	19	3	77	0	0	0	3
Cranes	91	5	0	0	14	3	68	0	0	0	1
Other	18	1	0	1	5	0	9	0	0	0	2
Hot substances	86	0	0	1	8	2	35	1	0	24	15
Ladders	54	0	2	1	23	4	23	0	0	0	1
Lumber	128	1	0	0	24	13	73	0	0	2	15
Machinery	156	5	0	6	51	4	75	2	0	5	8
Metal stock	623	3	6	0	110	83	330	0	1	4	86
Radiations from welding apparatus	33	0	0	0	4	0	2	0	0	8	19
Ship hulls	64	1	2	3	6	1	47	0	0	0	4
Vehicles	39	2	1	0	3	5	26	1	0	0	1
Working surfaces	176	2	9	2	36	3	116	0	0	1	7
Staging	50	1	2	1	23	0	23	0	0	0	0
Other	126	1	7	1	13	3	93	0	0	1	7
Other	274	2	4	1	50	12	162	0	2	10	31

[1] Includes cases involving no unsafe act.