INJURIES AND ACCIDENT CAUSES

in

WAREHOUSING OPERATIONS

Bulletin No. 1174

UNITED STATES DEPARTMENT OF LABOR
James P. Mitchell, *Secretary*

BUREAU OF LABOR STATISTICS
Aryness Joy Wickens, Acting Commissioner

Injuries and Accident Causes in WAREHOUSING OPERATIONS

A detailed analysis of injuries, injury rates, and hazards for 1950, by type of warehouse, region and occupation

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ABSTRACT

The incidence of work injuries in the warehousing and storage industry is generally high. In 1952 the injury-frequency rate for the entire industry was 36.4. This was more than double the all-manufacturing average and was exceeded by only 6 of the 49 nonmanufacturing averages available. In respect to injury severity, however, the industry's record tended to be better than average.

Detailed records for the year 1950 indicate that the highest incidence of injuries in the industry occurs in refrigerated warehouses, followed in descending order by merchandise warehouses, farm-products warehouses, and household-goods warehouses. Seventy-seven percent of the reported injuries were experienced by operating personnel who represented 59 percent of the total employment; 11 percent by materials-movement personnel who constituted 10 percent of the total employment; and 12 percent by the clerical and maintenance workers who accounted for 31 percent of the employment.

The most common types of injury-producing accidents were those in which workmen (1) were struck by moving objects; (2) strained themselves while handling materials or equipment; (3) were caught in, on, or between moving objects; or (4) fell. The latter two groups produced the most severe injuries.

Supervisory failures to properly plan and organize work procedures, and defective material and equipment were prominent in the list of accident causes. Unsafe materials-handling procedures and the practice of unnecesarily assuming an unsafe position or posture were the contributing faults most commonly ascribed to the employees.

Accident prevention suggestions, prepared by two experienced safety engineers for a group of typical warehousing accidents, indicate that most accidents in the industry could be prevented through the application of very simple precautions.

Injuries and Accident Causes in Warehousing Operations*

THE INDUSTRY RECORD

The incidence of work injuries in the warehousing and storage industry has been consistently high. In 7 of the 8 postwar years the injury-frequency rate 1/ for the industry, as reported in the annual work-injury summaries of the Bureau of Labor Statistics, has been above 30. The one exception occurred in 1948 when the industry average dropped to 26.6 disabling injuries per million employee-hours worked.

In 1952, the latest year for which final figures are available, the average injury-frequency rate for the warehousing and storage industry was 36.4. 2/ This was more than double the all-manufacturing industry average and was exceeded by only 7 of the 162 separate manufacturing industry averages available for comparison. Among the nonmanufacturing industries, only 6 of the 49 industry classifications covered by the Bureau of Labor Statistics had higher injury-frequency rates. Five of these higher rates were for construction activities; the other was for stevedoring operations.

In terms of injury severity, however, the record of warehousing and storage industry is generally somewhat better than that for most industries.

The most favorable injury-severity comparison between warehousing and storage and other industries was found in the occurence of permanent-partial disabilities. In warehousing operations, 1.7 percent of all disabling injuries in 1952 resulted in some degree of permanent impairment compared with 5.4 percent for all-manufacturing. That ratio (1.7 percent) was the median for the nonmanufacturing group of industries but it was well below the 5.9 percent ratio in the comparable stevedoring industry.

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* This report was prepared in the Branch of Industrial Hazards, Bureau of Labor Statistics, U. S. Department of Labor, by Frank S. McElroy and George R. McCormack.

1/ See description of Scope and Method of Survey, Page 2, for definition of injury-frequency rate.

2/ Work Injuries in the United States During 1952, Bureau of Labor Statistics Bulletin No. 1164.

Furthermore, in a broad comparison of injury severity among industries, the 1952 record showed an average time charge of 50 days per case for all reported injuries and 12 days per case for all temporary-total disabilities in warehousing and storage operations compared with corresponding averages of 85 days and 17 days for all-manufacturing. The standard severity rate, 3/ representing the loss to the industry, however, was 1.8 days per 1,000 employee-hours worked in warehousing and storage and 1.3 for all-manufacturing. This apparent anomaly arises from the method of computing the standard severity rate which reflects injury frequency as well as injury severity. Specifically, the comparatively low average severity of injuries in warehousing and storage in 1952 is overbalanced by the relatively high frequency of injury occurrence, thus resulting in a disproportionately high standard severity rate.

SCOPE AND METHOD OF SURVEY

The warehousing and storage industry, as defined for this study, includes all establishments which provide storage facilities for hire. These establishments are generally designated as "public warehouses." Storage and warehousing facilities owned and operated by manufacturers, retailers, or others for the accommodation of their own products or materials, commonly called "private warehouses," have been excluded.

In addition to providing storage facilities, many public warehouses perform supplementary services on their premises, such as packing, crating, sorting, or blending the commodities of their customers. Many warehouses also provide pickup and delivery service for the commodities moving into and out of their plants. Others, particularly the household-goods warehouses, frequently provide trucking and hauling, or moving, services for commodities which do not enter into their storage operations. All of these operations are recognized as integral to the warehousing industry although the extent to which they are performed varies widely among the various kinds of warehouses and even among warehouses of any specific classification. General records of warehousing operations, such as the industrywide injury rates, therefore, include these supplementary operations wherever they are performed by warehousing establishments.

For this detailed study, however, the lack of uniformity in the outside moving, hauling, and delivery services precluded the presentation of data relating to those operations in significant categories. The study, therefore, has been restricted to the experience of inside warehousemen, that is, to activities performed at the warehouse. The experience of highway truck-drivers, their helpers, and of other employees who perform the major portion of their duties away from the warehouse has been excluded. For the same reason, the experience of automotive mechanics employed by warehousing establishments has been excluded.

3/ See description of Scope and Method of Survey, Page 2 , for definition of injury-severity rate.

This detailed study has two objectives. The first stems from the fact that the injury rates regularly available for the warehousing and storage industry represent the composite experience of the varied operations of all types of public warehouses. The wide differences in the experience of the different kinds of warehouses and the varying effects which their operations have on the injury totals are obscured in the industrywide figures. The first objective, therefore, is to break down the broad injury experience data into significant categories reflecting functional, operating, and geographic differences within the industry. These groupings help to indicate the kinds of operations which are most productive of injuries and which should receive particular attention in the planning and development of safety programs within the industry.

The second objective is to present information as to how and why injury-producing accidents have occurred in the industry. Such information helps to identify the hazards and unsafe practices which most commonly lead to accidents and thereby serves as a specific guide to accident-prevention activities.

Because detailed injury data cannot be compiled until final records are available, it is generally impossible to present extended analyses of injury experience until long after the general data become available. The detailed data in this report, therefore, are for the year 1950, although general injury-rate data for 2 subsequent years are currently available. The underlying characteristics of injury experience change slowly, however, and it is probable that the relationships among the various operations and the accident-cause patterns appearing in the 1950 record will be reasonably applicable for a number of subsequent years.

The injury-rate data were collected by mail on a voluntary reporting basis. Sampling procedures taking into account geographic distribution, employment distribution, and type of warehousing were employed. Usable reports were received from 2,695 public warehouses representing approximately 28 percent of all warehouse establishments in the United States. These reports covered the 1950 injury experience of nearly 32,000 inside warehouse employees.

The reporting group included 934 farm-products warehouses, 913 household-goods warehouses, 515 merchandise warehouses, and 304 refrigerated and cold-storage warehouses. The remaining 29 warehouses had services so diversified that they could not appropriately designate their activities in any one classification or failed to indicate the type of warehousing service rendered.

In addition to providing summary reports, 274 cooperating warehouses made their original accident records available for inspection and analysis. A representative of the Bureau of Labor Statistics visited each of these warehouses and transcribed from their records the following data where available: (a) place where accident occurred; (b) occupation and age of injured worker; (c) nature of injury and part of body injured; (d) object or substance producing the injury; (e) type of accident; (f) hazardous working condition and/or unsafe act leading to the accident.

This group of establishments employed about 14,000 warehousemen. Their injury-frequency rate (51.2), was somewhat higher than the average for all warehousemen included in the survey but there was no indication that their hazards differed greatly from those of other warehousemen. Most of the variation is due to the exclusion of warehouses with zero frequency rates--i.e., warehouses which had no injuries for analysis--from this part of the study. Individual case records were collected in this part of the survey for 1,604 disabling injuries. These included 2 fatalities, 1 permanent-total disability, 57 permanent-partial disabilities, and 1,544 temporary-total disabilities.

Injury Rates

The injury-rate comparisons presented in this report are based primarily upon injury-frequency and severity rates compiled according to the definitions and procedures specified in the American Standard Method of Compiling Industrial Injury Rates, as approved by the American Standards Association in 1945. These standard rates have been supplemented by an additional measure of injury severity designated as the average time charge per disabling injury.

The definitions 4/ of the several disability classifications as applied in this survey are as follows:

(1) Fatality.--A death resulting from a work injury is classified as a work fatality regardless of the time intervening between injury and death.

(2) Permanent-Total Disability.--An injury other than death which permanently and totally incapacitates an employee from following any gainful occupation is classified as permanent-total disability. The loss, or complete loss of use, of any of the following in one accident is considered permanent-total disability:

(a) Both eyes; (b) one eye and one hand, or arm, or leg, or foot; (c) any two of the following not on the same limb: Hand, arm, foot, or leg.

4/ See American Standard Method of Compiling Industrial Injury Rates, approved by the American Standards Association, October 11, 1945.

(3) Permanent-Partial Disability.--The complete loss in one accident of any member or part of a member of the body, or any permanent impairment of functions of the body or part thereof to any degree less than permanent-total disability is classified as permanent-partial disability, regardless of any preexisting disability of the injured member or impaired body function. The following injuries are not classified as permanent-partial disabilities, but are classified as temporary-total, temporary-partial disabilities, or medical treatment cases, depending upon the degree of disability during the healing period: (a) hernia, if it can be repaired; (b) loss of fingernails or toenails; (c) loss of teeth; (d) disfigurement; (e) strains or sprains not causing permanent limitation of motion; (f) fractures healing completely without deformities or displacements.

(4) Temporary-Total Disability.--Any injury not resulting in death or permanent-impairment is classified as a temporary-total disability if the injured person, because of his injury, is unable to perform a regularly established job, open and available to him, during the entire time interval corresponding to the hours of his regular shift on any one or more days (including Sundays, days off, or plant shutdowns) subsequent to the date of injury.

Injury-Frequency Rate.--The injury-frequency rate represents the average number of disabling work injuries occurring in each million employee-hours worked. It is computed according to the following formula:

$$\text{Frequency rate} = \frac{\text{Number of disabling injuries} \times 1{,}000{,}000}{\text{Number of employee-hours worked}}$$

Average Time Charge per Injury.--The relative severity of a temporary injury is measured by the number of calendar days during which the injured person is unable to work at any regularly established job open and available to him, excluding the day of injury and the day on which he returns to work. The relative severity of death and permanent impairment cases is determined by reference to a table of economic time charges included in the American Standard Method of Compiling Industrial Injury Rates. These time charges, based upon an average working-life expectancy of 20 years for the entire working population, represent the average percentage of working ability lost as the result of specified impairments, expressed in unproductive days. The average time charge per disabling injury is computed by adding the days lost for each temporary injury and the days charged according to the standard table for each death and permanent impairment and dividing the total by the number of disabling injuries.

Injury-Severity Rate.--The injury-severity rate weights each disabling injury with its corresponding time loss or time charge and expresses the aggregate in terms of the average number of days lost or charged per 1,000 employee-hours worked. It is computed according to the following formula:

$$\text{Severity rate} = \frac{\text{Total days lost or charged} \times 1{,}000}{\text{Number of employee-hours worked}}$$

Accident Analysis

The accident-cause analysis procedure used in this study differs in some respects from the procedures specified in the American Standard Method of Compiling Industrial Accident Causes. The deviations from the Standard include the introduction of an additional analysis factor, termed the "agency of injury" and modification of the standard definitions of some of the other factors. These changes permit more accurate cross classifications.

Agency of Injury.--The standard classification provides for the selection of but one "agency" in the analysis of each accident. By definition, this agency may be either (a) the object or substance which was unsafe and thereby contributed to the occurrence of the accident, or (b) in the absence of such an object or substance, the object or substance most closely related to the injury. Under this definition, therefore, a tabulation of "agencies" for a group of accidents includes objects or substances which may have been inherently safe and unrelated to the occurrence of the accidents, as well as those which led to the occurrence of the accidents because of their condition, location, structure, or method of use. The development of the classification "agency of injury" represents an attempt to separate and classify separately these two agency concepts.

As used in this study, the "agency of injury" is the object, substance, or bodily reaction which actually produced the injury, selected without regard to its safety characteristics or its influence upon the chain of events constituting the accident.

Accident Type.--As used in this study, the accident-type classification assigned to each accident is purely descriptive of the occurrence resulting in an injury, and is related specifically to the agency of injury. It indicates how the injured person came into contact with or was affected by the previously selected agency of injury, as for example, by "striking against" the named agency of injury. The definition represents a change from the standard procedure in two respects: First, the accident-type classification is specifically related to the previously selected agency of injury; second, the sequence of selecting this factor is specified.

Hazardous Working Condition.--Under the standard definition, the hazardous working condition indicated in the analysis is defined as the "unsafe mechanical or physical condition of the selected agency which could have been guarded or corrected." An example of such a hazard is the lack of a guard for a press. This implies the prior selection of the "agency" but does not provide for recognition of any relationship between the hazardous condition and accident-type classifications. Nor does the standard provide for any definite relationship between the "agency" and the "accident-type" classifications.

To provide continuity and to establish direct relationships among the various analysis factors to permit cross classification, the standard definition was modified for this study to read: "The hazardous working condition is the hazardous condition which permitted or occasioned the occurrence of the selected accident type." The hazardous-condition classification, therefore, was selected after the determination of the accident-type classification. It represents the physical or mechanical reason for the occurrence of that particular accident without regard to the feasibility of guarding or correcting the condition.

Elimination of the condition "which could have been guarded or corrected" is based upon the premise that statistical analysis should indicate the existence of hazards, but should not attempt to specify the feasibility of corrective measures.

Agency of Accident.--For the purpose of this study, the agency of accident was defined as "the object, substance, or premises in or about which the hazardous condition existed," as, for example, the press which was unguarded. Its selection, therefore, is directly associated with the hazardous condition leading to the occurrence of the accident and not with the occurrence of the injury. In many instances the agency of injury and the agency of accident are identical. The double agency classification, however, avoids any possibility of ambiguity in the interpretation of the "agency" tabulations.

Unsafe Act.--The unsafe act definition used in this survey is identical with the standard definition, i. e., "that violation of a commonly accepted safe procedure which resulted in the selected accident type."

WAREHOUSING OPERATIONS AND THEIR HAZARDS

Operations in the public warehousing industry are generally similar, varying only in the length of time goods remain in storage and in the degree to which the various operations have been mechanized. The rate of turnover (time elapsing between receiving and shipping) depends, mainly, on the kind of goods or commodity stored--i. e., type of warehouse. The degree of mechanization, however, depends not only on the type of goods handled but the desire of management.

In general, goods to be stored are received at the warehouse by truck or railroad car. From the loading dock, the goods are moved to the storage area and piled. For delivery, the operations are merely reversed.

General merchandise warehouses store processed goods or merchandise for manufacturers, brokers, distributors, and other shippers until the goods are requested. In addition to their storage functions, general merchandise warehouses frequently act as branch house distributors for manufacturers, performing all activities that the manufacturer might do in the distribution of his products. Merchandise or other commodities on which a tax must be paid before it is released must be stored in bonded warehouses. Merchandise, as a rule, does not remain in public warehouses for long periods of time, as warehousing costs may reduce profits. Frequently, merchandise is packed in uniform-size packages. As a result, the goods may be palletized and fork-lift trucks may be used for transporting and piling.

A cold-storage warehouse is one in which perishables are stored at artifically cooled temperatures of 45 degrees or less. Some commodities are preserved by freezing; temperatures in those storage areas may be as low as 10 or 12 degrees below zero. Other perishables cannot be frozen without damage; these commodities must be stored in rooms which are kept at temperatures above the freezing point. Generally, the humidity must be controlled carefully in cold-storage warehouses. In most cases, commodities remain in these warehouses for several months. Uniform-size containers also permit the use of forklift trucks in cold-storage warehouses.

Farm-products warehouses are those in which agricultural products are stored until they are needed by industrial organizations. Grain elevators and cotton warehouses are two of the more common types. Farm-products warehouses, in addition to storing agricultural products, frequently perform certain processing functions such as the cleaning of grain and compressing of cotton. As most warehouses in this group restrict their operations to one commodity, mechanical equipment can generally be used. Storage usually extends for several months.

Household-goods warehouses store personal property rather than merchandise. Many establishments also perform auxiliary services such as packing and crating; repairing and cleaning of furniture, rugs, and draperies; moth proofing; and trucking. (The latter service was excluded from this special survey.) Property stored in these warehouses usually remains in storage for long periods of time. Powered mechanical-handling equipment is seldom practical because of the variety of goods stored. Handtrucks and dollies are usually available, however.

Employment in public warehouses varies widely during the year. Generally, it is low during the first part of the calendar year and at a maxium about October. This is especially true in farm-products and cold-storage warehouses, the peak corresponding to, or following slightly, the harvesting season. Household-goods warehouses have two peak employment periods--May and October--the moving periods in many cities. At those times, persons closing their permanent residences frequently move their personal effects into storage whereas others, reestablishing permanent homes, remove their goods from storage.

The chance of severely strained muscles from lifting probably is the outstanding hazard to warehousemen. Warehousing operations require a great deal of manual handling even though forklift trucks, conveyors, and other mechanical-handling equipment are used to some extent. Goods for storage must be lifted from motortrucks or railroad cars and placed on handtrucks or other equipment on the loading dock. At the storage area they are usually lifted again and piled although, in some instances, the piling is done mechanically with forklift trucks or other equipment. When the goods are to be delivered, the operations are reversed. Dock plates must be lifted to bridge the gap between the loading dock and the railroad car or motortruck. Cakes of ice are handled extensively in cold-storage warehouses. In addition, warehouse equipment such as handtrucks and skids must be lifted occasionally. Frequently, the warehouse piles are high and the lifting hazard is enhanced by the necessity of overreaching.

Manual handling operations also result in other types of injuries. Hands or fingers may be lacerated by rough or splintered containers or by dock plates, skids, handles of handtrucks, and other warehouse equipment. Nails projecting from barrels, crates, furniture, and other objects may result in punctured hands or fingers. In addition, hands and fingers as well as feet and toes may be crushed under objects as they are being placed or by goods which are dropped as they are being handled.

Unstable piles of goods are also important hazards to warehousemen. Unsafely piled goods in storage may fall on passing workmen without warning, particularly if heavily loaded trucks, used in nearby passageways, cause vibrations within the warehousing structure. Insecurely piled goods near passageways may fall also if the pile is bumped either by workmen or industrial trucks. Improper loading on a handtruck can cause the load to fall while it is being moved or while the truck is being loaded or unloaded. Loads, inadequately blocked or tied in railroad cars or motortrucks, may shift during transit and fall on workmen as the vehicles are being unloaded. In addition, loads thrown against railroad car doors during movement of trains may spill out on workmen when they open the doors.

Vehicular hazards are common in warehousing. "Blind" corners and poor layout of traffic lanes may result in collisions between vehicles or between vehicles and workmen. The practice of loading forklift trucks and similar equipment so that the loads block part of the operator's line of vision frequently accents this hazard. In handtruck operations, hands and fingers are often pinched between the handles of the trucks and doorways, piles of materials, or other objects.

The possibility of a slip, a stumble, or a fall is high in warehousing. Loose boards, improperly placed cases, crates, or other materials frequently present tripping hazards. Tripping may also result from rough floors in warehouses, railroad cars, and motortrucks. The necessity of working on top of piled materials frequently presents serious possibilities of falls. Slipping

hazards are important in refrigerated warehouses where floors are usually wet or damp and, occasionally, icy. Loading docks even when covered may be slippery from rain, snow, or sleet. Dock plates also become slippery in inclement weather; they may be slippery even in good weather when their surfaces have been worn smooth.

Cold-storage warehouses have many unique hazards. Temperatures in refrigerated warehouses may vary from the general atmospheric level of 70 to 90 degrees to the freezing room temperatures of 10 and 12 degrees below zero. Some warehouses have found it advisable to schedule work in refrigerated rooms during the early working hours, making it unnecessary for workmen to enter the refrigerated rooms after becoming heated from other work. Other hazards unique in cold-storage warehouses arise from defrosting operations. The slipping hazard has already been noted. In addition, since drainage is frequently inadequate, warehousemen must remove ice and water in barrels or other containers. The handling and moving of these containers involves all the hazards associated with manual handling and trucking operations.

Machine hazards are not common in warehouses. However, merchandise and cold-storage warehouses occasionally use belt conveyors to transport goods to storage. Household-goods warehouses may have woodworking machinery for repairing furniture. In addition, most warehouses have some maintenance machinery. Unguarded machines in those operations are, therefore, potential injury producers.

The opening and closing of railroad car doors is a common source of injury. Materials which spill when the door is opened have previously been mentioned as a hazard. Also, the opening and closing of boxcar doors may lead to pinched fingers or strained muscles, particularly because the doors frequently stick. Handtools of many kinds are used in warehouses and their misuse frequently results in injuries.

FACTORS IN THE INJURY RECORD

The injury record of any establishment or any group of establishments is a composite of many factors. The kinds of materials processed or handled, the types of processing performed, the extent to which operations are mechanized and the kinds of equipment used, the State safety regulations and the extent to which those regulations are enforced, the type of personnel employed, the size of the establishments, and the extent of the safety programs carried on in the establishments all have a direct bearing upon the volume of injuries experienced. In particular instances the influence of these factors may be offsetting, but in comparisons based upon large groups of operations their effects frequently can be demonstrated, as in the following groupings of the 1950 injury experience of warehousemen.

Comparison by Type of Warehouse

The four general types of warehousing establishments showed great

variations in injury experience (table 1). Average frequency rates ranged from a low of 21.0 for warehousemen of household goods to a high of 39.7 for workers in refrigerated warehouses. In general, the warehouse groups in which the volume of injuries was high tended to have relatively few serious injuries; the reverse was true in those groups which had relatively low frequency rates.

Although refrigerated warehouses as a group had the highest frequency rate, their severity records were the best in the industry. Of the 606 injuries reported by these warehouses, only 1 resulted in death and only 16 resulted in permanent disability. As a result, injury severity averages were only 39 days lost time per disabling injury and 1.6 days lost per thousand hours worked. Refrigerated warehouses specializing in the storage of food products had the highest frequency rate recorded for any specific type of warehouse, 40.9. However, a high incidence of temporary-total disabilities, coupled with a low frequency of serious disabilities depressed their average time loss per disabling injury to 37 days and their severity rate to 1.5.

Merchandise warehouses had a frequency rate of 33.0 disabling injuries per million hours worked. Serious disabilities, slightly more frequent than in refrigerated warehouses but about equal to the average for all warehouses, were overbalanced by the relatively high incidence of temporary-total disabilities. Severity records, 64 days lost time per injury and 2.1 days lost per thousand hours worked, were, therefore, somewhat better than the averages for all warehouses.

Rates were also computed for four specific types of merchandise warehouses: canned goods, flour and grain-mill products, miscellaneous food products, and general merchandise. Within these specialized groups, injuries were most frequent in canned-goods warehouses, 39.5 per million hours. A fatality and a permanent finger injury among the 58 reported disabilities were primarily responsible for the group's relatively unfavorable severity records: 119 days lost time per injury and 4.7 days lost time per thousand hours worked.

Injuries were even more severe in flour and grain-mill products warehouses. Of the 36 injuries reported by that group of warehouses, 1 was a death and 3 were permanent disabilities. Coupled with a low incidence of temporary disabilities, 23.1 per million hours worked, the serious disabilities resulted in an average time loss per disabling injury of 322 days and a severity rate of 8.4, the most adverse severity records for any warehousing group.

Farm-products warehouses had a frequency rate of 25.0 disabling injuries per million hours worked, but these included relatively few serious disabilities. Severity records for this group of plants were, therefore, better than average. Injuries were, generally, more frequent and more severe in cotton warehouses than in grain elevators. Respectively, their frequency rates were 26.7 and 22.1; severity averages, 73 and 54 days lost per injury; and

severity rates, 1.9 and 1.2.

Serious disabilities were relatively frequent in household-goods warehouses. Consequently, the severity records for that group of warehouses were unfavorable--184 days lost per disabling injury and 3.9 days lost per thousand hours worked.

Regional and State Comparisons

Variations in injury rates among the different States and regions may reflect any one or any combination of several factors. State safety regulations and the degree to which they are enforced, the age and maintenance of plants and equipment, and employment factors such as the work experience of available workers, all tend to influence the average level of injury rates in any area.

Injury-rate comparisons may also be affected by the type of warehouse predominating in the particular areas. For example, the highest national average frequency rate was recorded by refrigerated warehouses. Any area in which this type of warehouse operation constitutes a high proportion of all warehousing operations, therefore, would be expected to have a comparatively high overall average regardless of other factors which might influence the rate. Because of these variable internal weighting factors, the validity of injury-rate comparisons among the States and regions on the basis of industry-wide averages may be questioned. The most realistic area comparisons, therefore, are those based upon specific types of warehouses rather than upon industry totals (table 2). Injury-rate comparisons based on State averages are limited because of the small number of warehouses that reported in each State.

Refrigerated Warehouses.--Average injury rates were computed for refrigerated warehouses in 5 geographic areas and 4 States. Two of the regional frequency rates were above 40--West North Central, 58.0, and Pacific, 44.5. The other 3 (Middle Atlantic, East North Central, and South Atlantic) had rates between 26 and 28. In general, injury severity was inversely related to injury frequency. In the West North Central region, injuries averaged only 10 days' disability; in the Pacific region the average was 21 days. In other regions, averages were 25, 132, and 35 days lost time per disability.

State frequency rates were computed for California, 43.3, Pennsylvania, 27.2, New York, 25.3, and Illinois, 24.4. Disabilities averaged 26, 20, 30, and 43 days, respectively.

Merchandise Warehouses.--Injury rates were computed for merchandise warehousemen in 7 geographic regions and 6 States. Regionally, the variations in injury-frequency rates were comparatively small, the rates ranging from 29.1 in the East North Central region to 37.5 in the Middle Atlantic region. Injury severity averages, however, had a considerable spread, ranging from 9 days lost per disability in the West South Central region to 126 days in the South Atlantic. For other regions the average numbers of days

lost per disability were: East North Central, 107; West North Central, 87; Middle Atlantic, 48; Pacific, 44; and New England, 13.

State frequency rates ranged from 27.1 in Pennsylvania to 54.2 in New Jersey. Illinois warehousemen averaged 27.8 disabling injuries per million hours worked, New York, 36.5, California, 38.9, and Indiana, 43.4. Injuries to Indiana warehousemen were, on an average, much more severe than those to workmen in any other State group for which averages were computed, 214 days lost per disability. Other State averages ranged from 16 days lost per injury in Illinois and New Jersey to 86 days in New York.

Farm-Products Warehouses.--Average injury rates for farm-products warehousemen were computed for 6 regions but only 3 States. Two regions had relatively high frequency rates--Mountain, 37.3, and West South Central, 29.1. In the other 4 regions the frequency rates ranged between 17 and about 20: South Atlantic, 17.0; East North Central, 18.3; West North Central, 19.3; and East South Central, 20.4. The average loss per disability was extremely high in 3 regions: South Atlantic, 198 days, Mountain, 164 days, and East North Central, 134 days.

State injury-frequency rates were: Illinois, 23.0; Mississippi, 30.3; and Texas, 34.4. Injury severity, measured by average time lost per disability, was 182 days, 33 days, and 24 days, respectively.

Household-Goods Warehouses.--Representative injury rates could be computed for warehousemen of household goods in only 4 regions and 2 States. The regional frequency rates were: East North Central, 13.3; Middle Atlantic, 19.7; Pacific, 21.7; and South Atlantic, 34.2. State frequency rates were: California, 19.9; and New York, 24.7.

The adverse severity record of workmen in this group of warehouses, 184 days lost per disability, was generally reflected in the regional rates: East North Central, 492 days lost per disability; Middle Atlantic, 366 days; South Atlantic, 185 days; and Pacific, 36 days. New York warehousemen averaged 413 days lost time per injury and California workmen, 40 days.

Metropolitan Area Comparisons

The limitations of injury-rate comparisons among regions and States apply equally to comparisons among metropolitan areas. Unfortunately, the number of reporting firms was not large enough to permit a comparison of injury rates by type of warehouse within the various metropolitan areas. However, because of the desire of safety personnel and plant managers for area detail, overall rates were computed for warehousemen in 10 metropolitan areas: Boston, Buffalo, Chicago, Kansas City, Los Angeles, Minneapolis-St. Paul, New Orleans, New York-Northeastern New Jersey, Philadelphia, and San Antonio (table 3).

Injury-frequency rates ranged from 23.8 (Chicago) to 66.2 (San Antonio). Three areas had rates between 25 and 30 (Boston, 25.5; Los Angeles, 25.6; and Buffalo, 29.3), 2 had rates between 30 and 40 (Philadelphia, 32.5; and New York-Northeastern New Jersey, 34.8), 1 had a rate of 40.4 (New Orleans), and 2 had rates of approximately 50 (Minneapolis-St. Paul, 50.5, and Kansas City, 50.6).

In five of these areas (Boston, Buffalo, Los Angeles, Minneapolis-St. Paul, and San Antonio) the cooperating warehouses reported no fatalities or permanent disabilities. As a result, the severity records for those areas were very favorable. On the other hand, serious disabilities were rather frequent in New York-Northeastern New Jersey (22 of 187 injuries), Kansas City (2 of 56 injuries), and Chicago (5 of 92 injuries). Severity records in those areas were, therefore, unfavorable.

Occupational Comparisons

For general comparisons, warehouse employees were divided into three occupational groups: operators, who comprised 59 percent of the total reported employment; materials-movement personnel, 10 percent; and other occupations (clerical and maintenance), 31 percent. Seventy-seven percent of the reported injuries were experienced by operators; 11 percent by materials-movement personnel, and 12 percent by the other occupations.

Operating Occupations.--Occupations found almost exclusively in the refrigerated warehouses had the most unfavorable injury-frequency rates. The three highest occupational injury-frequency rates were: 85.9 for coolermen; 76.1 for ice handlers; and 61.7 for freezermen (tables 1 and 4). Handlers and stackers, who had the fourth highest injury rate (51.6), were employed in various types of warehouses, but they averaged 53 injuries per million hours worked in refrigerated warehouses compared with about 28 in merchandise or farm-products warehouses. Compress operators, employed exclusively in cotton warehouses, ranked fifth (48.2) among the occupations with high injury rates.

Three of the operting occupations had industrywide frequency rates ranging between 30 and 40: General warehousemen, 38.2; packers and craters, 35.6; and order fillers, 34.6. General warehousemen, the largest occupational group in the industry, are employed in all types of warehouses and their injury experience, consequently, varied as widely. Their frequency rates ranged from 22.9 in farm-products warehouses to 49.7 in merchandise warehouses; averages were 41.7 in refrigerated warehouses and 36.9 in warehouses storing household goods.

The lowest injury-frequency rates for operating personnel were: 13.9 for food processors; 18.9 for refrigerating engineers; and 21.4 for grain-elevator men.

Operating occupations with the highest injury-frequency rates generally had the most favorable injury-severity records. Coolermen, for example, experienced no deaths and only 1 permanent impairment in 81 disabling injuries. All of the 100 injuries reported for freezermen were temporary and handlers and stackers had only 1 permanent impairment in 147 reported injuries. In contrast, the low frequency rate for refrigerating engineers was counterbalanced by an unfavorable injury-severity record--1 death and 3 permanent impairments in the total of 41 injuries reported.

Materials-Movement Workers.--Handtruckers had the highest injury-frequency rate among materials-movement workers. Their average was 44.0 disabling injuries per million hours worked, but among 162 cases no death occurred and only 3 permanent impairments.

Elevator operators (27.0) and forklift operators (26.2) had practically identical injury-frequency rates but the former had the better injury-severity records. Forklift operators had 4 permanent impairments among a total of 51 cases.

Miscellaneous Occupations.--Maintenance workers had an industrywide injury-frequency rate of 37.2. In merchandise warehouses their average rate was 40.5; it was 30.7 in refrigerated warehouses, and 22.2 in farm-products warehouses.

Frequency rates for clerical operations varied widely. Checkers, whose duties bring them into close contact with operating hazards, had an industrywide rate of 23.4 compared with 2.0 for the strictly office personnel. The highest rate for checkers was 42.2 in refrigerated warehouses; and the highest rate for other clerical workers was 4.9 in farm-products warehouses. Practically all of the injuries experienced by checkers and office personnel were only temporarily disabling.

Janitors (11.4) and watchmen (9.8) had relatively low industrywide frequency rates, but both of these occupations had a relatively high proportion of serious injuries.

KINDS OF INJURIES EXPERIENCED

Fatalities and Permanent-Total Disabilities

Individual case records of 1,604 injuries were collected for detailed analysis by Bureau representatives. Two of these injuries resulted in death and one in permanent-total disability. Elevators accounted for the two fatalities. In one case, the warehouseman was found at the foot of an elevator shaft and, in the other, an elevator operator was decapitated when his head was caught between the elevator cage and the hoistway. A crane was responsible for the single permanent-total disability. In that accident a link broke in the chain sling which permitted a steel angle to fall on a warehouseman, permanently disabling both of his arms.

Permanent-Partial Disabilities.

In the detailed group of injuries there were 57 permanent-partial disabilities. Of these, 17 were amputations and 40 were bruises, cuts, strains, and fractures which resulted in the loss of use of some body part or function. Three of the amputations involved toes and the remainder affected fingers or thumbs. An elevator, a crane, and a baling press accounted for the three toe amputations. In the first case, a warehouse helper had his foot crushed between an elevator and the hoistway. Four of his toes were fractured; two of these were amputated later. In the crane accident, grease from the gear housing dripped onto the brake of the boom. The boom slipped, fell, and the crane block struck the workman's foot, amputating one toe. In the baling-press accident, a head sewer lost three toes when his foot was caught under the baling press.

Two or more fingers were lost by each of three workmen. A foreman lost parts of two fingers in the valve of a pneumatic conveyor when he reached into the spout of the conveyor to loosen flour which had become clogged. Another foreman (maintenance) lost two fingers in a circular saw. The third man, an oiler, lost four fingers in the gears of a wheat conveyor while he was applying grease.

Of the 11 amputations involving one finger or thumb, one resulted from contact with a circular saw and another with a metal shear. One man had his finger amputated in a meat grinder, one lost a finger in a roller of a belt conveyor, and another lost a finger in a baling press.

Forklift trucks were involved in two single finger amputations. In one case, a warehouse laborer tripped. When he fell, he touched the release lever of a forklift; the fork dropped and amputated his finger. In the other case, a forklift operator was using a board as a lever to aline the cab of his lift. When the board slipped, his finger was caught between the hoist and the cab.

Two warehousemen had fingers amputated by the storage goods which they were handling. In one accident, the warehouseman crushed his finger between a crate and the side of a box car into which he was loading the crate. In the second accident, a laborer was lifting one end of a steel beam. He slipped and the beam fell on his finger.

A jacklift and the crosshead of an engine accounted for two thumb amputations. A handtrucker, operating a jacklift, lost his thumb when it was caught between the jacklift and the load. An engineer lost his thumb when it was caught by the moving crosshead.

The 40 loss-of-use cases included 1 arm injury, 2 leg injuries, 15 arm and finger injuries, 15 foot and toe injuries, 3 eye injuries, 3 back injuries, and 1 lung injury. Falling objects resulted in 4 thumb and finger injuries and 9 foot and toe injuries. Most of these objects fell either

from the hands of workmen or from equipment such as handtrucks. Falls accounted for 7 permanent disabilities--2 leg, 1 arm, 1 foot, 1 eye, and 2 back injuries. All but the eye injury occurred in falls from elevations.

Workmen, caught between vehicles and other objects, experienced five permanent loss-of-use injuries. One of these was a hand injury, another a finger injury, and three were toe injuries. Moving parts of equipment produced six permanent hand or finger injuries. The point of operation of a portable sander, a roller of a belt conveyor, a baling press, two freight-car doors, and the door of an ice elevator were involved in those accidents. Manual handling operations were responsible for a back, a hand, and a finger injury. The back injury was a strain due to lifting; the hand and finger injuries resulted from the workers' hands being caught between objects being handled.

Flying objects accounted for two of the permanent eye injuries. In one case a nail glanced when struck by a hammer and, in the other, a splinter was thrown by the blade during the operation of a circular saw. One warehouseman injured a toe permanently when an iron pipe, used to "break down" rolls of newsprint, slipped and struck his foot. Another workman injured one of his thumbs when he bumped against a piece of lumber and another injured his foot when he slipped and struck a skid. The lung injury resulted from the inhalation of a chemical when a carboy broke.

Temporary-Total Disabilities

Reflecting the large volume of materials handling by warehousemen, four types of injuries accounted for nearly all temporary-total disabilities. Strains and sprains constituted 35 percent of the temporary injury volume; bruises and contusions, 30 percent; cuts, lacerations, and punctures, 15 percent; and fractures, 13 percent. Nearly 3 percent of all temporary-total disabilities were hernias. Back, leg, foot, toe,hand, and finger injuries predominated. It would appear, therefore, that more general use of mechanical handling equipment and wider use of personal safety equipment would materially reduce the number of injuries to warehousemen.

Most of the strains and sprains were back injuries resulting from overexertion in lifting or moving heavy objects. However, sprained ankles were also common. Bruises and contusions were chiefly foot, leg, and toe injuries. Most of these injuries occurred when workmen dropped materials they were handling. Bruised fingers and hands were also common, occurring when workmen set materials down.

Most cuts and lacerations were finger or hand injuries. Generally these resulted from workmen rubbing against sharp-edged or rough materials such as crates and boxes during materials-handling operations. Cuts to feet and legs were less common, but nevertheless occurred in considerable numbers. Nearly 15 percent of all temporarily disabling cuts and lacerations were infected.

Fractures, among the most severe of the temporary disabilities, averaged 36 days lost time per case. Falling materials accounted for many fractured

feet and toes. Fingers, ribs, and hands were also fractured frequently.

ACCIDENT ANALYSIS

Accident reports frequently do not indicate the specific reason for the occurrence of the particular events culminating in an injury. In most cases, the only available information comes from the injured person or from witnesses present at the time of the accident. Generally, those persons lack both the skill and the opportunity to investigate the event fully to determine the actual cause of the accident. In the analysis of a large number of reports, therefore, it is common to find a large proportion deficient in one or more factors important to the safety engineer. Despite these limitations, however, the analyst can draw much useful information from even the most sketchy accident descriptions.

The description of an accident invariably tends to follow the normal line of thinking on the part of an interested person who hears that a friend or acquaintance has been injured. The first thought is of the injury itself. Was it a burn, a cut, a bruise, a strain, or something else? Then, what produced the injury and how did it happen? These are all descriptive facts which are usually apparent to the witnesses. They are stressed, therefore, in describing the events. The more analytical question, "Why did the accident happen?" normally arises only after the desire for descriptive information has been satisfied. Frequently it goes unanswered, either because of preoccupation with the descriptive factors, or because the answer may not be readily apparent.

The direct approach in accident analysis, therefore, is to draw from the records the various elements of information in the order in which they are usually recorded. Alone, these elements may have limited value, but when related to each other they can be of considerable value in indicating the accident-prevention activities needed. The first step toward an understanding of the accident problem is, therefore, the determination of the objects or substances most commonly producing injuries.

Agencies of Injury

Containers, the most frequently listed agency of injury, accounted for nearly one-third (30.3) of all injuries to warehousemen. These injuries, however, did not tend to be severe. None of the 484 injuries in this group resulted in death and only 8 resulted in permanent disability. Consequently, the average time lost per injury was only 30 days, about half the average for all injuries. Boxes and cases were most frequently involved but bags, sacks, bales, barrels, kegs, tubs, cans, drums, and other containers were responsible for nearly 55 percent of the injuries in this group (table 7).

Nearly half the injuries ascribed to containers were strains experienced in lifting. Injuries to the trunk, back, abdomen, shoulder, etc., were, therefore, most common. One-fourth of the container injuries were bruises

and contusions and one-ninth were fractures. Fingers, hands, toes, feet, and legs were most frequently affected. In many of these accidents the containers fell from piles, from equipment, or dropped from workmen's hands. In other instances, warehousemen crushed their hands or fingers under or between the containers which they were handling.

Containers were particularly prominent injury producers in farm-products warehouses where approximately 35 percent of all injuries involved contact with containers (table 8). Heavy bales of cotton were frequent sources of injury in cotton warehouses. Proportionately, containers were least important as injury producers in household-goods warehouses, but, even there, they produced approximately one-fourth of all warehouse injuries.

Vehicles, second in importance as an agency of injury, produced nearly one-seventh of all warehousing injuries. Although generally more severe than container injuries, vehicle injuries were still below average in severity. Handtrucks and similar equipment accounted for 65 percent of all vehicle injuries. Powered industrial trucks including forklift trucks and motortrucks were responsible for 25 percent and railroad cars for 10 percent.

More than half of the injured employees in this group were operating or using vehicles at the time of their injury. In many cases, the workmen were squeezed or crushed between vehicles and other objects. In other instances, they were struck by handtrucks being moved by co-workers. Nearly half of the injuries inflicted by vehicles were relatively minor bruises and contusions. About 20 percent, however, were fractures. Feet, legs, toes, and fingers were most frequently injured.

Reflecting their greater use of vehicles, merchandise warehouses reported the greatest proportion of vehicle injuries, approximately 17 percent. Handtrucks alone accounted for 11 percent of all injuries in that group of warehouses.

Working surfaces, ranking third in the agency of injury list, were responsible for approximately one-ninth of all injuries. This group of 180 injuries included one fatality and 7 permanent disabilities. As a result, the average severity of the group was high--147 days lost time per injury. Falls produced nearly all of these injuries. In many instances the injured workers fell from vehicles, platforms, scaffolds, piled materials, or other elevations. Injuries to feet, legs, and back were most common; bruises, strains, and fractures predominated.

One of every 16 injuries to warehousemen involved contact with metal objects--either items in storage such as bars, angles, plates, coils, etc., or metal parts of warehouse equipment. Manual handling operations were responsible for most of these injuries. Frequently workmen dropped the objects on their toes or feet. In other cases they lacerated their hands or fingers in rubbing against rough or sharp edges, or strained themselves while lifting. Other warehousemen were injured when they bumped against the metal objects.

About 5 percent of the disabling injuries resulted directly from straining movements rather than from contact with physical objects or substances. In practically all of these cases the worker slipped or stumbled and strained himself as he attempted to maintain his balance. Five in every eight of these injuries affected feet or legs; most of the remainder were back injuries.

Handtools ranked next as an agency of injury. These injuries resulted primarily from workmen striking themselves with hammers, saws, knives, and tools as they were using them. Injuries to the fingers, hands, legs, and feet were most common. About half of the injuries were cuts and about one-fifth were bruises.

Ice, lumber, machines, and furniture each accounted for approximately one of every 40 injuries. Falling blocks of ice produced most of the injuries ascribed to that agency. In many cases the ice fell from equipment or was dropped by workmen, but half of the injuries in this group resulted when blocks of ice toppled over. Bruised or fractured legs, feet, and toes were, therefore, common. Strains, the second most frequent injury, generally resulted from overexertion in lifting.

The handling of lumber was responsible for most of the injuries in that group. In many instances workmen dropped the lumber on their feet or toes. In other cases they lacerated their hands rubbing against splinters or rough edges, or strained themselves lifting heavy boards.

Eight of the 42 injuries produced by machines resulted in permanent disability; 7 of these were amputations. Consequently, the average time lost per disability was high, 96 days. Many of these machines were peculiar to the type of warehouse in which they were being used--ice-cubing, crushing, and scoring machines in cold-storage warehouses; compresses in cotton warehouses; and shears in steel warehouses. Circular saws, used chiefly for maintenance work and crating, are more widely distributed. In most of these accidents the injured employee was caught in moving parts of the equipment or came in contact with points of operation. Machines were also involved in another type of accident--that resulting from the movement of machines such as farm equipment, textile machinery, etc., into and out of storage. These injuries were mainly strains which were the result of lifting.

Most of the furniture injuries occurred in manual handling operations; more than half were strains resulting from lifting furniture. However, furniture which fell from equipment such as handtrucks or from the hands of workmen accounted for many bruises, contusions, and fractures. Reflecting the warehouse operation, furniture was particularly important as an injury producer in household-goods warehouses, where it accounted for 19 percent of all injuries.

Other agencies included pallets, skids, foodstuffs, chemicals, elevators, rolls of paper, conveyors, and doors. Although relatively infrequent, injuries involving elevators and conveyors were, on an average, very severe.

Of the 22 injuries produced by contact with elevators, one was a fatality and another a permanent disability. As a result, elevator injuries averaged 306 days lost time per disability. Similarly, 4 of the 18 conveyor injuries were permanent disabilities. Conveyor injuries were, therefore, the most severe, resulting in 335 days lost per disability.

Accident Types

More than four-fifths of all injuries resulted from four general types of accidents: workmen were struck by moving objects; they strained themselves while handling materials or equipment; they were caught in, on, or between moving objects; and they fell. The latter two groups accounted for the most severe injuries.

Nearly a third (30.7 percent) of all injuries resulted from warehousemen being struck by moving objects (tables 7-9). Most of these originated in manual handling operations and in the use of equipment, especially vehicles and handtools. In nearly 70 percent of these cases it was a falling object which inflicted the injury. About a third of these objects fell from the hands of workmen, approximately a fourth fell from equipment such as handtrucks, and about a fifth fell from piles of materials. Containers, metal stock or parts, lumber, foodstuffs, and dock plates were the objects most frequently dropped by workmen. Objects falling from equipment were mostly containers or metal parts; those falling from piles were generally containers. About 10 percent of the falling objects toppled from upright positions and struck workmen; blocks of ice were most frequently involved in these accidents.

In approximately a sixth of the accidents involving moving objects the objects were hand-propelled. Most commonly these were handtrucks or handtools. Flying objects, mostly small particles, were involved in approximately 1 of every 14 accidents attributed to moving objects.

Accidents in which workmen were struck by moving objects were frequent in all types of warehouses. Relatively, the number of injuries attributed to that type of accident ranged from 28.5 percent of all injuries in cold-storage warehouses to 32.2 percent in farm-products warehouses. Accidents involving falling objects were particularly important in merchandise warehouses, accounting for 22.5 percent of all injuries in that group.

Overexertion, the second most common type of accident, accounted for nearly a fourth (23.4 percent) of all injuries. Three-fourths of these occurred in lifting operations. Containers, metal parts, furniture, lumber, and foodstuffs were most frequently involved. Other over-exertion accidents included those resulting from pulling, pushing, carrying, or rolling objects. Containers, such as bales and heavy barrels, produced most of those injuries. Overexertion accidents were relatively most common in cold-storage warehouses where nearly a fourth (24.6) of all injuries were ascribed to that type of accident.

Approximately one-sixth of the disabling injuries resulted from warehousemen being caught in, on, or between moving objects. Nearly 10 percent of these injuries resulted in death or permanent disability. The average severity of injuries in this group, 103 days lost per disability, was, therefore, exceeded only by those produced by falls. About two-fifths of these accidents involved vehicles (table 9). In most of these cases the warehouseman was squeezed between the vehicle and some other object, but there were many instances in which hands or feet were crushed by moving parts of vehicles, machines, elevators, or conveyors. Another large group of "caught in, on, or between" accidents occurred in the manual handling of materials, particularly containers. Most of these accidents produced hand injuries resulting from workmen setting the handled objects on their hands or fingers.

Falls, constituting about 12 percent of the total volume of accidents, produced a relatively high proportion of serious injuries. This group of accidents included 112 falls from elevations, 1 resulting in death and 6 in permanent impairments, and 83 falls on the same level, 1 of which resulted in permanent impairment. Injuries resulting from falls from elevations had an average time loss of 211 days per case compared with 38 days for injuries produced by falls on the same level. The elevations from which warehousemen most frequently fell were vehicles, platforms, scaffolds, and piled materials. Falls on the same level generally originated in a slip or by tripping over an obstruction.

One of every 10 injuries resulted from a workman striking against or bumping into some object. Most of these injuries originated in the handling of materials or in the operation or use of machines, tools, and vehicles. Equipment, chiefly machines and vehicles, projecting nails or slivers on cases and boxes, and sharp or rough edges of metal parts and containers were the objects most frequently contacted.

Other disabling injuries to warehousemen included strains occasioned by slips or stumbles (nearly 5 percent). In these cases, the workman was injured as he twisted or strained his body attempting to maintain his balance; no contact with any particular object was involved. The inhalation or absorption of chemicals accounted for less than 2 percent of all disabling injuries.

ACCIDENT CAUSES

Modern accident analysis is based upon two premises: First, there is an identifiable cause for every accident and, second, when that cause is known, it is usually possible to eliminate or counteract it as a possible source of future accidents of the same kind. In many instances, a variety of circumstances contributes to the occurrence of an accident and the course that accident prevention should take may seem confused because of the multiplicity of the possible avenues of action. The particular course adopted, however, appears to be of little consequence so long as the aim, the prevention of accidents, is attained.

It is commonly accepted that every accident may be traced to the existence of some hazardous working condition, to the commission of an unsafe act by some individual, or to a combination of these two accident-producing factors. The sole purpose of accident analysis, as applied to large groups of cases is, therefore, to determine the specific factors within each of these two categories of accident causes most frequently involved in the occurrence of accidents. With this knowledge, it is possible to plan a safety program centered on the elimination of these specific accident factors with assurance that success in this objective should lead quickly to a substantial reduction in the volume of injuries.

It must be recognized, however, that accident analysis has definite limitations. At best it can furnish clues only as to the directions in which accident-prevention activities should be pointed. What these activities should be and how they are to be carried out must be determined by the individual in control of each safety program after his general objectives have been indicated through accident analysis. It must also be recognized that accident analysis cannot go beyond the reported facts. In other words, the accuracy of any analysis is wholly dependent upon the accuracy and completeness of the original accident reports. In this respect, it has been consistently apparent in the Bureau's surveys that the inadequacies of reporting seriously limit the possibilities of effective analysis. The limitations are not great in broad studies of this type which bring a sufficient volume of adequate reports into consideration to support an analysis. The shortcomings are specifically at the company or establishment level where the most effective analysis can be performed only when all the necessary facts are available.

In interpreting the findings in this study relating to hazardous conditions and unsafe acts, it is essential to recognize that these two factors are not necessarily mutually exclusive. The analytical procedures utilized in the study were not directed toward the determination of a single major cause of each accident since such determination would involve an exercise of judgment seldom possible from the available facts. On the contrary, an effort was made to determine independently for each accident whether there was a hazardous condition which contributed directly to its occurrence, and whether the event could be directly associated with an unsafe act.

Many of the reports were inadequate, however, and it is impossible, therefore, to draw any conclusions as to whether hazardous working conditions or unsafe acts were the leading cause of accidents. For the accident preventionist, however, this is a minor limitation. Since his approaches to the elimination of accident causes in the two categories necessarily must be different, the pattern of the specific factors within each general category is of more importance than the interrelationship between the major groups of accident causes.

The correction of hazardous working conditions usually is entirely within the powers of management and can be accomplished by direct action. The avoidance of unsafe acts, on the other hand, requires cooperation and under-

standing by both management and workers. To achieve this, it is necessary for management to take the lead by providing safety-minded supervision and by making sure that all workers are acquainted with the hazards of their operations and are familiar with the means of overcoming them.

Hazardous Working Conditions

Two general groups of hazardous working conditions caused more than 60 percent of all accidents to warehousemen: hazardous working procedures, 34.4 percent; and defects of agencies, 26.0 percent. Two other groups, improperly guarded agencies and hazardous arrangement or placement of materials, accounted for an additional 33.2 percent (tables 10 and 11).

Hazardous Working Procedures.--Broadly speaking, most of the accidents attributed to hazardous working procedures reflect supervisory inadequacies in the proper planning of manual materials-handling operations. The failure to provide adequate assistance or mechanical equipment for lifting and moving heavy or bulky materials was a prominent source of accidents. Environmental working circumstances which necessitated great physical exertion in close quarters, sometimes in cramped positions, inevitably produced many injuries. Similarly, many of the injuries were the readily predictable results of unsafe procedures such as manually piling and unpiling materials at levels above shoulder height.

Hazardous procedures associated with manual materials handling were particularly prominent in the household-goods warehouses where the use of mechanical equipment is very limited. Cotton-storage warehouses also had a relatively high ratio of such accidents.

The most common injuries resulting from these accidents were back strains and crushed fingers and toes. The back strains frequently were the results of simple overlifting, but close quarters and high lifting were important factors in many instances. The placement of materials in close quarters was an important element in the occurrence of many finger and toe injuries. The difficulty of holding or controlling hand-held materials of excessive weight or of awkward size or shape, however, was primarily responsible for the finger and toe injuries.

Defects of Agencies.--About 1 in every 4 of the warehousing accidents resulted from a physical defect in the premises, in the equipment used, or in the materials handled.

Defects in the working environment, commonly reflected either inadequate maintenance and repair or inadequate attention to housekeeping. Rough and splintered floors presented tripping hazards and made it difficult to control the movements of industrial trucks. Wet and icy floors in refrigerated areas and on loading docks and other outdoor areas in inclement weather contributed to many falls. Similarly, falls resulting from slippery surfaces on trucks and on the metal dock plates used to bridge the space

between trucks and loading docks were common.

Accidents ascribed to defective industrial trucks most commonly resulted from defects acquired in use and permitted to exist because of inadequate maintenance. There were, however, a considerable number of accidents which could be attributed to inherent defects in the design of the vehicles. The absence of proper protection for the operator against contact with the load or with fixed objects in the area of operations permitted the occurrence of numerous crushing injuries. Defective controls, and controls so placed that they could be touched unintentionally caused some trucks to move unexpectedly and brought injuries to the operators or to others in the vicinity. Defective brakes led to some collisions and the necessity of hand cranking the motors on some trucks led to a few injuries when the motors "kicked back."

Defects in the materials handled were a common source of accidents in all types of warehouses. Most frequently these defects consisted of unrepaired damage to the containers and bindings of the materials. Splintered, rough, and sharp-edged containers and projecting nails and wire were responsible for many hand and finger injuries.

Inadequately Guarded Agencies.--In warehousing, as in other industries, the accidents arising from inadequate guarding tend to produce injuries of greater than average severity. Eighteen percent of the warehousing accidents were directly attributable to inadequate guarding. These accidents, however, produced 1 of the 2 reported fatalities and 35 percent of the reported permanent impairments. Their importance in the accident record of the industry, therefore, is greater than is indicated by their number.

More than a third of the accidents in this group resulted from a failure to provide guardrails and toeboards on elevated surfaces, or protective gates on elevators. The absence of guardrails resulted in many falls and the lack of toeboards permitted materials to slide from elevations and fall onto workers. The absence of an elevator shaft gate caused one worker to fall to his death in the shaft, and the absence of elevator car gates led to several accidents in which workers' feet were crushed between the car and shaft wall.

Since the use of machines, other than conveyors and industrial trucks, is quite limited in the warehousing industry the volume of accidents chargeable to inadequate machine guarding was relatively small. More than a fourth of those which did occur, however, produced permanent disabilities. The machines most commonly involved were baling presses, circular saws, grinders, and ice-cutting (scoring, crushing, and cubing) machines.

Two varieties of accidents involving inadequate provisions for anchoring or locking movable surfaces were common in loading and unloading operations. The lack of facilities for anchoring dock plates frequently resulted

in the plates shifting and dropping workers and their loads into the space between the dock and the vehicle. Somewhat similarly, the lack of an adequate supporting device for the tailgates of trucks frequently allowed the gates to drop on workmen or to drop with them when they were entering or leaving the trucks.

In handtrucking operations there were many accidents in which the trucker's hand was pinched or crushed between the truck handle and some fixed object. Almost invariably these accidents would have been prevented had the trucks been equipped with handle guards.

Accidents resulting from the lack of guards on power transmission equipment, belts, pulleys, etc., were not particularly common, but the severity of the injuries produced by such accidents tended to be high. Five of the 13 reported cases resulted in permanent disabilities.

Hazardous Arrangement or Placement.--Improperly piled or improperly placed materials constitute a prominent hazard in warehousing, particularly in merchandise and household-goods warehouses. Most of the reported accidents which were attributed to these hazards were cases in which materials fell on workers. In a number of instances the materials fell from completed piles and struck workers who were working nearby or simply passing by the piles. In other instances they fell from warehouse trucks while being moved or slid off the loading docks while being moved into or out of storage.

The hazards of working around improperly piled materials were frequently intensified by a failure to maintain adequate clear space for the operations being performed. Inadequate aisle space and inadequate arrangements for the free flow of traffic in the warehouses were basically responsible for many collisions in which warehouse trucks struck workers or knocked over piled materials.

Miscellaneous.--Two other hazardous working conditions--poor housekeeping and lack of personal safety equipment--accounted for one of every 20 injuries to warehousemen. Most of the latter group were associated with using handtools or machines.

Unsafe Acts

For the purposes of this analysis, an unsafe act was defined as that "violation of a commonly accepted safe procedure which occasioned or permitted the occurrence of the injury-producing accident." Literally, this definition means that no personal action shall be designated unsafe unless there is a reasonable, less hazardous, alternative procedure. For example, the operation of a machine for which no guard was provided was classified as a hazardous working condition and not as an unsafe act because the worker had no choice other than to use the unguarded machine. On the other hand, the operation of a machine from which the guard had been removed was classified as an unsafe act because the alternative safe procedure would have been

the replacement of the guard before operating the machine.

The definition does not imply, however, that the worker who committed the unsafe act was aware of the alternative safe procedure nor that his act was the result of a considered choice between the alternatives. From the analysis of the individual accidents it is apparent that, in many cases, the worker knew the safe procedure but consciously decided not to follow it. In other cases, the individual acted unsafely simply because he did not know the safe method. There are, therefore, two steps in any safety program which are essential to the reduction of unsafe acts, namely education and enforcement. All workmen should be carefully instructed in the safe methods of performing their duties and they should be taught to recognize hazards involved in deviations from the safe procedures. Management then should provide adequate supervision to assure that the safe procedures are followed.

Two general types of unsafe acts predominated. Unsafe handling of materials or equipment contributed to the occurrence of 40.5 percent of the accidents and assuming unsafe positions or postures contributed to 36.7 percent (tables 11-13). Of somewhat lesser importance, unsafe loading or placing of materials was responsible for 10.1 percent of the accidents; the failure to secure materials or to warn others of their possible movement was responsible for 4.8 percent; and operating or working at excessive speed was responsible for another 4.6 percent.

Unsafe Handling.--A basic rule in manual materials handling is that the worker must exercise some judgment in taking hold of the objects which he is moving. He should avoid the necessity of sliding his hands along sharp or splintery edges of materials; he should be sure that his hold is such that he will be able to release the material without crushing his hands; he should be sure that the weight is reasonably balanced before making his lift to avoid twisting or straining his body; and he should be sure that his grip is firm so that the material will not slip from his grasp. Equally important, he should recognize his own physical limitations and should make full use of all available mechanical equipment to avoid possible overexertion.

Violations of these commonsense operating practices contributed to a substantial volume of injuries. The most common fault was that of grasping objects at the wrong places--either placing the hands in a position to be pinched or crushed when the objects were moved or set down, or grasping them in a manner which did not give good balance and as a result threw excessive strain on the muscles. Accidents attributal to these unsafe practices were common in all types of warehouses, but were particularly prominent in farm-products warehouses and in household-goods warehouses. In many of these cases the associated hazardous condition was inadequate workspace.

The failure to maintain a good grip on objects being lifted was also a prominent source of injury. These were primarily cases in which objects slipped from the workers' hands and fell on their feet or produced severe strains when the workers attempted to regain control of the slipping objects.

In many instances overlifting, improper placement of the hands for good support, and attempting to lift slippery or sharp-edged articles were contributing factors.

The practice of pulling handtrucks rather than pushing them was a somewhat less common, but nevertheless important, source of injuries. The resulting accidents were primarily cases in which the operators were caught between the trucks and fixed objects or instances in which the trucks got out of control and overran the operators.

Assuming Unsafe Positions or Postures.--The outstanding fault among this group of unsafe practices was the simple failure to watch one's footing. Most of the resulting accidents were slips or falls arising from tripping over obstructions, stepping too near the edge of elevations, or stepping upon loose materials. Poor housekeeping and improperly placed materials were contributing factors in many of these accidents.

A similar failure to observe their surroundings led to a number of accidents in which workers bumped into fixed objects or equipment which should have been obvious to them. Handtruckers, particularly, frequently misjudged distances and crushed their fingers between the truck handles and walls, columns, or piled materials.

Unnecessary exposure to moving equipment or to falling materials was also a prominent unsafe act. Among others, this category included such invitations to injury as walking in front of moving industrial trucks, working too close to traffic lanes, entering the area under suspended loads, and approaching piled materials while stacking operations were in progress.

Strains and sprains from improper lifting practices, particularly bending at the hips and keeping the knees straight when raising objects from the floor, were common in all types of warehouses. Careful training in the principles of raising a load with the leg muscles rather than those of the back appears to be necessary throughout the industry.

Unsafe Loading or Placing.--Most of the unsafe acts in this category consisted of placing materials insecurely on elevations from which they fell and struck nearby workers. The most common fault was that of overloading or precariously balancing materials on handtrucks. These materials frequently fell off when the trucks bumped into obstructions or turned sharp corners. The handtruck operators were frequently the victims of their own improper procedures, but it was not unusual to find that the injured person was in no way connected with the loading or operation of the vehicles. Similarly, insecure piling and improper placement of materials near the edge of elevations resulted in injuries to others as frequently as to the workers who were responsible for creating the hazards.

Accidents resulting from unsafe loading or placing of materials constituted a higher percentage of the volume of accidents in the household-goods

warehouses than in any other variety of warehouses. The wide variation in the shapes, sizes, and weights of the materials handled in the household-goods warehouses probably accounts in large measure for this circumstance. There was, however, a considerable volume of accidents attributable to these unsafe acts in both the merchandise and refrigerated warehouses. The farm-product warehouses, on the other hand, had relatively few such accidents.

Miscellaneous Unsafe Acts.--The miscellaneous group of unsafe acts included a wide variety of unsafe practices, none of which individually accounted for a large volume of accidents. In the aggregate, however, these seemingly unimportant lapses in working procedures were contributing factors in the occurrence of over 12 percent of the reported accidents.

Among the more prominent faults in the group was the failure to secure materials or equipment against unexpected movement. Generally this consisted of leaving loaded handtrucks on inclines without adequately blocking them so that they would not run away if bumped or jarred. A related fault was that of failing to warn others in the area when moving materials or handtrucks in close quarters. Equally hazardous was the practice of throwing materials and of kicking or shoving handtrucks out of the way and letting them run free in the work space. Characteristically, these unsafe actions generally resulted in injuries to persons other than the ones who acted improperly. Most of the injuries were bruises or contusions from being struck by the moving materials. The practice of throwing material from man to man, however, tended to produce severe strains and sprains when the catcher found it difficult to hold on to the materials tossed to him.

Operating industrial trucks, both powered and hand types, at excessive speeds was responsible for a considerable number of injury-producing collisions. Speed was also a factor in some cases where materials were thrown from the trucks on turns or when the trucks passed over rough surfaces.

The general use of personal protective equipment, such as gloves, safety hats, and steel-toed shoes, undoubtedly would have minimized or prevented many of the injuries. Increased use of these items obviously should be encouraged. There were, however, relatively few accidents reported which could be ascribed specifically to the failure to use such protective devices. The most common circumstance in which the failure to use protective equipment was a direct factor in the accidents arose in the manual handling of materials which had sharp or rough edges. In such operations the use of gloves or other hand protectors is an essential part of the operation and a failure to use them is distinctly an unsafe act.

In some instances the accidents could be attributed to the workers' failure to wear adequate clothing for the work they were performing. Wearing worn-out shoes with thin or broken soles led to a number of foot injuries when workers stepped on sharp objects. Trousers that were too long or were ragged and torn tripped some workers or threw them off balance when they caught on obstructions. In refrigerated warehouses a common fault was that

of entering the deep cold areas without donning the heavy clothing required for work in those temperatures.

ACCIDENT-PREVENTION SUGGESTIONS

To illustrate the more common types of hazards encountered in warehousing operations, a number of typical accidents were selected for specific comment. All available details relating to the occurrence of these accidents were assembled and submitted to two experienced safety engineers who were requested to prepare recommendations as to how each accident might have been prevented. 5/ The following accident-prevention suggestions reflect the combined judgment of these consultants.

In presenting these accident-prevention suggestions, there is no intent to imply that they constitute a comprehensive set of safety rules for the warehousing industry, nor that the suggested methods constitute the only ways in which these accidents could have been avoided. Many safety engineers undoubtedly would attack the problems involved in these accidents in different ways and would achieve equally good results. The objective is simply to indicate that there is a comparatively simple way to eliminate practically every type of hazard encountered in employment. The particular method adopted is of minor importance so long as it accomplishes its purpose.

Brief descriptions of the selected accidents, accompanied by the suggestions for prevention of such events, follow.

5/ Sheldon W. Homan, Safety Engineer of the Division of Safety Standards, Bureau of Labor Standards, U. S. Department of Labor, and Odell D. Maxwell, Supervising Safety Engineer, Bureau of Supplies and Accounts, Department of the Navy, cooperated in the preparation of this section of the report.

CASE DESCRIPTIONS AND RECOMMENDATIONS

1. A repairman was using a circular saw. As he fed a piece of lumber to the saw, his finger struck the blade and was amputated. The saw was not guarded.

All points of operation of woodworking machinery should be guarded in conformance with the American Standard Safety Code for Woodworking Machinery. An adequate cover guard riding on the stock would have prevented his finger from contacting the blade.

2. A maintenance foreman, using a bench saw, lacerated his finger on the blade. Investigation disclosed that (a) a guard was provided for the saw but that it did not completely cover the blade, and (b) the foreman was wearing gloves which were caught and entangled by the blade.

(a) Circular saws should be equipped with a guard which will enclose the blade completely. (See American Standard Safety Code for Woodworking Machinery.) (b) Gloves should not be worn by employees working with or around moving machinery.

3. A maintenance man was adjusting a conveyor belt. He placed his hand on the belt. His hand was drawn under a roller.

All employees should be carefully trained in the safe performance of their duties. Maintenance men should never be permitted to make repairs or adjustments on machinery while it is in operation. Instead, the power should be disconnected and a sign or lock should be placed on the switch to prevent other workmen from closing the switch while repairs or adjustments are being made.

4. An oiler was greasing a fitting on a powered conveyor. When a second workman gave the signal indicating that he was closing the switch, the oiler reached to remove a grease gun from the conveyor. His gloved finger was caught by a roller and was amputated.

Safety procedures should be developed for all operations and supervisors should be required to enforce those safe practices strictly. Before oiling or repairing powered equipment, workmen should disconnect the power, lock the power switch, and place a "Do not start" tag on it. No one should be permitted to remove the tag or start the equipment except the workman who locked the equipment and placed the tag.

5. A foreman was operating an ice crusher. As he was feeding it, a small piece of ice flew from the machine and struck his eye.

(a) A chute or conveyor which would automatically feed the ice to the crusher should be installed.

(b) Where there is a possibility of flying materials, face shields or goggles should be provided and worn.

6. An employee was using a grinder to sharpen an ice bar. A small piece of metal struck the workman's eye. Investigation disclosed that no goggles had been provided.

(a) A permanent shield of flexiglass or other nonshattering transparent material should be installed on all grinding wheels.

(b) Goggles should be provided and worn during grinding operations.

7. An employee was removing a roll of lead from a rack. He misjudged the weight of the roll and, when he pulled it clear of the rack, it slipped from his grasp and fell on his foot. Investigation disclosed that the rack was approximately 6 feet from the floor.

(a) Heavy articles, such as rolled lead, should be stored at or near the floor level.

(b) Safety shoes should be worn by all employees engaged in materials-handling operations. In this case, the shoes might have minimized or prevented the injury.

8. A handtrucker was removing bales of cotton, piled two high, from storage. When he pulled a bale from the top layer of the pile, it rolled and struck his leg.

Mechanical handling equipment should be used for handling bales of cotton when they are stored or piled more than one layer high.

9. A warehouse laborer was loading cans of eggs on a handtruck. He dropped one of the cans on his foot, fracturing it. Investigation disclosed that the cans weighed approximately 70 pounds, and, though they were not frosted, they were chilled and hard to handle.

(a) Because of the weight of the cans and the difficulty in handling them, two men trained to work as a team should be assigned to this work.

(b) Although they would not have prevented the accident, safety shoes or foot guards would have prevented or minimized the injury.

10. While a laborer was moving packing cases, he scratched his arm on a nail projecting from one of the cases. He neglected to get first aid and infection developed.

(a) Before handling, all packing cases should be inspected for projecting nails and other defects. Projecting nails should be removed or bent into the wood immediately.

(b) All injuries regardless of their severity should be given first-aid treatment immediately after the accident.

11. A laborer was handling rough lumber in the lumber yard. A splinter punctured his finger, which became infected. Investigation disclosed that no gloves had been provided.

Employees engaged in this type of work should be furnished gloves or other hand protection. Adequate supervision should be provided to assure its use.

12. A handtrucker was lifting a piece of steel onto his truck. When the steel slipped, he cut his hand on the sharp edge of the metal. Investigation disclosed that the employee was not wearing gloves which had been provided.

All employees should be carefully instructed in the safe performance of their duties. Adequate supervision should be provided to assure observance of those procedures.

13. An employee was piling furniture in a warehouse. He bent over to pick up a rolled rug and felt a sharp pain in his back.

All warehouse employees should be carefully trained in correct lifting procedures. Adequate supervision should be provided to assure observance of those practices. In this case, the employee was using his back instead of his legs to lift the rug--i. e., lifting with a bent back.

14. An employee in a grain warehouse strained his back lifting a 100-pound bag of grain at the bagging machine.

(a) Manual handling at the bagging machine should be replaced with mechanical handling equipment--i. e., conveyor system which is much more effective and safer.

(b) When 100-pound bags are handled manually, two men trained to work as a team should be assigned to that work.

15. A warehouse laborer, standing on the pile, was stacking bags of pecans. He misjudged his footing and fell from the pile. Investigation disclosed that the pile of pecans was approximately 5 feet high and that no footboard had been provided.

(a) This is a good example of the inherent hazard of nonmechanized piling. This hazard, which is difficult to control, could be eliminated by mechanical-handling equipment and palletized loads.

(b) For manual piling operations such as this, a properly guarded working platform or a suitable plank should be used to provide adequate footing.

16. A warehouseman, walking by a pile of discarded lumber, stepped on a nail projecting from one of the boards.

Good housekeeping is essential to safety. Nails projecting from lumber should be removed or bent into the wood as the lumber is removed from service. In addition, discarded lumber should be safely piled or stored where it will not project into walkways.

17. A warehouseman was piling meat in a freezer room. When the pile shifted, a 150-pound piece of meat fell on him.

Manual handling of frozen meat is an extremely hazardous procedure. Mechanical handling equipment with picture-frame pallets should be provided for handling frozen meat.

18. A freezer man was stacking boxes of meat in cold storage. He placed a box into position and then, as he arose, he bumped his head on a beam. Investigation disclosed that he was standing on a pile of boxes near the ceiling.

Only mechanical stacking should be permitted when storing materials near the ceiling or in cramped quarters.

19. An employee was using a portable electric saw. A splinter of wood, thrown by the saw, struck his eye.

The speed of particles thrown by power-driven equipment will usually be sufficient to result in permanent injury to eyes. Therefore, safety goggles should be provided to all operators of portable or stationary power-driven woodworking and millworking equipment. Supervisors should be required to enforce the use of such personal protective equipment rigidly.

20. A warehouseman was unloading bales of cotton from a truck. When the hook he was using loosened from a bale, he fell backwards to the floor. Investigation disclosed that the hook was dull.

All equipment should be inspected at frequent, regular intervals. Defective equipment should be removed from service or repaired immediately.

21. An employee was assembling crates. His hammer struck a nail a glancing blow and the nail flew, striking him in the eye.

Management should provide, and employees should be required to wear, safety goggles during all nailing operations. Other employees working near nailing operations should also be required to wear goggles.

22. As a warehouseman was loading a handtruck, it moved, crushing his toes. Investigation disclosed that the truck wheels had not been blocked.

(a) All employees should be carefully trained in the safe performance of their duties and adequate supervision should be supplied to enforce those safe procedures. In this case, the wheels of the truck should have been blocked during the loading operation.

(b) All employees engaged in materials-handling operations should be required to wear steel-toed safety shoes. If this employee had been wearing safety shoes, the injury could have been minimized and might have been avoided altogether.

23. While a handtrucker was moving a bale of cotton a second trucker ran into him. Investigation disclosed that the second trucker was following very closely and failed to stop when the first trucker slowed to make a turn.

Bales of cotton obstruct, in some degree, the view of the trucker. Therefore, when several truckers are engaged in this work they should be instructed to follow not closer than 10 feet from the trucker ahead. Supervisors should be required to enforce that instruction rigidly.

24. An employee was using a two-wheeled handtruck to move barrels into storage. He crushed his fingers between the handle of the truck and a doorway. Investigation disclosed that the truck handles had a 24-inch spread and the doorway was only 32 inches wide.

Handles of two-wheeled handtrucks should be equipped with hand guards.

25. A warehouseman was pushing a truck loaded with cans of frozen eggs. One of the cans fell from the truck onto his foot. Investigation disclosed that the load, which had not been secured, moved as the truck crossed a rough spot in the concrete floor.

(a) All loads on hand trucks should be staked or otherwise secured to prevent movement during transit.

(b) Regular, frequent inspections and proper maintenance are necessary to safety. In this case, a regular inspection would have revealed the rough concrete floor; proper maintenance would have assured its repair.

(c) Employees engaged in materials-handling operations should be required to wear steel-toed safety shoes.

26. A handtrucker was pulling a 4-wheeled truck. He slipped on a small piece of ice lying on the floor and the truck rolled against his ankle.

(a) Handtrucks should be pushed, not pulled.

(b) Good housekeeping is essential to safety. A regular cleaning schedule should be developed and followed strictly. In addition, employees should be trained to remove promptly any material dropped while it is being transferred.

27. After being used, a metal runway was placed on edge against the side of a warehouse. It toppled over and struck a warehouseman. Investigation disclosed that a handtrucker had bumped the runway as he was passing it. As a result, the runway was standing in a vertical position just prior to the accident.

When not in use, equipment such as runways should be stored carefully so that it will not become a tripping or falling hazard.

28. To unload a truck, a warehouseman had placed two planks from the tailgate of the truck to the ground. As he carried a barrel down the runway, one of the planks slipped from the tailgate. The warehouseman fell and injured his leg.

The handling of barrels on an inclined plane by one man is an extremely dangerous practice. For this operation, (a) two men trained to work as a team should be used, (b) the inclined plane should be securely fastened to the platform of the truck, and (c) the truck should be blocked securely so that it cannot move forward.

29. A 12-inch plank was being used as a walkway from a truck to the ground. As a packer was using the walkway he slipped and fell. Investigation disclosed that it had been raining and the plank was wet.

The surface of all inclined walkways should be cleated or covered with a nonskid material.

30. A warehouse laborer was unloading newsprint from a railroad car. When the dock plate slipped, he fell between the boxcar and the platform and a roll of newsprint fell on him.

Dock plates should be anchored to prevent slipping.

31. An assistant superintendent was installing a conveyor belt. The ladder, on which he was standing, slipped and he fell, fracturing a vertebra.

Generally, ladders should not be used in maintenance work. Instead, suitable working platforms with guard-rails and toeboards should be provided.

32. An employee was unloading 100-pound bags of flour from a boxcar. He slipped on some loose paper and fell. Investigation disclosed that the paper had been placed on the car floor before the bags of flour were loaded.

Good housekeeping is essential to safety. In this case, the paper should have been removed as the unloading progressed. Adequate supervision should be supplied to enforce good housekeeping practices.

33. An oiler was greasing the gears of a wheat conveyor while it was being used. His fingers were amputated in the gears. Investigation disclosed that the oiler had removed the guard to grease the gears.

When in motion, machinery should never be oiled or greased by hand. If greasing is necessary when machinery is in motion, a pressure system should be installed so that removal of guards in unnecessary.

34. A packer was removing cardboard from storage. One of the pieces of cardboard projected about 1 foot from the pile. The warehouseman stepped on this overhang and fell.

Poor piling practice is indicated. Piles should be set back as the height of the pile increases. Overhangs should not be permitted.

35. An employee stepped from the elevator into a dark basement. While trying to find the light switch he stepped on a nail projecting from a board.

Investigation disclosed that (a) the light switch was on the wall near a door, approximately 12 feet from the elevator, and (b) the board had been discarded by the maintenance crew.

(a) A two-way light switch should be installed near the elevator door.

(b) Good housekeeping is essential to safety in any operation. A regular cleaning schedule should be developed and followed strictly. In addition, employees should be trained to place discarded materials in trash boxes supplied for that purpose. Supervisors should be required to enforce these housekeeping practices rigidly.

36. A night watchman slipped from a freight elevator and fell 4 feet, fracturing his hip. Investigation disclosed that neither the elevator hoistway nor cage had gates and that the watchman, thinking the elevator was near the floor level, stepped off in the dark.

Elevator hoistways and cages should be equipped with gates as required by the American Standard Safety Code for Elevators, Dumbwaiters, and Escalators.

37. An employee was moving furniture in an elevator as it was ascending. His foot was crushed between the elevator cage and the hoistway. Investigation disclosed that the cage was not equipped with a gate.

(a) Car gates should be installed on the elevator cage.

(b) The sill plate at the shaftway door should be beveled. In this case, the beveled sill would have pushed the employee's foot back into the car.

38. A warehouseman was pulling a bale of cotton from a pile. He slipped and fell against a bale, cutting his hand on one of the bands. Investigation disclosed that (a) the floor of the warehouse was littered with scraps of cotton and (b) the end of one of the bands projected from the bale.

(a) Good housekeeping is essential to safety. A regular cleaning schedule should be developed and followed strictly. In addition, employees should be trained to remove promptly any material dropped while it is being transferred. Supervisors should be required to enforce these procedures rigidly.

(b) Before moving bales of cotton to storage, they should be inspected and loose ends of steel strapping should be rolled.

39. The driver of a towmotor was injured when the towmotor fell from the warehouse loading platform. Investigation disclosed that the operator attempted to turn his towmotor on the platform without slowing down.

(a) The platform should be equipped with a toeboard.

(b) All employees should be carefully instructed in the safe performance of their duties. In addition, adequate supervision should be provided to enforce safe procedures. In this case, the driver should have slowed his towmotor before making the turn.

40. An employee fractured his ankle when he stepped into a hole on a concrete loading platform. Investigation disclosed that the concrete platform had cracked and the hole developed as a result of the extensive use of handtrucks.

Periodic inspections of the premises and adequate maintenance are necessary to prevent accidents of this type. In this case the cracked concrete platform should have been repaired before the hole developed.

41. A packer was placing a metal strap around a crate. When he swung the strapping over the crate, it struck and lacerated his leg.

All workmen should be carefully trained in the safe performance of their duties. In this case, the strap should first be placed under the crate and then wrapped over the top and fastened.

42. A warehouse laborer was unloading frozen meat from a boxcar. When he opened the car door, a piece of meat weighing 100 pounds fell from the car and struck his head. Investigation disclosed that the load had shifted during transit.

A car-door puller should be provided for opening boxcar doors. With that device, workmen may stand in the clear while opening boxcar doors.

43. An employee was unloading drums of oil from a railroad car. His foot slipped off the edge of the platform and he fell between the platform and the car. Investigation disclosed that the platform was not defective nor slippery and that the workman had evidently misjudged his step.

A 4-inch angle iron toeboard should be installed on the platform.

APPENDIX--STATISTICAL TABLES

The injury-frequency rate is the average number of disabling work injuries for each million employee-hours worked. A disabling work injury is any injury which (a) results in death or any degree of permanent physical impairment, or (b) makes the injured worker unable to perform the duties of any regularly established job, which is open and available to him, throughout the hours corresponding to his regular shift on any 1 or more days after the day of injury (including Sundays, days off, or plant shutdowns).

The severity rate is the average number of days lost for each 1,000 employee-hours worked. The computations of days lost include standard time charges for fatalities and permanent disabilities as listed in the American Standard Method of Compiling Industrial Injury Rates, approved by the American Standards Association, 1945.

Table 1.--Work-injury rates for warehousemen, 1950, classified by type of warehouse and occupation.

Type of warehouse and occupation	Number of warehouses	Number of employees	Employee-hours worked (thousands)	Injury-frequency rates of--				Injury-severity		
				All disabling injuries	Deaths	Permanent-partial disabilities	Temporary-total disabilities	Average time lost per--		Severity rate
								Disabling injury (days)	Temporary-total disability (days)	
Total 1/	2,695	31,956	65,095	31.0	0.1	1.3	29.6	71	13	2.2
TYPE OF WAREHOUSE										
Farm products, total	934	8,503	16,258	25.0	.1	1.0	23.9	67	15	1.7
Cotton	478	5,691	1,014	26.7	.1	1.1	25.5	73	14	1.9
Grain	456	2,812	6,120	22.1	-	.8	21.3	54	16	1.2
Household goods	913	5,132	10,872	21.0	.2	2.1	18.7	184	15	3.9
Merchandise, total 1/	515	10,201	20,775	33.0	.1	1.3	31.6	64	13	2.1
Canned goods	44	772	1,467	39.5	.7	.7	38.1	119	11	4.7
Flour and grain-mill products	27	641	1,387	26.0	.7	2.2	23.1	322	17	8.4
General	237	4,559	9,310	29.2	-	.8	28.4	46	14	1.3
Refrigerated, total 1/	304	7,278	15,249	39.7	.1	1.0	38.6	39	12	1.6
Food products	262	6,139	12,858	40.9	.1	.8	40.0	37	12	1.5
General	39	1,105	2,318	34.5	-	2.6	31.9	50	11	1.7
OCCUPATION										
Operators, total 1/	3,373	18,713	38,269	40.5	.2	1.6	38.7	75	13	3.0
Compress operators	18	270	561	48.2	-	5.4	42.8	143	10	6.9
Coolermen	64	465	943	85.9	-	1.1	84.8	17	11	1.5
Engineers, refrigerating	249	954	2,164	18.9	.5	1.4	17.0	200	21	3.8
Food processors	41	265	432	13.9	-	4.6	9.3	725	12	10.1
Freezermen	133	782	1,622	61.7	-	-	61.7	10	10	.6
Grain elevatormen	161	406	936	21.4	-	1.1	20.3	28	13	.6
Handlers and stackers	247	1,378	2,851	51.6	-	.4	51.2	34	9	1.9
Ice handlers	93	438	946	76.1	-	-	76.1	14	14	1.1
Order fillers	66	274	550	34.6	-	-	34.6	5	5	.2
Packers and craters	350	1,121	2,330	35.6	.4	3.4	31.8	227	18	8.1
Warehousemen, general	1,939	12,296	24,842	38.2	.2	1.8	36.2	76	14	2.9
Materials-movement, total	688	3,263	6,260	36.7	-	1.1	35.6	36	10	1.3
Elevator operators	106	300	630	27.0	-	-	27.0	15	15	.4
Forklift operators	329	951	1,945	26.2	-	2.1	24.1	105	13	2.8
Handtruckers	253	2,012	3,685	44.0	-	.8	43.2	16	8	.7
Other, total 1/	3,085	9,980	20,565	11.8	2/	.6	11.2	79	15	.9
Checkers	443	1,158	2,398	23.4	-	.4	23.0	20	15	.5
Clerical, except checkers	1,306	5,536	11,552	2.0	-	.1	1.9	23	10	2/
Janitors	262	414	790	11.4	-	2.5	8.9	105	7	1.2
Maintenance workers	633	1,413	2,927	37.2	-	1.7	35.5	56	13	2.1
Watchmen	366	963	2,049	9.8	.5	1.0	8.3	473	18	4.6

1/ Includes figures not shown separately because of insufficient data.

2/ Less than 0.05.

Table 2.--Work-injury frequency rates for warehousemen, 1950, classified by geographic region, State, and type of warehouse.

Geographic region and State	Total--all warehouses	Farm-products warehouses	Household-goods warehouses	Merchandise warehouses	Refrigerated warehouses
Total	31.0	25.0	21.0	33.0	39.7
New England region, total	30.3	-	-	30.9	-
Massachusetts	28.0	-	-	-	-
Middle Atlantic region, total	30.3	-	19.7	37.5	26.3
New Jersey	41.7	-	-	54.2	-
New York	29.9	-	24.7	36.5	25.3
Pennsylvania	24.2	-	-	27.1	27.2
East North Central region, total	24.4	18.3	13.3	29.1	27.9
Illinois	24.2	23.0	-	27.8	24.4
Indiana	31.4	-	-	43.4	-
Michigan	25.8	-	-	-	-
Ohio	17.6	-	-	-	-
Wisconsin	26.5	-	-	-	-
West North Central region, total	34.3	19.3	-	32.0	58.0
Iowa	22.4	-	-	-	-
Kansas	32.1	-	-	-	-
Minnesota	36.6	-	-	-	-
Missouri	49.0	-	-	-	-
South Atlantic region, total	26.3	17.0	34.2	30.6	26.7
Georgia	19.3	-	-	-	-
North Carolina	18.2	-	-	-	-
Virginia	24.6	-	-	-	-
East South Central region, total	20.1	20.4	-	-	-
Alabama	8.3	-	-	-	-
Mississippi	29.5	30.3	-	-	-
West South Central region, total	40.5	29.1	-	29.8	-
Louisiana	38.0	-	-	-	-
Oklahoma	23.2	-	-	-	-
Texas	49.6	34.4	-	-	-
Mountain region, total	37.2	37.3	-	-	-
Pacific region, total	34.4	-	21.7	35.6	44.5
California	33.7	-	19.9	38.9	43.3
Washington	38.1	-	-	-	-

Note: Data from which these rates were worked are available on request to the Bureau of Labor Statistics, U. S. Department of Labor, Washington 25, D. C.

Table 3.--Work-injury rates for warehousemen, 1950, classified by metropolitan area.

Metropolitan area	Number of warehouses	Number of employees	Employee-hours worked (thousands)	Injury-frequency rates of--				Injury-severity		
				All disabling injuries	Deaths	Permanent-partial disabilities	Temporary-total disabilities	Average time lost per--		Severity rate
								Disabling injury (days)	Temporary-total disability (days)	
Total 1/	2,695	31,956	65,095	31.0	0.1	1.3	29.6	71	13	2.2
Boston, Mass.	95	472	1,019	25.5	-	-	25.5	12	12	.3
Buffalo, N. Y.	82	501	1,024	29.3	-	-	29.3	11	11	.3
Chicago, Ill., total 1/	264	1,970	3,872	23.8	.3	1.0	22.5	94	11	2.2
Merchandise warehouses	83	770	1,409	27.0	-	.7	26.3	18	10	.5
Cold-storage warehouses	71	722	1,479	27.0	-	2.0	25.0	43	9	1.1
Kansas City, Mo.	63	542	1,106	50.6	.9	.9	48.8	129	17	6.5
Los Angeles, Calif.	190	1,048	2,148	25.6	-	-	25.6	11	11	.3
Minneapolis-St. Paul, Minn.	67	528	1,108	50.5	-	-	50.5	7	7	.4
New Orleans, La.	79	655	1,314	40.4	-	1.5	38.9	30	13	1.2
New York-Northeastern New Jersey, total 1/	438	2,641	5,381	34.8	.2	3.9	30.7	153	16	5.3
Merchandise warehouses	157	1,536	3,118	44.6	-	3.5	41.1	67	12	3.0
Household goods warehouses	217	843	1,728	21.4	.6	5.8	15.0	508	25	10.9
Philadelphia, Pa., total 1/	174	1,223	2,434	32.5	-	.4	32.1	17	13	.6
Merchandise warehouses	59	673	1,340	29.8	-	.7	29.1	21	14	.6
San Antonio, Tex.	22	519	1,284	66.2	-	-	66.2	9	9	.6

1/ Includes figures not shown separately because of insufficient data.

Table 4.--Work-injury frequency rates for warehousemen, 1950, classified by occupation and by type of warehouse.

Occupation	Total-all warehouses	Farm-products warehouses	Household-goods warehouses	Merchandise warehouses	Refrigerated warehouses
Total	31.0	25.0	21.0	33.0	39.7
Operators, total	40.5	24.7	36.3	46.0	47.3
Compress operators	48.2	48.2	-	-	-
Coolermen	85.9	-	-	-	88.5
Engineers, refrigerating	18.9	-	-	-	19.1
Freezermen	61.7	-	-	-	60.7
Grain-elevatormen	21.4	22.0	-	-	-
Handlers and stackers	51.6	28.6	-	28.2	53.4
Ice handlers	76.1	-	-	-	76.1
Packers and craters	35.6	-	36.7	-	-
Warehousemen, general	38.2	22.9	36.9	49.7	41.7
Materials movement, total	36.7	37.1	-	38.8	44.4
Forklift operators	26.2	18.7	-	26.7	-
Handtruckers	44.0	41.2	-	57.9	-
Other, total	11.8	9.7	2.1	7.2	10.8
Checkers	23.4	-	-	19.9	42.2
Clerical, except checkers	2.0	4.9	1.0	2.8	-
Janitors	11.4	-	-	7.4	-
Maintenance workers	37.2	22.2	-	40.5	30.7
Watchmen	9.8	10.7	-	9.1	-

Table 5.--Disabling work injuries to warehousemen of 274 warehouses, 1950, classified by nature of injury, part of body injured, and type of warehouse.

Nature of injury and part of body injured	Total--all warehouses 1/		Farm-products warehouses		Household-goods warehouses		Merchandise warehouses		Refrigerated warehouses	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	1,604	100.0	222	100.0	123	100.0	740	100.0	509	100.0
NATURE OF INJURY										
Strains, sprains	543	33.8	76	34.2	43	34.9	252	34.2	168	33.0
Bruises, contusions	475	29.6	61	27.5	29	23.6	212	28.6	169	33.1
Cuts, lacerations	240	15.0	34	15.3	27	22.0	120	16.2	59	11.6
Fractures	230	14.3	32	14.4	21	17.1	112	15.1	63	12.4
Hernias	41	2.6	4	1.8	1	.8	14	1.9	22	4.3
Amputations	18	1.1	6	2.7	1	.8	8	1.1	3	.6
Foreign bodies, N.E.C.	16	1.0	4	1.8	-	-	7	.9	5	1.0
Burns and scalds	19	1.2	2	.9	-	-	6	.8	11	2.2
Other	22	1.4	3	1.4	1	.8	9	1.2	9	1.8
PART OF BODY INJURED										
Lower extremities	544	34.0	57	25.7	45	36.6	252	34.1	185	36.3
Leg	173	10.8	29	13.0	11	8.9	78	10.5	55	10.8
Foot	227	14.2	21	9.5	26	21.2	101	13.7	76	14.9
Toe	144	9.0	7	3.2	8	6.5	73	9.9	54	10.6
Trunk	512	31.9	74	33.3	38	30.9	242	32.7	156	30.6
Back	302	18.9	43	19.2	21	17.1	147	19.8	89	17.4
Chest	69	4.3	9	4.1	9	7.3	36	4.9	15	2.9
Abdomen	63	3.9	7	3.2	1	.8	22	3.0	33	6.5
Shoulder	52	3.2	11	5.0	4	3.3	23	3.1	14	2.8
Hips, pelvis	15	.9	-	-	2	1.6	9	1.2	4	.8
Other	11	.7	4	1.8	1	.8	5	.7	1	.2
Upper extremities	408	25.4	72	32.4	33	26.8	176	23.8	127	25.0
Arm	69	4.3	15	6.8	7	5.7	26	3.5	21	4.1
Hand	136	8.5	27	12.2	8	6.5	54	7.3	47	9.2
Finger	203	12.6	30	13.4	18	14.6	96	13.0	59	11.7
Head	96	6.0	14	6.3	4	3.3	49	6.6	29	5.7
Eye	43	2.7	10	4.5	2	1.7	18	2.4	13	2.5
Brain, skull	17	1.1	-	-	1	.8	13	1.8	3	.6
Other	36	2.2	4	1.8	1	.8	18	2.4	13	2.6
Body, general	44	2.7	5	2.3	3	2.4	21	2.8	12	2.4

1/ Includes figures not shown separately because of insufficient information to classify.

Table 6.--Disabling work injuries to warehousemen of 274 warehouses, 1950, classified by nature of injury, part of body injured, and agency of injury.

Part of body injured and agency of injury	Total number of injuries	Strains, sprains	Bruises, contusions	Cuts, lacerations	Fractures	Hernias	Amputations	Foreign bodies, N.E.C.	Burns and scalds	Other
Total	1,604	543	475	240	230	41	18	16	19	22
PART OF BODY INJURED										
Lower extremities	544	115	224	65	132	-	2	-	3	3
Leg	173	48	79	30	14	-	-	-	2	-
Foot	227	64	91	28	40	-	-	-	1	3
Toe	144	3	54	7	78	-	2	-	-	-
Trunk	512	349	90	2	27	41	-	-	-	3
Back	302	273	26	-	2	-	-	-	-	1
Chest	69	16	33	1	18	-	-	-	-	1
Abdomen	63	15	6	-	-	41	-	-	-	1
Shoulder	52	34	14	-	4	-	-	-	-	-
Hips, pelvis	15	8	4	1	2	-	-	-	-	-
Other	11	3	7	-	1	-	-	-	-	-
Upper extremities	408	75	94	147	65	-	15	-	5	7
Arm	69	20	20	16	8	-	-	-	1	4
Hand	136	46	30	39	16	-	-	-	4	1
Finger	203	9	44	92	41	-	15	-	-	2
Head	96	1	35	26	5	-	1	16	10	2
Eye	43	-	7	10	-	-	-	16	9	1
Brain, skull	17	-	9	6	2	-	-	-	-	-
Other	36	1	19	10	3	-	1	-	1	1
Body, general	44	3	32	-	1	-	-	-	1	7
AGENCY OF INJURY										
Containers	484	241	123	49	51	19	1	-	-	-
Boxes, cases	220	108	67	19	18	7	1	-	-	-
Other	264	133	56	30	33	12	-	-	-	-
Vehicles	220	49	101	24	41	2	3	-	-	-
Powered	55	16	16	9	12	-	2	-	-	-
Hand	143	28	75	11	26	2	1	-	-	-
Railroad cars	22	5	10	4	3	-	-	-	-	-
Working surfaces	180	49	72	21	35	2	-	-	-	1
Floors	109	31	42	14	20	1	-	-	-	1
Other	71	18	30	7	15	1	-	-	-	-
Metal parts	108	22	26	34	24	1	1	-	-	-
Bodily motions	82	64	8	-	6	4	-	-	-	-
Handtools	55	9	11	27	7	1	-	-	-	-
Ice	42	11	15	1	12	3	-	-	-	-
Lumber	42	12	12	14	4	-	-	-	-	-
Machines	42	5	10	14	6	-	7	-	-	-
Furniture	41	23	5	4	7	2	-	-	-	-
Pallets, skids	33	7	11	7	6	2	-	-	-	-
Foodstuffs	26	7	12	1	4	2	-	-	-	-
Chemicals	22	-	-	-	-	-	-	-	13	9
Elevators	22	3	8	4	5	-	2	-	-	-
Rolls of paper	20	5	11	-	4	-	-	-	-	-
Conveyors	18	1	9	3	2	-	3	-	-	-
Doors	18	6	4	4	4	-	-	-	-	-
Foreign bodies	17	-	-	1	-	-	-	16	-	-
Other	125	27	36	29	12	2	1	-	6	12
Unclassified; insufficient data	7	2	1	3	-	1	-	-	-	-

Table 7.--Work accidents to warehousemen of 274 warehouses, 1950, classified by activity, agency of injury, and accident type.

Agency of injury and accident type	Total number of accidents1/	Handling materials	Operating or using equipment				Walking, standing, etc.	Other
			Total	Vehicles	Hand-tools	Other		
Total	1,604	934	353	201	98	54	257	7
AGENCY OF INJURY								
Containers	484	437	25	20	3	2	12	-
Boxes, cases	220	201	12	11	1	-	2	-
Other	264	236	13	9	2	2	10	-
Vehicles	220	55	119	114	5	-	38	-
Powered	55	11	24	20	4	-	18	-
Hand	143	34	90	90	-	-	13	-
Railroad cars	22	10	5	4	1	-	7	-
Working surfaces	180	61	25	16	9	-	90	-
Floors	109	34	11	6	5	-	61	-
Other	71	27	14	10	4	-	29	-
Metal parts	108	87	14	6	6	2	5	-
Bodily motions	82	30	5	4	-	1	46	-
Handtools	55	6	45	-	45	-	4	-
Ice	42	35	5	-	2	3	2	-
Lumber	42	27	3	-	2	1	7	1
Machines	42	7	34	-	1	33	1	-
Furniture	41	34	3	3	-	-	3	1
Pallets, skids	33	24	5	5	-	-	2	-
Foodstuffs	26	23	2	2	-	-	-	-
Other	242	107	67	30	25	12	47	5
Unclassified; insufficient data	7	1	1	1	-	-	-	-
ACCIDENT TYPE								
Struck by moving objects	490	296	129	64	56	9	39	3
Falling objects	341	252	47	34	8	5	23	1
From hands of workmen	124	104	12	8	1	3	6	-
From equipment	93	55	29	23	4	2	5	1
From piles of materials	75	65	1	1	-	-	3	-
From other positions	49	28	5	2	3	-	9	-
Hand-operated or wielded objects	75	17	52	27	25	-	4	1
Flying or thrown objects	35	8	20	1	15	4	3	1
Power-driven equipment	15	-	8	2	6	-	6	-
Other moving objects	24	19	2	-	2	-	3	-
Overexertion due to	374	355	19	9	9	1	-	-
Lifting objects	273	273	-	-	-	-	-	-
Other activities	101	82	19	9	9	1	-	-
Caught in, on, or between	265	108	116	88	9	19	32	-
A vehicle and another object	107	12	72	72	-	-	18	-
Handled objects	60	54	5	1	4	-	-	-
Moving parts of equipment	55	15	28	5	4	19	10	-
Other objects	43	27	11	10	1	-	4	-
Falls	195	53	30	20	9	1	108	-
To lower levels	112	27	12	8	4	-	70	-
On same levels	83	26	18	12	5	1	38	-
Striking against	150	75	43	15	11	17	29	-
Bumping into objects	96	44	37	13	7	17	13	-
Rubbing against objects	36	29	5	1	4	-	1	-
Other	18	2	1	1	-	-	15	-
Slips and stumbles (not falls)	77	27	5	4	-	1	45	-
Inhalation, absorption	26	9	8	-	3	5	1	3
Other accident types	21	11	2	-	1	1	3	1
Unclassified; insufficient data	6	-	1	1	-	-	-	-

1/ Includes figures not shown separately because of insufficient information to classify.

Table 8.--Work accidents to warehousemen of 274 warehouses, 1950, classified by agency of injury, accident type, and type of warehouse.

Agency of injury and accident type	Total--all warehouses 1/		Farm-products warehouses		Household-goods warehouses		Merchandise warehouses		Refrigerated warehouses	
	Number	Percent 2/	Number	Percent 2/	Number	Percent 2/	Number	Percent 2/	Number	Percent 2/
Total	1,604	100.0	222	100.0	123	100.0	740	100.0	509	100.0
AGENCY OF INJURY										
Containers	484	30.3	78	35.5	30	24.4	222	30.2	152	29.9
Boxes, cases	220	13.8	3	1.4	26	21.1	109	14.8	82	16.1
Other	264	16.5	75	34.1	4	3.3	113	15.4	70	13.8
Vehicles	220	13.8	19	8.6	15	12.2	128	17.4	57	11.2
Powered	55	3.4	4	1.8	6	4.9	34	4.6	11	2.2
Hand	143	9.0	12	5.4	9	7.3	81	11.0	40	7.8
Railroad cars	22	1.4	3	1.4	-	-	13	1.8	6	1.2
Working surfaces	180	11.3	32	14.5	13	10.6	81	11.0	51	10.0
Floors	109	6.9	14	6.4	11	9.0	47	6.4	36	7.0
Other	71	4.4	18	8.1	2	1.6	34	4.6	15	3.0
Metal parts	108	6.8	9	4.1	3	2.4	85	11.5	11	2.2
Bodily motions	82	5.1	5	2.3	8	6.5	35	4.8	32	6.3
Handtools	55	3.4	15	6.8	6	4.9	11	1.5	22	4.3
Ice	42	2.6	-	-	-	-	-	-	42	8.3
Lumber	42	2.6	13	5.9	3	2.4	20	2.7	6	1.2
Machines	42	2.6	20	9.1	4	3.3	9	1.2	9	1.8
Furniture	41	2.6	1	.5	23	18.7	14	1.9	3	.6
Pallets, skids	33	2.1	-	-	1	.8	22	3.0	10	2.0
Foodstuffs	26	1.6	-	-	-	-	-	-	26	5.1
Other	242	15.2	28	12.7	17	13.8	109	14.8	87	17.1
Unclassified; insufficient data	7	-	2	-	-	-	4	-	1	-
ACCIDENT TYPE										
Struck by moving objects	490	30.7	71	32.2	36	29.3	236	32.0	145	28.5
Falling objects	341	21.4	38	17.2	27	22.0	166	22.5	109	21.4
From hands of workmen	124	7.8	20	9.0	12	9.7	50	6.8	41	8.1
From equipment	93	5.8	7	3.2	5	4.1	53	7.2	28	5.5
From piles of material	75	4.7	9	4.1	6	4.9	37	5.0	23	4.5
From other positions	49	3.1	2	.9	4	3.3	26	3.5	17	3.3
Hand-operated or wielded objects	75	4.7	18	8.2	6	4.9	34	4.6	17	3.3
Flying or thrown objects	35	2.2	9	4.1	1	.8	16	2.2	9	1.8
Power-driven equipment	15	.9	2	.9	2	1.6	6	.8	5	1.0
Other moving objects	24	1.5	4	1.8	-	-	14	1.9	5	1.0
Overexertion due to	374	23.4	52	23.6	27	22.0	168	22.8	125	24.6
Lifting objects	273	17.1	33	15.0	21	17.1	121	16.4	97	19.1
Other activities	101	6.3	19	8.6	6	4.9	47	6.4	28	5.5
Caught in, on, or between	265	16.6	33	15.0	17	13.8	122	16.6	92	18.1
A vehicle and another object	107	6.7	5	2.3	5	4.1	56	7.7	40	7.9
Handled objects	60	3.8	4	1.8	7	5.6	28	3.8	21	4.1
Moving parts of equipment	55	3.4	18	8.2	1	.8	18	2.4	18	3.5
Other objects	43	2.7	6	2.7	4	3.3	20	2.7	13	2.6
Falls	195	12.2	36	16.4	15	12.2	84	11.4	57	11.2
To lower levels	112	7.0	21	9.6	9	7.3	54	7.3	25	4.9
On same levels	83	5.2	15	6.8	6	4.9	30	4.1	32	6.3
Striking against	150	9.4	18	8.2	18	14.6	77	10.4	37	7.3
Bumping into objects	96	6.0	14	6.4	10	8.1	47	6.4	25	4.9
Rubbing against objects	36	2.3	2	.9	5	4.1	21	2.8	8	1.6
Other	18	1.1	2	.9	3	2.4	9	1.2	4	.8
Slips and stumbles(not falls)	77	4.8	5	2.3	7	5.7	33	4.5	30	5.9
Inhalation, absorption	26	1.6	2	.9	1	.8	13	1.8	10	2.0
Other accident types	21	1.3	3	1.4	2	1.6	4	.5	12	2.4
Unclassified; insufficient data	6	-	2	-	-	-	3	-	1	-

1/ Includes figures not shown separately because of insufficient information to classify.
2/ Percents are computed on classified cases only.

Table 9.--Work accidents to warehousemen of 274 warehouses, 1950, classified by accident type and agency of injury.

Accident type	Total number of accidents	Containers	Vehicles	Working surfaces	Metal parts	Bodily motions	Hand tools	Ice	Lumber	Machines	Furniture	Pallets, skids	Foodstuffs	Other	Unclassified
Total	1,604	484	220	180	108	82	55	42	42	42	41	33	26	242	7
Struck by moving objects	490	170	61	14	56	-	33	24	22	2	10	15	16	67	-
Falling objects	341	154	14	14	46	-	4	20	16	2	9	15	16	31	-
From hands of workmen	124	45	8	9	18	-	1	5	9	2	5	7	9	6	-
From equipment	93	46	1	-	23	-	1	5	3	-	3	-	4	7	-
From piles of materials	75	59	-	-	2	-	-	-	-	-	1	4	3	6	-
From other positions	49	4	5	5	3	-	2	10	4	-	-	4	-	12	-
Hand-operated or wielded objects	75	2	38	-	3	-	25	-	1	-	1	-	-	5	-
Flying or thrown objects	35	3	-	-	6	-	-	1	4	-	-	-	-	21	-
Power driven objects	15	-	6	-	-	-	4	-	-	-	-	-	-	5	-
Other moving objects	24	11	3	-	1	-	-	3	1	-	-	-	-	5	-
Overexertion due to	374	226	23	4	22	-	8	12	9	5	22	7	8	27	1
Lifting objects	273	181	5	4	21	-	1	6	8	3	17	4	7	15	1
Other activities	101	45	18	-	1	-	7	6	1	2	5	3	1	12	-
Caught in, on, or between	265	55	186	1	4	-	6	5	1	16	3	6	-	62	-
A vehicle and another object	107	2	82	-	-	-	-	-	-	-	-	1	-	22	-
Handled objects	60	39	1	1	3	-	4	1	-	1	2	3	-	5	-
Moving parts of equipment	55	1	14	-	-	-	1	-	-	15	-	-	-	24	-
Other objects	43	13	9	-	1	-	1	4	1	-	1	2	-	11	-
Falls	195	1	14	154	1	-	1	1	1	1	-	2	-	19	-
To lower levels	112	-	4	96	1	-	-	-	-	-	-	1	-	10	-
From vehicles	24	-	1	23	-	-	-	-	-	-	-	-	-	-	-
From platforms, scaffolds	21	-	-	21	-	-	-	-	-	-	-	-	-	-	-
From piled materials	20	-	1	18	-	-	-	-	-	-	-	1	-	-	-
From other elevations	47	-	2	34	1	-	-	-	-	-	-	-	-	10	-
On same level	83	1	10	58	-	-	1	1	1	1	-	1	-	9	-
Striking against	159	31	16	7	25	-	7	-	9	18	5	3	2	27	-
Bumping into objects	96	22	14	1	11	-	3	-	1	18	3	3	2	18	-
Equipment	41	-	14	-	-	-	2	-	-	18	1	2	-	4	-
Projecting nails, slivers	25	15	-	-	2	-	1	-	1	-	2	1	1	2	-
Other objects	30	7	-	1	9	-	-	-	-	-	-	-	1	12	-
Rubbing against objects	36	9	1	-	14	-	4	-	2	-	2	-	-	4	-
Other	18	-	1	6	-	-	-	-	6	-	-	-	-	5	-
Slips and stumbles (not falls)	77	-	-	-	-	77	-	-	-	-	-	-	-	-	-
Inhalation, absorption	26	-	-	-	-	-	-	-	-	-	-	-	-	26	-
Other accident types	21	1	-	-	-	5	-	-	-	-	1	-	-	14	-
Unclassified; insufficient data	6	-	-	-	-	-	-	-	-	-	-	-	-	-	6

Table 10.--Work accidents to warehousemen of 216 warehouses, 1950,

classified by hazardous working condition and agency of accident

Hazardous working conditions	Total number of accidents	Containers	Working surfaces	Vehicles	Metal parts	Machines	Piles of materials	Furniture	Conveyors	Ice	Hand-tools	Elevators	Ladders	Other	Unclassified
Total	1,331	293	152	123	46	41	25	23	20	20	17	16	14	126	415
Hazardous working procedures	316	198	5	16	19	4	2	19	4	11	-	-	-	38	-
Lifting or moving heavy objects	281	179	5	13	19	4	-	18	-	11	-	-	-	32	-
Lifting objects to high places	26	19	-	-	-	-	-	1	4	-	-	-	-	2	-
Other	9	-	-	3	-	-	2	-	-	-	-	-	-	4	-
Defects of agencies	238	39	75	53	20	2	-	3	1	2	1	3	1	38	-
Slippery	75	3	55	12	-	-	-	-	-	-	-	-	-	5	-
Sharp-edged, rough, slivered	58	18	10	4	18	-	-	-	-	-	-	-	-	8	-
Improperly designed or constructed	44	2	4	28	-	2	-	1	1	-	-	1	-	5	-
Hidden defects, cracked, worn	39	8	1	8	2	-	-	-	-	2	1	2	1	14	-
Projecting nails, wires, etc	22	8	5	1	-	-	-	2	-	-	-	-	-	6	-
Improperly guarded agencies	165	2	29	36	-	32	13	-	15	-	8	11	7	12	-
Lack of guardrails, gates, etc	59	-	19	11	-	1	13	-	4	-	-	9	-	2	-
Lack of point-of-operation enclosures	37	-	-	-	-	28	-	-	1	-	8	-	-	-	-
Lack of anchors, locks, etc	34	2	10	6	-	2	-	-	3	-	-	2	-	9	-
Lack of handle guards	15	-	-	15	-	-	-	-	-	-	-	-	-	-	-
Lack of enclosures for gears, pulleys etc.	13	-	-	4	-	1	-	-	7	-	-	-	-	1	-
Other	7	-	-	-	-	-	-	-	-	-	-	-	7	-	-
Hazardous arrangement	139	54	8	16	6	-	10	1	-	7	2	1	6	28	-
Unsafely stored or piled	85	50	1	1	6	-	7	1	-	-	2	-	-	17	-
Unsafe layout of operations	41	4	7	15	-	-	3	-	-	7	-	1	-	4	-
Other	13	-	-	-	-	-	-	-	-	-	-	-	6	7	-
Poor housekeeping	31	-	30	1	-	-	-	-	-	-	-	-	-	-	-
Lack of personal safety equipment	20	-	-	-	1	3	-	-	-	-	6	-	-	10	-
Other	7	-	5	1	-	-	-	-	-	-	-	1	-	-	-
Unclassified; insufficient data	415	-	-	-	-	-	-	-	-	-	-	-	-	-	415

Table 11.--Work accidents to warehousemen, 1950,

classified by hazardous working condition, unsafe act, and type of warehouse.

Hazardous working condition and unsafe act	Total--all warehouses 1/		Farm-products warehouses		Household-goods warehouses		Merchandise warehouses		Refrigerated warehouses	
	Number	Percent 2/	Number	Percent 2/	Number	Percent 2/	Number	Percent 2/	Number	Percent 2/
HAZARDOUS WORKING CONDITIONS (216 warehouses)										
Total	1,331	100.0	214	100.0	89	100.0	600	100.0	418	100.0
Hazardous working procedures	316	34.4	57	37.1	28	41.8	138	34.0	93	32.8
Lifting heavy objects	281	30.6	51	33.2	26	38.8	128	31.5	76	26.8
Lifting to high places	26	2.8	4	2.6	1	1.5	6	1.5	15	5.3
Other	9	1.0	2	1.3	1	1.5	4	1.0	2	.7
Defects of agencies	238	26.0	31	20.1	14	20.9	113	27.8	76	26.9
Slippery	75	8.2	9	5.9	4	6.0	22	5.4	40	14.2
Sharp-edged, rough	58	6.3	7	4.5	5	7.4	34	8.4	10	3.5
Improperly designed	44	4.8	4	2.6	1	1.5	29	7.1	8	2.8
Hidden defects, worn	39	4.3	6	3.9	1	1.5	21	5.2	11	3.9
Projecting nails, wires	22	2.4	5	3.2	3	4.5	7	1.7	7	2.5
Improperly guarded agencies	165	18.0	36	23.4	9	13.4	64	15.8	55	19.4
Lack of guardrails, gates	59	6.5	10	6.5	4	5.9	25	6.3	20	7.0
Lack of point-of-operation enclosures	37	4.0	15	9.8	4	6.0	9	2.2	9	3.2
Lack of anchors, locks	34	3.7	4	2.6	1	1.5	18	4.4	11	3.9
Lack of handle guards	15	1.6	2	1.3	-	-	3	.7	10	3.5
Lack of enclosures for gears, pulleys, etc.	13	1.4	2	1.3	-	-	6	1.5	5	1.8
Other	7	.8	3	1.9	-	-	3	.7	-	-
Hazardous arrangement	139	15.2	20	13.0	10	14.9	67	16.5	41	14.5
Unsafely stored or piled	85	9.3	11	7.2	8	11.9	46	11.4	20	7.1
Unsafe layout of operations	41	4.5	7	4.5	1	1.5	18	4.4	14	4.9
Other	13	1.4	2	1.3	1	1.5	3	.7	7	2.5
Poor housekeeping	31	3.4	4	2.6	4	6.0	16	3.9	7	2.5
Lack of personal safety equipment	20	2.2	5	3.2	1	1.5	6	1.5	8	2.8
Other	7	.8	1	.6	1	1.5	2	.5	3	1.1
Unclassified	415	-	60	-	22	-	194	-	135	-
UNSAFE ACTS (245 warehouses)										
Total	1,477	100.0	205	100.0	102	100.0	698	100.0	462	100.0
Using equipment unsafely	424	40.5	62	42.9	31	40.2	187	38.0	142	43.6
Taking wrong hold	183	17.5	33	22.7	16	20.7	77	15.7	56	17.2
Gripping insecurely	159	15.2	25	17.4	11	14.3	74	15.0	48	14.8
Pulling hand trucks	60	5.7	1	.7	2	2.6	27	5.5	30	9.2
Using hands instead of equipment	16	1.5	2	1.4	1	1.3	7	1.4	6	1.8
Other	6	.6	1	.7	1	1.3	2	.4	2	.6
Taking unsafe positions	383	36.7	61	42.4	30	39.0	168	34.1	120	36.9
Inattention to footing	161	15.4	26	18.0	15	19.5	72	14.6	46	14.1
Lifting with bent back	61	5.8	7	4.9	4	5.2	27	5.5	22	6.8
Inattention to surroundings	57	5.5	7	4.9	5	6.5	26	5.3	19	5.8
Exposure to moving equipment	29	2.8	5	3.5	1	1.3	9	1.8	13	4.0
Other	75	7.2	16	11.1	5	6.5	34	6.9	20	6.2
Unsafe loading or placing	106	10.1	7	4.9	10	13.0	55	11.2	33	10.2
Failing to secure or warn	50	4.8	2	1.4	4	5.2	33	6.7	11	3.4
Operating or working at unsafe speeds	48	4.6	8	5.6	1	1.3	29	5.9	10	3.1
Failing to wear personal safety equipment	27	2.6	3	2.1	1	1.3	16	3.3	7	2.2
Other	7	.7	1	.7	-	-	4	.8	2	.6
Unclassified	432	-	61	-	25	-	206	-	137	-

1/ Includes figures not shown separately because of insufficient information to classify.
2/ Percents are computed on classified cases only.

Table 12.--Work accidents to warehousemen of 245 warehouses, 1950, classified by unsafe act and accident type.

Unsafe acts	Total number of accidents	Struck by moving objects			Over-exertion	Caught in, on, or between	Falls			Striking against	Slips, stumbles	Inhalation, absorption	Contact with extreme temperatures	Other	Unclassified
		Total	Falling objects	Other			Total	To lower levels	On same level						
Total	1,477	459	317	142	324	257	181	109	72	136	71	24	12	8	5
Using equipment unsafely	424	154	113	41	68	141	6	2	4	46	6	2	-	1	-
Taking wrong hold of objects	183	20	4	16	44	92	1	-	1	25	-	-	-	1	-
Gripping objects insecurely	159	123	109	14	17	6	2	2	-	11	-	-	-	-	-
Pulling instead of pushing handtrucks	60	9	-	9	2	39	3	-	3	2	5	-	-	-	-
Using hands instead of equipment	16	1	-	1	4	4	-	-	-	6	1	-	-	-	-
Other	6	1	-	1	1	-	-	-	-	2	-	2	-	-	-
Taking unsafe positions or postures	383	60	28	32	74	60	112	76	36	33	39	-	1	4	-
Inattention to footing	161	16	14	2	-	10	89	58	31	6	39	-	1	-	-
Lifting with bent back	61	-	-	-	57	-	-	-	-	-	-	-	-	4	-
Inattention to surroundings	57	13	3	10	-	19	1	1	-	24	-	-	-	-	-
Exposure to moving equipment	29	7	1	6	-	22	-	-	-	-	-	-	-	-	-
Exposure to falling or rolling objects	14	6	5	1	6	2	-	-	-	-	-	-	-	-	-
Other	61	18	5	13	11	7	22	17	5	3	-	-	-	-	-
Unsafe loading or placing	106	76	73	3	6	17	2	2	-	4	-	-	1	-	-
Failing to secure or warn	50	24	11	13	1	24	-	-	-	-	-	-	-	-	1
Failure to look or block	29	14	11	3	1	14	-	-	-	-	-	-	-	-	-
Failure to warn	21	10	-	10	-	10	-	-	-	-	-	-	-	-	1
Operating or working at unsafe speeds	48	20	10	10	11	2	2	1	1	5	7	-	-	1	-
Throwing objects instead of passing	19	7	5	2	11	1	-	-	-	-	-	-	-	-	-
Other	29	13	5	8	-	1	2	1	1	5	7	-	-	1	-
Failing to wear personal safety equipment	27	4	-	4	1	2	2	2	-	17	-	1	-	-	-
Other	7	1	-	1	-	3	-	-	-	1	-	-	1	1	-
Unclassified; insufficient data	432	120	82	38	163	8	57	26	31	30	19	21	9	1	4

Table 13.--Work accidents to warehousemen of 245 warehouses, 1950, classified by unsafe act and activity.

Unsafe act	Total number of accidents 1/	Handling materials	Operating or using equipment				Walking, standing, etc.	Other
			Total	Vehicles	Hand-tools	Other		
Total	1,477	848	338	194	91	53	235	7
Using equipment unsafely	424	268	144	79	35	30	9	-
Taking wrong hold of objects	183	119	61	14	24	23	2	-
Gripping objects insecurely	159	136	16	6	9	1	5	-
Pulling instead of pushing hand-trucks	60	2	58	58	-	-	-	-
Using hands instead of equipment	16	8	6	-	-	6	2	-
Other	6	3	3	1	2	-	-	-
Taking unsafe positions or postures	383	172	85	52	27	6	119	-
Inattention to footing	161	74	10	10	-	-	75	-
Lifting with bent back	61	61	-	-	-	-	-	-
Inattention to surroundings	57	15	29	27	2	-	11	-
Exposure to moving equipment	29	2	10	4	2	4	14	-
Exposure to falling or rolling objects	14	10	3	-	2	1	1	-
Other	61	10	33	11	21	1	18	-
Unsafe loading or placing	106	61	33	29	2	2	7	1
Failing to secure or warn	50	26	4	2	1	1	13	-
Failure to lock or block	29	18	4	2	1	1	6	-
Failure to warn	21	8	-	-	-	-	9	-
Operating or working at unsafe speeds	48	22	13	8	3	2	12	-
Throwing objects instead of passing	19	17	-	-	-	-	2	-
Other	29	5	13	8	3	2	10	-
Failing to wear personal safety equipment	27	15	7	-	6	1	3	-
Other	7	1	3	-	1	2	1	1
Unclassified; insufficient data	432	283	49	24	16	9	69	5

1/ Includes figures not shown separately because of insufficient information to classify.

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