Injuries and Accident Causes in the Manufacture of Clay Construction Products

A Detailed Analysis of Hazards and of Injury Rates for 1948 by Region, Plant Size, and Operating Departments

Bulletin No. 1023

UNITED STATES DEPARTMENT OF LABOR

MAURICE J. TOBIN, *Secretary*

BUREAU OF LABOR STATISTICS

EWAN CLAGUE, *Commissioner*

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Letter of Transmittal

UNITED STATES DEPARTMENT OF LABOR,
BUREAU OF LABOR STATISTICS,
Washington, D. C., April 1, 1951.

The SECRETARY OF LABOR:

I have the honor to transmit herewith a report on the occurrence and causes of work injuries in the clay construction products industry.

This report, a portion of which appeared in the March 1950, Monthly Labor Review, constitutes a part of the Bureau's regular program of compiling work-injury information for use in accident-prevention work. The statistical analysis and the preparation of the report were performed in the Bureau's Branch of Industrial Hazards by Frank S. McElroy and George R. McCormack. The specific accident-prevention suggestions were prepared by the staff of the Safety Standards Division of the Bureau of Labor Standards.

EWAN CLAGUE, *Commissioner.*

Hon. MAURICE J. TOBIN,
Secretary of Labor.

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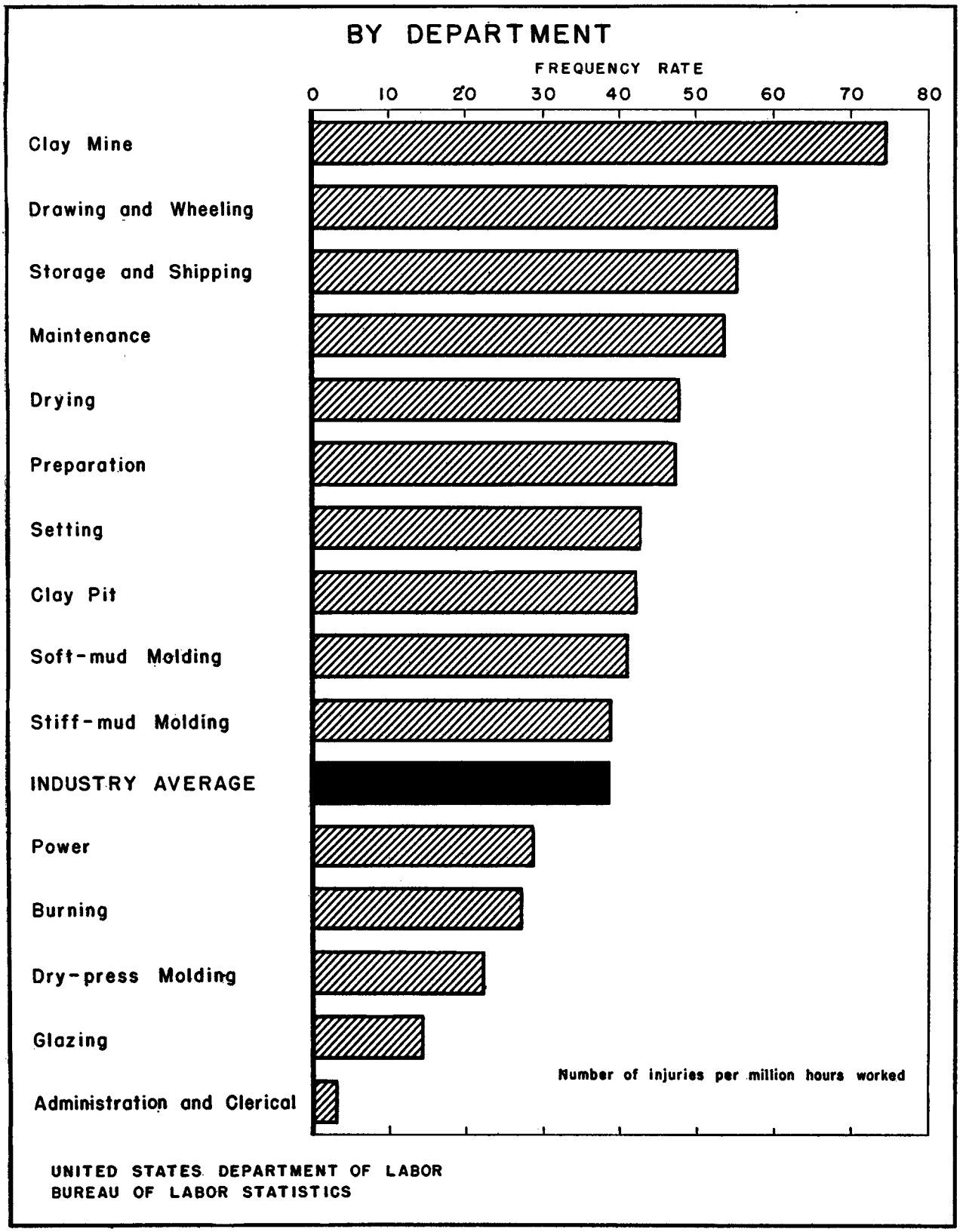

Injuries and Accident Causes in the Manufacture of Clay Construction Products

The Industry Record

The injury rate for the clay construction products industry in 1949 was lower than in any year since 1940. Nevertheless, the industry's average of 36.8 disabling [1] injuries per million employee-hours worked during 1949 was higher than for any other industry in the stone, clay, and glass group, and more than twice the all-manufacturing average of 15.0.[2] Only 5 of the 145 listed manufacturing industries had injury-frequency rates [3] higher than that of the clay construction products industry.

Four of the industries with higher injury rates in 1949—logging, sawmill, planing mill, and integrated saw-and-planing mill—were in the highly hazardous lumbering group. The fifth—boatbuilding—was in the transportation equipment group. In contrast, a number of manufacturing industries, commonly recognized as potentially hazardous, achieved much lower injury records. Among these were the explosives industry, with an injury-frequency rate of 1.8; aircraft manufacturing, 4.4; motor-vehicle manufacturing, 6.7; iron and steel manufacturing, 6.8; and cement manufacturing, 8.0.

[1] A disabling work injury is any injury occurring in the course of and arising out of employment, which (a) results in death or any degree of permanent-physical impairment, or (b) makes the injured person unable to perform the duties of any regularly established job, which is open and available to him, throughout the hours of his regular shift on any day after the day of injury, including Sundays, holidays, and periods of plant shut-down.

[2] Bureau of Labor Statistics press release, Work Injuries Decline in 1949, September 21, 1950.

[3] The injury-frequency rate is the average number of disabling work injuries for each million employee-hours worked. See chapter on Scope and Method for additional definitions.

In the years before World War II, the injury-frequency rate for the clay construction products industry generally fluctuated in the high 30's, whereas the all-manufacturing rate hovered at about 15. In 1942, wartime influences—shortages of trained workers, new equipment, repair parts, etc.—drove the clay construction products industry rate up to 47.1. In the following year it dropped to 42.9 and held at about this level through 1947. In 1948 it dropped to 38.6 and in 1949 fell again to 36.8. This represents a return to approximately the same level which prevailed in the prewar years. In all of these changes, the movement of the clay construction products rate closely paralleled that in the all-manufacturing rate, which also rose sharply in the early years of the war. After reaching a peak of 20.0 in 1943, the all-manufacturing rate gradually dropped to 17.2 in 1948 and then to 15.0 in 1949, at which point it was slightly below its 1939–40 level of 15.4 and 15.3.

Injury-frequency rate comparisons serve an important purpose in showing the existence of a safety problem and in indicating its relative magnitude. The abstract qualities of frequency rates, however, give injuries somewhat the status of bookkeeping entries and tend to obscure the fundamental human and economic factors of the problem. The suffering, despair, and frustration of injured workers and their families cannot be measured. Nor can the full monetary cost of accidents be determined from any available records. It is possible, however, to approximate the economic loss arising from injuries and thereby to bring the problem into better perspective.

An Estimate of the Injury Costs

In 1948, the year on which this detailed study was based, about 6,600 workers in the clay construction products industry were disabled by on-the-job injuries. This represents about 1 disabling injury for every 13 employees in the industry. About 35 of these injured workers died as a result of their injuries and 175 others were left with some degree of permanent-physical impairment. The remaining 6,390 suffered no permanent ill effects, but each was injured seriously enough to require at least a full day for recuperation.

Although no accurate records of the costs of these injuries are available, it is apparent that they represent a tremendous economic loss which must be absorbed by the injured workers, their employers, and ultimately by the consumers of the industry's products. The actual time lost by the injured workers during 1948 is estimated at about 132,000 man-days.

Time lost within the year, however, does not measure adequately the real work-loss resulting from injuries. Many of the seriously injured workers will find their earning ability reduced for the remainder of their lives. The loss for fatally injured workers is equivalent to the total earnings expected during the years in which they would have worked if their careers had not been cut short. If additional allowance were made for the future effects of the deaths and permanent impairments included in the total, the economic time-loss chargeable to the injuries experienced in 1948 would amount to 495,000 man-days. Evaluated on the basis of 1948 average earnings for production workers in the industry ($49.57 a week),[4] this represents a loss of $3½ million in present and future earnings. In part, this loss is covered by workmen's compensation payments financed by the employers, but since compensation payments are never equivalent to full wages, the injured workers and their dependents must bear a considerable portion of this loss.

In addition to wage losses, there are payments for medical and hospital care, and many indirect costs such as damage to materials and equipment, interrupted production schedules, the cost of training replacement workers, time lost by other workers who stopped to offer assistance at the time of the accident, and supervisory time spent caring for the injured or reorganizing operations after the accident. Unfortunately, the indirect costs are seldom recorded and as a result cannot be determined accurately. However, studies[5] have indicated that, for manufacturing generally, the indirect costs of injury-producing accidents average about four times the direct costs of compensation payments plus medical and hospital expenses. Assuming that this ratio is approximately correct for the clay construction products industry, the indirect costs of the injury-producing accidents in 1948 would amount to at least $10½ million, bringing the total loss to over $14 million.

[4] Hours and Earnings Industry Report, Bureau of Labor Statistics, mimeographed release.

[5] Industrial Accident Prevention, by H. W. Heinrich, New York, McGraw-Hill Book Co., Third Edition, 1950.

Scope and Method of the Survey

The Bureau of Labor Statistics has compiled annual injury rates for the clay construction products industry each year since 1926. In recent years these surveys have included reports from over 400 employers, representing a total exposure of over 80 million man-hours of employment. All of the data assembled in the annual surveys are collected by mail. Reporting is entirely voluntary.

In order to provide greater detail and to permit more specific analysis than is usually possible on the basis of the annual surveys, the survey was greatly expanded in 1948. The report form was enlarged and each cooperating employer was requested to report separately for each department or type of operation carried on in his plant. In addition he was asked to describe his plant safety program and the first-aid facilities available to his employees. Usable reports were received from 675 plants, employing approximately 53,000 workers with a total exposure of over 107 million man-hours.

In addition to supplying summary reports for use in evaluating the magnitude and general as-

pects of the injury problem in the industry, 133 of the cooperating plants also made their original accident records available for detailed analysis. This group of plants employed about 23,000 workers. Their combined injury-frequency rate was 43.0. This was about 10 percent above the industry average, but there was no indication that their hazards differed greatly from those of other plants in the industry.

A Bureau of Labor Statistics representative visited each of these 133 cooperating plants, and insofar as the data were available, transcribed from their records the following items regarding each accident: Place where the accident occurred; the occupation, age, and sex of the injured worker; the nature of the injury and the part of the body injured; the object or substance which produced the injury; the type of accident; the unsafe condition and/or the unsafe act which led to the accident; and the object or substance with which the unsafe condition was associated. In order to broaden the analysis and permit a greater degree of detail, this part of the survey was extended to cover not only disabling injuries, but also all those injuries requiring treatment by physicians. A total of 2,114 disabling injury cases and 3,568 medical cases was recorded.

The injury rate comparisons presented in this report are based primarily upon injury-frequency and severity rates compiled under 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.

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:

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

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 which is open and available to him, excluding the day of injury and the day on which he returns to work. The relative cost 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:

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

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, which are usually followed in the Bureau's studies. The deviations from the Standard include the introduction of an additional analysis factor, termed the "agency of injury" and the modification of the standard definitions of some of the other factors in order to permit more accurate cross classifications.

Agency of Injury.—The standard classification provides for the selection of only 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 unsafe 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 will include objects or substances which may have been inherently safe and unrelated to the occurrence of the accidents as well as those which because of their condition, location, structure, or method of use led to the occurrence of accidents. 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 which resulted 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. This represents a change from the standard procedure in two respects: First, in that the accident type classification is specifically related to the previously selected agency of injury; and second, that the sequence of selecting this factor is specified.

Unsafe Condition.—Under the standard definition the unsafe 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." This implies the prior selection of the "agency" but does not provide for recognition of any relationship between the unsafe 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 so as to permit cross classification, the standard definition was modified for this study to read: "The unsafe mechanical or physical condition is the hazardous condition which permitted or occasioned the occurrence of the selected accident type." The unsafe condition classification, therefore, was selected after the determination of the accident type classification and represents the physical or mechanical reason for the occurrence of that particular accident without regard to the feasibility of guarding or correcting the unsafe 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 unsafe condition existed." Its selection, therefore, is directly associated with the unsafe condition which led 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 were found to be 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 was identical with the standard definition, i. e., "that violation of a commonly accepted safe procedure which resulted in the selected accident type."

The Industry and Its Hazards

The clay construction products industry includes a wide variety of plants manufacturing many different construction items. Their more common products include structural brick, structural tile, floor and wall tile, sewer pipe, and refractories. In general, the processes employed in making these products are very similar—wet clay is molded into the desired shape and then baked so that it will retain that shape. All of the plants in the industry, therefore, have certain similarities.

Production methods, however, differ widely between plants. Each type of product requires some specialized equipment. As a result, most plants tend to concentrate on one or two particular kinds of products. These product differences and wide

differences in plant size result in very divergent organizational patterns. As a general rule, however, each plant has at least three basic departmental units. Preparation departments process the clay; molding departments shape it into the desired forms, and burning departments fuse it permanently into those forms. Other operations, such as setting, drawing, wheeling, and sorting, may be included in these basic departments or, in the larger establishments, may be set up as separate departments. Less common operations, such as glazing and model making, are sometimes organized as departments and most plants operate their service and maintenance activities as separate departments.

Clay Pits and Mines

Nearly three-fourths of the cooperating plants indicated that they operate their own clay pits or mines adjacent to their plants. In most instances these are open-pit operations, although a substantial volume of production comes from underground workings.

In pit operations where the clay is soft, power shovels are used to dig the material and to load it directly into trucks or narrow-gage railway cars for delivery to the plants. These soft-clay pits commonly have sloping sides, so that the hazard of falling material is not great. The workers are, however, exposed to mechanical hazards in operating the equipment and to traffic hazards associated with the haulage vehicles. The pit surfaces, moreover, may be very irregular and slippery when wet, presenting many possibilities for falls.

Where the clay is hard and shalelike, pit operations present much the same hazards as are encountered in stone quarrying. These pits frequently have a vertical working face where the material is blasted down or cut down mechanically. This work, therefore, involves blasting hazards and the possibility of injury from falling material as well as the hazards associated with power-shovel and trucking operations.

Most clay mines are drift mines. Generally their operations are very similar to those in coal mining; in fact, coal and clay are sometimes taken from the same workings. Common practice at the mine face is to undercut the clay and blast it down as in coal mining. Loading the broken-down materials into the mine cars is usually a hand operation in clay mines. The hazards faced by clay miners are much the same as those encountered by coal miners, except that clay mines tend to be less "gassy" and less likely to have explosive-dust concentrations than coal mines. The possibility of serious explosions is, therefore, minimized in clay mining, but the hazards of blasting, or roof falls, of working on irregular and slippery surfaces, of contact with the mine cars, and of overexertion in handling heavy materials are ever present.

Preparation Departments

In preparation departments conveyors carry the raw clay to hoppers from which it is fed into grinders or granulators. A common form of grinder consists of a large, heavy plate which rotates under a pair of pressure rolls. The clay is fed onto the plate in batches and is carried under the rolls as the plate rotates. The crushed material is scraped from the plate into a bucket conveyor which carries it to a series of screens which pass the properly sized particles and return the oversized particles for regrinding. In some instances the revolving plate in the grinder is itself a screen through which the particles drop as they are ground to size.

Granulators resemble grinders but are supplemented by a series of revolving knives which break up the larger lumps of clay before the material reaches the crushing rolls.

In brick, sewer pipe, and structural tile plants the ground clay is conveyed directly from the screens to the molding department. In floor and wall tile plants, however, the ground clay must first be mixed with talc and other ingredients. This is done in an agitator where the various materials are thoroughly mixed in water. The thick liquid mixture is then pumped into the tank of a drying machine. An endless wire blanket moves through this tank, picking up a thin layer of the material which it carries over a steam-heated drum. As the blanket leaves the drum, a blade scrapes off the dried material, which drops onto a conveyor to be carried to another grinding and screening process.

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After grinding, the pulverized materials are carried by conveyor to storage bins or directly to the hoppers of mixing or molding machines.

The atmosphere in the preparation departments is generally quite dusty, particularly in the older structural brick plants. Within the industry this dust is a recognized source of discomfort and eye irritation, but because of its low silica content, it is not considered to be particularly hazardous. J. J. Bloomfield, Sanitary Engineer Director, Division of Industrial Hygiene, Public Health Service, however, has written, "Many dusts are now recognized as dangerous, and, in the extreme, it may even be doubted whether any dust can be treated as harmless."[6] Aside from its possible physiological hazards, this dust creates a substantial housekeeping problem, particularly where it settles and becomes caked on floors or stairways. When even slightly moist, such areas may become very slippery and lead to serious falls. Mechanical hazards are also very prevalent in these departments. Unguarded belts, pulleys, and gears on machines and conveyors appeared to be the rule rather than the exception.

Molding Departments

Molding operations fall into three general classifications, soft-mud, stiff-mud, and dry-press, depending upon the moisture content of the mixture. Structural brick is usually produced by either the soft-mud or the stiff-mud process, sewer pipe by the stiff-mud process, and refractories, floor, and wall tile by the dry-press process.

In the soft-mud and stiff-mud processes the prepared clays are mixed with water in a machine called a pug mill. From the pug mill the wet clay usually passes into a de-airing machine which compacts the mixture. Generally, the pug mill, the de-airing machine, and the molding machine are in tandem and are operated as a unit.

Bricks, molded by the soft-mud process, are pressed by machine into molds containing forms for 9 or 10 bricks. The filled mold is taken from the machine, turned over on a pallet and removed, leaving the soft bricks on the pallet. The pallets are then loaded onto dryer cars for transfer to the drying department. Much of this work, particularly in the older plants, is done by hand. Some plants, however, have an automatic molding machine which performs all of these operations mechanically, delivering the loaded pallets onto dryer cars by conveyor.

In molding bricks or structural tile by the stiff-mud process, the wet clay is forced through a die on a machine called an auger. As the ribbon of clay leaves the machine, it moves slowly on a conveyor past a cutter which slices off the bricks or tiles in predetermined sizes. The formed bricks or tiles are then removed from the conveyor by hand and are piled on dryer cars.

Sewer pipe is also extruded, but in a different manner. The pipe-molding machine operates vertically, pressing out one length of pipe on each down stroke of its piston. A bell-shaped die, held against the bottom of the cylinder by chained counter weights, catches the first clay extruded and shapes it into the bell end of the pipe section. When the die becomes full, it is carried down, away from the cylinder on the end of the extruded section of pipe. At the end of the stroke, the extruded pipe is cut free from the cylinder and lifted out of the die by hand. The operating crew on a pipe press usually consists of five men. The operator controls the piston. The leverman lubricates the die before each stroke and locks it to the bottom of the cylinder. The transfer man removes the extruded section of pipe from the machine and places it in a trimming box where the trimmer cuts it to exact size and evens up any rough edges. The fifth member of the crew is clean-up man, who gathers up the loose pieces of clay and removes them from the working area. Hand truckers move the pipe sections to the drying room.

Refractories and floor and wall tile are usually molded by the dry-press method. Except for the consistency of the material, this process is very similar to the soft-mud process. The raw materials are dropped into a mold and pressed into shape by the descending ram of the press.

With the exception of some irregular refractory shapes, practically all molding is now done by

[6] Industrial Hygiene, A series of lectures on principles and practices (p. 73), by J. J. Bloomfield, Sanitary Engineer Director, Division of Industrial Hygiene, Public Health Service, Federal Security Agency, Washington, D. C. (1950).

machine. There are, therefore, many machine hazards in these departments. Unguarded gears, belts, and pulleys are rather common. The various presses also present serious point-of-operation hazards which are seldom adequately guarded.

Industrial type hand trucks or push cars operating on rails are used to move the "green" products from the molding department to the drying department. All of these trucking operations present some hazards. The trucks sometimes bump into workers; workers bump into the trucks; materials fall from the trucks; and the operators may be injured from over exertion in moving the loaded equipment. Rough floors and slippery spots resulting from spilled clay frequently contribute to accidents in these operations.

In some of the larger brick plants, mechanical transfer cars are used to move the dryer and kiln cars. Electrically powered cars operate on a track running past the molding, drying, and burning departments. This track is laid in a pit so that the beds of the transfer cars come flush with the working surface of the plant. Tracks set in or on the plant floor at right angles to the transfer track carry the dryer or kiln cars from the working areas to the transfer cars, and matching tracks on the transfer cars permit them to be pushed onto or off the transfer cars without lifting. This procedure facilitates handling the materials and eliminates many of the hazards associated with strictly hand trucking. It does, however, introduce additional hazards. The pit in which the transfer cars operate is relatively shallow. Nevertheless, it creates the possibility of serious falls. The tracks on which the dryer and kiln cars move through the working area frequently constitute tripping hazards, and because those tracks are frequently uneven and out of level, unblocked cars may drift unexpectedly and bump into nearby workers. These track irregularities also lead to many pinched fingers when workers are coupling or uncoupling the cars.

Hazards associated with poor housekeeping are less common in the molding departments than in some of the other plant areas. The chief problem of this nature is created by the small bits of wet clay which fall on the floor near the molding operations, particularly around the sewer-pipe presses.

Drying Departments

Green products molded by the soft-mud or stiff-mud process are usually too wet and soft to withstand piling or extensive handling. They must, therefore, be partially dried and hardened before they are put through the final burning. This is accomplished in drying ovens or drying rooms where hot air is passed over them to extract the moisture. Products molded by the dry-press process, such as refractories or floor and wall tiles, seldom require drying before being burned.

In structural brick plants the dryer cars, on which the palletized bricks were placed after molding, are pushed into drying ovens, where they remain for several hours. The dryer cars are then moved to the kilns, where they are unloaded. In sewer-pipe plants the green sections of pipe are usually placed upright on the drying-room floor. This floor is usually made of planks laid over steam pipes, with narrow openings between each row of planks. Heat from the steam pipes rises through the sewer pipe sections to dry them.

The most prominent hazards in the drying departments are associated with the trucking operations. In most instances, the trucks or dryer cars are moved entirely by hand. The possibility of overexertion injuries in this work is increased by frequently uneven and sometimes slippery floors. Where the dryer cars operate on rails, the rails present additional tripping hazards. The possibility of burns or heat exhaustion is also a hazard factor in this work, particularly when it is necessary to enter the drying tunnels to remove the dryer cars. In some plants the latter hazard has been largely overcome by providing pulleys and cables for pulling the cars from the tunnels. Power for this operation is sometimes supplied by the transfer cars. These cables, which are located just above the floor, constitute another tripping hazard.

Setting Departments

When the dried products reach the kilns, the first operation is to remove them from the hand trucks or dryer cars and to pile them in the kilns or on kiln cars for the final burning. This is called setting. When periodic kilns are used, the mate-

rials are piled directly on the kiln floor. Where tunnel kilns are used, the products are piled on cars which move through the kilns on rails.

The objective in piling the materials for burning is to expose as much as possible of their surface to the heat. Bricks, therefore, are piled on edge with open spaces around each unit. Floor and wall tiles are placed in containers called saggers, which hold them apart. Sewer-pipe sections usually are placed on end, and generally are piled three high.

Setting bricks in periodic kilns usually is a two-man operation. One worker, the tosser, removes the bricks from the dryer car and tosses them to the setter, who places them in the pile. In loading kiln cars, the setter commonly works alone because the piles are low enough to permit him to work from the floor. In setting heavy sewer pipe, two men usually are necessary—occasionally portable motor driven hoists are used because of the weight involved.

The outstanding hazards encountered in setting operations are those associated with manual handling of material. Sewer pipes, structural tiles, and refractory shapes frequently are quite heavy and may be very awkward to hold. There are, therefore, many possibilities for the occurrence of strains, sprains, and crushed fingers and toes. Most of the products, regardless of their weight, are rough and may have sharp edges to inflict cuts or scratches. Great physical effort is sometimes necessary in moving the loaded cars and hand trucks, particularly inside the periodic kilns where the floor may be very irregular because of its exposure to the intense heat. Loose sand used in piling bricks presents an eye hazard and frequently makes the working surfaces slippery. Steel runways, often used for access to the kilns, also tend to become worn and slippery. In addition, kilns in which glazed materials have been burned may have sharp projecting pieces of fused glaze attached to their floors, walls, and roofs. Contact with these projections can produce severe abrasions.

Setters, piling bricks in the periodic kilns, customarily stand on the piles to set the upper layers. As the piles are loose, they constitute a very unstable working surface and present many possibilities of falls. The setter also faces the possibility of being struck by the bricks thrown to him by the tosser. The tosser, in turn, is exposed to being struck by material falling from the pile or by a brick which the setter failed to catch.

Burning Departments

There are two basic types of kilns with many variations within each type. Periodic kilns are loaded and sealed while cool—then the fires are started and the required heat maintained, usually for a period of 6 or 7 days—after which they are cooled down and the burned products removed. Periodic kilns may be either round or rectangular. When less than a full load of materials is to be burned in a rectangular kiln, a temporary wall is customarily built inside the kiln to avoid having to heat the entire area. Many of the periodic kilns are heated by coal which is hand-fired through openings located at intervals around the outside wall. Fire boxes inside the openings are so located that the draft pulls the flames and heat over and through the piled materials. Oil- or gas-fired periodic kilns are common in some areas.

Continuous kilns are held constantly at burning temperature and the materials are moved in and out of the heat on rail cars. In the tunnel kiln, the most common type of continuous operation, the heat is applied at the center and the temperature diminishes toward each end. Most of these kilns are gas- or oil-fired. The loaded kiln cars are pushed into the entrance of the tunnel and progress through the heat by being pushed forward as new cars are added to the line. At the exit, workmen must enter part way into the kiln in order to uncouple and pull out the cars. This involves exposure to relatively high temperatures even though the cars at this point are well away from the intense heat generated at the center of the tunnel. Occasionally in these operations the pile of brick on a car may collapse inside the tunnel. When this happens, it may be necessary for the workers to put on asbestos clothing and enter the hot kiln to clear the obstructions.

The greatest hazards in the burning department

are the possibility of burns from contacting hot objects and of heat exhaustion from entering hot atmospheres.

Drawing and Wheeling Departments

After the products have been burned, they are transported to storage piles, usually by wheelbarrow or hand truck. Transferring the materials from the kiln cars or from the piles in the periodic kilns to the hand trucks and piling in the storage yards are hand operations. The products are still hot at this stage and the air around them may be very warm from their radiant heat. The chief hazards, therefore, consist of exposure to heat and hot objects, falls from the piled materials, slips on loose sand or broken pieces of burnt clay, cuts from the sharp edges of broken products, and overexertion in handling the materials.

Miscellaneous Departments

Many clay products are given a glaze finish. In most instances the liquid glaze is applied to the unburned products mechanically. However, it may be applied manually with a spray gun. In the latter operation, the workers must wear face shields and respirators and must contend with wet and slippery floors.

The final operation in floor and wall-tile plants is to sort the tile by color and by quality. In this work it is often necessary to break apart tiles which became fused in the burning. When the tiles part, small chips may fly, thereby creating a considerable eye hazard.

Refractories, generally, are finished to fine tolerances by grinding on an emery wheel. In these operations flying particles create an extreme eye hazard.

Factors in the Injury Record

The injury record of any plant or of any group of plants is a composite of a great many factors. The kinds of material processed; the types of processing performed; the safety regulations of the States in which the plants are located, and the extent to which those regulations are enforced; the kind of personnel employed; the size of the plants; and the extent of the safety programs carried on in the plants all have a direct bearing upon the volume of injuries experienced. In particular instances, the influence of these factors may offset each other, but in comparisons based upon large groups of operations their effects frequently can be demonstrated, as in the following breakdowns covering 1948 experience in the clay construction products industry.

Product Comparisons

Although some plants in the industry manufacture a variety of clay products, the majority are highly specialized, concentrating their activities upon a single type of product. Therefore, the reports received in the survey were classified into eight specific product groups, each representing plants engaged in substantially similar operations.

The wide variations in the injury-frequency rates of these groups indicate significant differences in the degree of hazard associated with the different types of production. Three groups had rates of over 50; one had a rate of 46; two had rates between 30 and 40; and two had rates between 20 and 30. The most hazardous group, plants manufacturing sewer pipe, had a rate of 53.7, closely followed by the drain-tile group with a rate of 51.6, and by the unglazed-structural-tile plants with a rate of 50.8. In each of these three groups of plants, one in every nine employees experienced a disabling injury during 1948.

Structural-brick plants, comprising the largest segment of the industry, had an average injury-frequency rate of 46. In these plants, 1 in every 11 employees suffered a disabling injury during the year.

The relatively small group of plants manufacturing terra-cotta products had an average frequency rate of 38.1, and the larger group of clay-refractory plants had an average rate of 32.6. Two groups—glazed-structural-tile plants, and roofing, floor, and wall-tile plants—had the lowest

injury rates, averaging 25.4 and 24.0, respectively. Even the safest group of clay construction products plants showed a substantially higher incidence of injuries than prevailed in manufacturing generally.

The severity of the injuries in the various groups of plants followed a somewhat different pattern. The terra-cotta plants, with 1 death and 2 permanent impairments among the 51 reported injuries, had the highest ratio of serious injuries. As a result, this group had the highest frequency rate for deaths and permanent impairments, 2.2; the highest severity rate, 5.6; and the highest average time charge per case, 146 days, among all of the plant groups.

Structural-brick plants also had a high proportion of serious injuries, giving them a frequency rate of 1.6 for fatalities and permanent impairments, a severity rate of 4.3, and an average time charge of 93 days per disabling injury. Eleven of the 19 fatalities reported in the entire survey occurred in structural-brick plants.

In contrast to the relatively high injury severity prevailing in the other types of plants, the roofing, floor, and wall-tile plants and the glazed-structural-tile plants reported no fatalities and very few permanent impairments. The glazed-structural-tile plants had a serious-injury frequency rate of only 0.4, a severity rate of only 0.5, and a low average time charge of 22 days per case. Complimenting their low over-all injury-frequency rate, the roofing, floor, and wall-tile plants had a frequency rate for serious injuries of 0.2, a severity rate of 0.4, and a very low average time charge of only 16 days per case.

Regional and State Comparisons

Variations in injury rates between geographic areas may reflect any one or a combination of several factors. State safety laws and the degree to which they are enforced, the age and maintenance of plants and their equipment, and employment factors, such as the experience of available workers, all tend to influence the average level of injury rates in any area.

Because of the wide variations in injury experience by type of product, the composition of the industry within the various areas may exercise an important influence upon the industry-wide frequency-rate averages for particular areas. For this reason, regional and State comparisons in the clay construction products industry are more significant when based on a specific type of plant rather than on industry totals.

Average frequency rates for structural-brick plants were computed for each of the 9 regions and for 16 States. Four of the regional averages were above 50—Middle Atlantic, 61.6; West North Central, 58.7; New England, 54.5; and West South Central, 51.7. Four others were above 30—East North Central, 44.2; Rocky Mountain, 38.6; East South Central, 35.7; and Pacific, 33.9. The lowest was 29.7 for the South Atlantic region. Individual State averages ranged from a high of 69.0 for the New Jersey brick plants to a low of 15.6 for the plants reporting from North Carolina. New York, Texas, Pennsylvania, and Illinois all had rates above 50, whereas West Virginia, Alabama, and South Carolina had rates below 30.

Five regional and four State average frequency rates were computed for clay refractories. The highest regional rate was 40.8, for the Middle Atlantic region—the lowest, 21.7, for the West North Central region. Pennsylvania had the highest of the State averages, 42.2, followed by Alabama, 36.3, New Jersey, 33.9, and Ohio, 25.3.

For the other groups of plants, the distribution was very thin and relatively few regional or State rates could be computed. Because of their limited number, comparisons based upon these averages do not appear to be significant.

Size of Plant Comparisons

Previous studies in other industries have indicated that a direct correlation often exists between injury-frequency rates and plant size, as measured by employment. The very small plants and the large plants commonly have lower average frequency rates than those prevailing in the medium-size plants. Presumably this is due to close supervision by the owners in the small plants and to the existence of organized safety programs in the large plants. The higher rates for medium-size plants apparently reflect the fact that these shops are too large for intimate supervision by top management and too small to have regularly established safety departments.

Small and medium-size plants predominate in

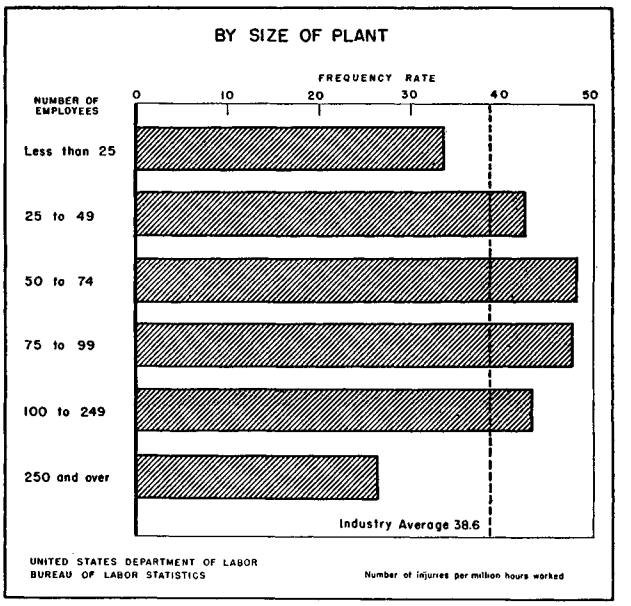
the clay construction products industry. Of the 675 plants reporting in the survey, 160 employed fewer than 25 workers apiece and 486 others employed fewer than 250 workers. Only 1 of the participating plants reported as many as 1,000 employees. Nevertheless, the frequency rates in this industry closely followed the general pattern observed in other industries.

In the entire reporting group, the lowest average frequency rate was 26.3 for the plants employing 250 or more workers. The very small plants, employing fewer than 25 workers apiece, had an average rate of 33.6. All of the size groups ranging from 25 to 250 employees had rates of over 40. It was significant that the 29 largest plants, representing over 33 million man-hours of exposure, did not report a single death or permanent-total disability. As a result, this group had a relatively low severity rate, 1.1, and a low average time charge per case, 43 days. Some deaths were reported in each of the other plant-size groups, giving them all substantially less favorable injury-severity records. The least favorable record in this respect was that of the very small plants, which reported three deaths and one permanent-total disability, with a total exposure of only 3.6 million man-hours. The severity rate for the small-plant group was 9.0 and the average time charge per disabling injury was 267 days.

Within the different product groups, the plant-size frequency-rate pattern was not consistent, probably because the number of plants in some of the groups was insufficient to average out the outstanding records of particular plants. The clay refractories and the structural-tile groups, however, conformed to the general pattern. In the structural-brick group, the very small plants had the lowest average frequency rate, but the large plants had a rate considerably higher than those of some of the medium-size plants.

Although these averages suggest that plant size exercises a significant influence upon the development of safety programs and thereby upon the general level of injury-frequency rates, it is important to recognize that plant size is far from being the controlling factor in safety. This is emphasized by the distribution of individual plant frequency rates within the different plant-size groups. For example, over 30 percent of the reporting plants operated throughout the year without a single disabling injury. Most of these were small plants, but this select group included some plants from every size classification except the 250 employees and over group. In addition, there were some plants in every size group which had injury-frequency rates of less than 20. At the other extreme, at least one plant in every size group had a rate of over 90, and in all groups, except 250 employees and over, one or more rates were over 125.

Chart 2.—Injury-Frequency Rates in the Clay Construction Products Industry, 1948



Safety Programs and First-Aid Facilities

Relatively few plants in this industry have organized safety programs. Of the 650 plants which furnished details on their safety activities, only 21 employed full-time safety engineers and less than a third had organized safety committees.

The influence of plant size upon the development of formal safety programs was strikingly apparent in the analysis of these plant records. The 21 plants which employed full-time safety engineers had an average employment of over 300 workers per establishment. Those which had organized safety committees but no full-time safety engineer averaged about 100 employees per plant, whereas those which had neither averaged only about 50 workers per plant. Plant size obviously is a major factor in determining how a plant can organize its safety program.

The experience of these plants constitutes strong evidence of the value of organized in-plant safety activities. The 442 plants which had neither safety engineers nor safety committees had an average frequency rate of 45.3. The group of 187 plants, which had safety committees but no safety engineers, had an average rate of 36.7. In contrast, the 21 plants employing safety engineers had an average frequency rate of 18.5, whereas the 17 which had both safety engineers and safety committees had a rate of 17.0.

Most of these differences in injury-frequency rates were accounted for by differences in the relative volume of temporary-total disabilities. This circumstance tends to support the possible conclusion that "disability control" entirely apart from "accident control" is important in determining the general level of injury-frequency rates in particular plants or groups of plants. This theory, in brief, is that the larger establishments, which can maintain treatment facilities on their premises and can offer a wider choice of temporary job assignments to partially disabled workers, will, as a result, be able to keep many injuries from becoming "lost-time" cases. In a plant without such facilities, similar injuries may result in lost time because the treatments must be given outside the plant or because there are no available jobs which partially disabled workers can perform. As the standard frequency rate is based upon lost-time cases, the latter type of plant may have a higher rate even though its actual injuries are comparable in number and nature with those of its larger competitor.

Departmental Injury Rates

The extent to which details were available concerning the injury experience of workers in particular operations varied greatly among the reporting plants. In many small plants, and also in some large plants, there was very little departmentalization. Workers commonly moved from one job to another as the need arose, and no records were kept of the time spent on particular operations. For these plants only plant-wide figures were available. In others, it was found that varying combinations of operations had been included in single departmental units, which limited the possibilities for detailed comparison. Practically all of the plants, however, were able to provide specific information for some of the standard operations. The departmental comparisons, therefore, are based upon the experience of those plants which could supply comparable details for separate operations and exclude the experience of plants from which these details could not be obtained.

Clay-mining operations had the highest of the departmental injury-frequency rates, 74.5. Next in line were the drawing and wheeling departments, with a rate of 60.3 and the storage and shipping departments, with a rate of 55.3. The high-frequency rates in these departments, however, were offset by their relatively small numbers of serious injuries. In clay mining, the average time charge per disabling injury was 36 days, just about half the industry average of 75 days. In storage and shipping, the average time charge was 29 days and in the drawing and wheeling departments it was only 12 days.

The plant maintenance departments had a high-frequency rate of 53.5 as well as a relatively high incidence of serious injuries. As a result, the severity rate for these departments was 5.0 and the average time charge was 93 days per case.

Four departmental groups had frequency rates ranging between 40 and 50. These included the drying rooms, 47.7; the preparation departments, 47.3; the setting departments, 42.8; and the clay pits, 42.1. The setting departments had a somewhat better than average severity record, but the other three groups had very unfavorable severity records. In the clay pits there were 3 fatalities, 1 permanent-total disability, and 6 permanent-partial disabilities among 121 reported injuries. As a result, the clay pits had the highest severity rate, 11.4, and the second highest average time charge, 271 days, recorded for any of the departmental classifications. In the preparation departments, 2 deaths, 1 permanent-total disability, and 11 permanent-partial disabilities in a total of 229 reported injuries gave the department a severity rate of 8.0 and an average time charge

of 169 days. The drying rooms, with 1 death and 3 permanent-partial disabilities in 80 cases, had a severity rate of 5.1 and an average time charge of 107 days per case.

Of the three general types of molding—dry press, stiff-mud, and soft-mud—the dry-press operations were the least hazardous. For this operation the frequency rate was 22.1 in contrast to rates of 38.7 for stiff-mud molding and 40.8 for soft-mud molding. The stiff-mud departments also had an adverse severity record. With 3 fatalities and 9 permanent-partial disabilities in 315 injuries, they had a severity rate of 4.0 and an average time charge of 104 days per case.

In the lower frequency rate range the power departments had a rate of 28.6; the burning departments, 27.1; the glazing departments, 14.2; and the clerical and administrative departments a rate of 3.0. In this group the burning and power departments had very poor severity records, whereas the glazing departments had an excellent severity record.

Kinds of Injuries Experienced

The 5,682 injury cases, which were examined in detail, included 6 deaths, 6 permanent-total disabilities, 55 permanent-partial disabilities, 2,047 temporary-total disabilities, and 3,568 injuries which required medical attention but did not result in loss of time after the day of injury. These cases represented all of the injuries for which records were available in the 133 plants cooperating in this phase of the survey. No information could be obtained regarding the presumably much larger group of minor injuries which either received no treatment at all or were given only on-the-spot first aid.

Definitions of the various classifications of disabilities are as follows:

(1) *Death.*—A fatality resulting from an industrial injury is classified as an industrial death 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 shall be classified as a permanent-total disability. The loss, or the complete loss of use, of any of the following in one accident shall be 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.

(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 shall be classified as permanent-partial disability, regardless of any preexisting disability of the injured member or impaired body function.

The following injuries shall not be classified as permanent-partial disabilities, but shall be 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 which do not cause permanent limitation of motion;

(*f*) Fractures which heal completely without deformities or displacements.

(4) *Temporary-total disability.*—An injury which does not result in death or permanent impairment shall be classified as a temporary-total disability if the injured person, because of his injury, is unable to perform a regularly established job, which is 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 shut-downs) subsequent to the date of injury.

(5) *Medical treatment case.*—For the purpose of this survey, any injury which did not result in death, permanent impairment, or temporary-total disability, but which required treatment by a physician was classified as a medical-treatment case.

Definitions (1), (2), (3), and (4) are from the American Standard Method of Compiling Industrial Injury Rates as approved by the American Standards Association, October 11, 1945. Definition (5) represents a combination of the American Standard definitions of temporary-partial disability and medical treatment cases.

Fatalities and Permanent-Total Disabilities

Three of the six reported fatalities resulted from head injuries; one was an electrocution; one was a case of suffocation under a clay slide; and one was a case of multiple injuries experienced in a boiler explosion. One of the three fatal head injuries occurred when a clay pit tractor over-

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turned and fell on its driver. In a second pit accident a planer operator was struck by falling shale and thrown against the planer. His skull was fractured by contact with the planer, not by the impact of the shale. The third head-injury fatality was a member of a sewer-pipe press crew. He was cleaning the die when the clay in the cylinder dropped out, striking him and throwing him head first against the die. The electrocuted worker was a car puller in the drying department. He received his fatal shock while using an ungrounded portable electric hoist. The suffocation case occurred when a molder entered a clay bin to loosen the clay. The pile slid over and he was caught under the material.

All of the six permanent-total disabilities were silicosis cases of which four were reported in one plant. Four of the disabled workers were press-room employees, one was a kiln man, and one was a dryer man. Each of these workers had comparatively long service in the industry. The youngest of the group was 41 years old; all of the others were over 50. The insidious nature of silicosis is emphasized by the fact that these six permanent-total disabilities were the only silicosis cases reported.

Permanent-Partial Disabilities

The 55 permanent-partial impairment cases included 23 finger amputations, 3 toe amputations, 1 enucleation of 1 eye, and 28 cases of contusions, cuts, fractures, and strains involving some residual loss of use of a body part or function.

Of the 23 finger amputations, only 1 involved more than 1 finger. In this case a pipe-press tripper lost four fingers when the key worked out of the brake wheel, allowing the die to move while he was closing the knife. Thirteen of the single finger amputations occurred in the operation or repair of powered machinery. Four of these cases were press accidents and three were conveyor accidents; the others involved a dryer, a grinder, a gasoline engine, a compressor, an elevator, and a fan. Eight of these machine accidents occurred while the machines were being cleaned, adjusted, or repaired.

The nine finger amputations which did not occur on machines included two experienced in moving or coupling plant cars and two cases in which the workers' fingers were caught in freight-car doors. The others occurred in the use of a chain hoist, repairing a truck, clearing a mud chute by hand, wheeling brick, and closing a window.

Two of the toe amputations occurred when plant cars ran over the workers' feet. The other occurred when the jack supporting a trailer slipped and dropped the unit on the worker's foot as he was coupling the trailer to a tractor.

The 28 loss-of-use cases included 10 finger injuries, 7 arm and wrist injuries, 2 toe injuries, 5 foot and leg injuries, 2 hip injuries, 1 back injury, and 1 eye injury. Four of the permanent arm injuries, four of the finger injuries, one of the leg injuries, and one of the toe injuries occurred when the workers were caught in moving machinery. The permanent back injury, both of the hip injuries, one leg injury, and two wrist injuries resulted from falls. Falling materials produced five of the permanent finger injuries and three of the foot injuries. The loss-of-vision case occurred when a nail flew into the worker's eye as he struck it with a hammer. In another case a seemingly minor injury developed into a permanent arm impairment. The employee struck his elbow on a part of a machine when the wrench he was using slipped. Another worker slipped as he was climbing down from a power shovel and grabbed a latch to avoid falling. His ring caught on the latch and he lost the entire use of the ring finger. A broken ankle, which developed into a permanent impairment, occurred when a lift truck moved unexpectedly and caught the foot of a worker who was adjusting the truck load.

Temporary-Total Disabilities

Nearly 30 percent of the temporary-total disabilities were strains or sprains. Another 30 percent were bruises or contusions; 16 percent were cuts or lacerations; and 11 percent were fractures. Hernia cases accounted for over 3 percent of the total, and burns accounted for more than 2 percent. In general, the hernia cases and the fractures were the most serious of the temporary-total disabilities.

About half of the strains and sprains were back cases. Most of the remainder were ankle, leg, wrist, and shoulder sprains. The high incidence of these injuries reflects the large volume of manual material-handling prevailing in the industry

and the irregular working surfaces so common in structural-clay products plants.

More than half of the disabling bruises and contusions were injuries to the lower extremities. The majority of these cases were foot and toe injuries produced by dropped or falling materials. More general use of safety shoes might well have avoided the occurrence of many of these injuries. Disabling bruises to hands and fingers were also very common in all branches of the industry. Most of these occurred in material-handling operations.

Over half of the disabling cuts and lacerations were hand or finger injuries, most of which occurred while handling sharp-edged or rough materials. Foot and leg cuts were relatively common and there were also a considerable number of lacerations to the head and to the eyes. As a group, these cases suggest that more general use of protective gloves, safety shoes, and goggles might materially reduce the volume of injuries in the industry.

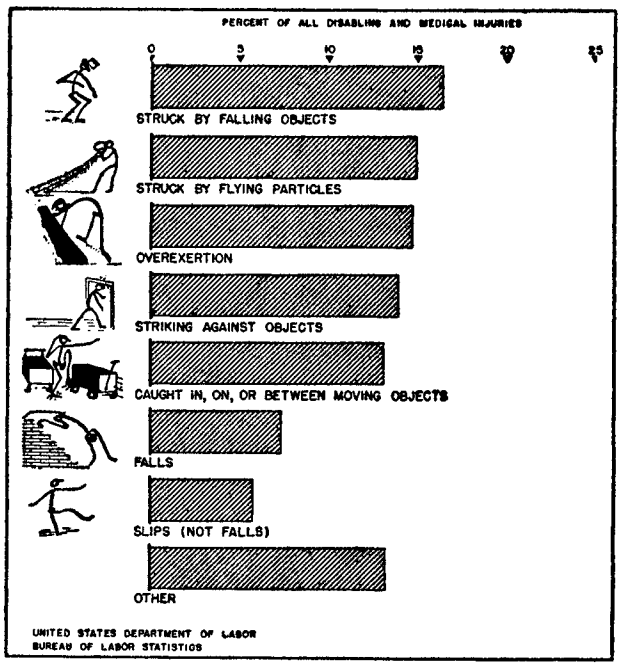
Nearly a third of the fracture cases consisted of broken toes, most of which might have been avoided if the workers had been wearing safety shoes. Foot fractures, finger fractures, and rib fractures also were very common.

Medical Treatment Cases

Nearly 30 percent of the injuries, which required medical treatment but did not result in the loss of time other than for treatment, were bruises or contusions. Most of these affected hands, fingers, feet, legs, or toes. Cuts and lacerations, two-thirds of which were hand or finger injuries, accounted for 26 percent of the medical treatment cases. Nineteen percent of the medical treatments were for the removal of foreign bodies from the eye, and 18 percent were treatments for strains or sprains.

In the aggregate, eye and finger injuries each constituted 22 percent of the medical treatment cases. The great majority of the eye injuries were produced by dust or flying particles of sand, shale, or burned clay. Many of these particles were wind-borne. Others were thrown off by the grinders, mixers, and material-handling equipment. There were, however, a considerable number of cuts and contusions to the eyes, which were produced by heavier flying materials, and a number of eye burns produced by contact with hot substances or chemicals. The finger injuries requiring medical treatment were primarily cuts and bruises.

Chart 3.—Major Types of Accidents in the Clay Construction Products Industry, 1948



Accident Analysis

Accident reports frequently are very deficient in indicating specifically the reason for the occurrence of the particular events which culminated in an injury. In most instances, the only available information comes from the injured person himself, or from witnesses who merely happened to be present at the time and who lack either the skill or the opportunity to fully investigate the event in order to determine the actual accident cause. In the analysis of a large number of accident reports, therefore, it is common to find a high proportion which are deficient in the one respect most important to the safety engineer. Despite these limitations, however, the analyst

can draw a great deal of useful information from even the most sketchy accident description.

Almost invariably an accident description 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 readily apparent to the witnesses. They, therefore, loom large in the accounts of the events. The more analytical question—why did it happen—normally arises only after the desire for descriptive information has been satisfied. It frequently 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. Standing alone, these elements may have limited value, but when related to each other they can do much to indicate the accident prevention activities which may be needed. The determination of the objects or substances which most commonly produce injuries, coupled with information as to how they produced the injuries, constitutes the first step toward an understanding of the accident problem.

Agencies of Injury and Accident Types

The most common variety of injuries encountered in the clay construction products industry arises not from physical contact with some particular object or substance, but from bodily motions or misuse of the body. Approximately one in every five of the recorded injuries was in this category. Four-fifths of the accidents in this group were simple cases of overexertion, primarily in lifting, carrying, or pushing objects. Manual material handling, therefore, is indicated as the industry's chief source of injuries. Most of the other accidents in the bodily motion group were cases in which the injured persons slipped or stumbled and wrenched or strained themselves in attempting to regain their balance. Most accidents of this nature reflect poor housekeeping conditions and poorly maintained working surfaces.

Plant products, the bricks, tiles, and sewer pipes made in the industry, were the second most common agencies of injury. One in every seven of the reported injuries arose from contact with these product items. A large majority of these accidents were cases in which the products fell on workers, from their own hands, from piles, or from loaded vehicles. Again the record points to manual material handling and to poor housekeeping as the leading source of injuries in the industry.

Vehicles were the third most common injury producers, accounting for about 1 in every 9 injuries. The most frequent accidents of this kind were those in which the injured person or some part of his body was caught and pinched between two vehicles or between a vehicle and some other object. There was also a large number of accidents in which the injured persons were simply struck by moving vehicles, and a considerable number in which the injured persons bumped into vehicles. Crowded work spaces and poor traffic lay-out generally are the primary reasons for accidents of these types.

Flying particles, dusts, bits of clay, and chips from broken products ranked fourth among the agencies of injury. All of the injuries in this group were eye cases and most of them were relatively minor. Their substantial numbers and the fact that many did produce severe disabilities emphasize the need for an expanded eye-protection program in the industry.

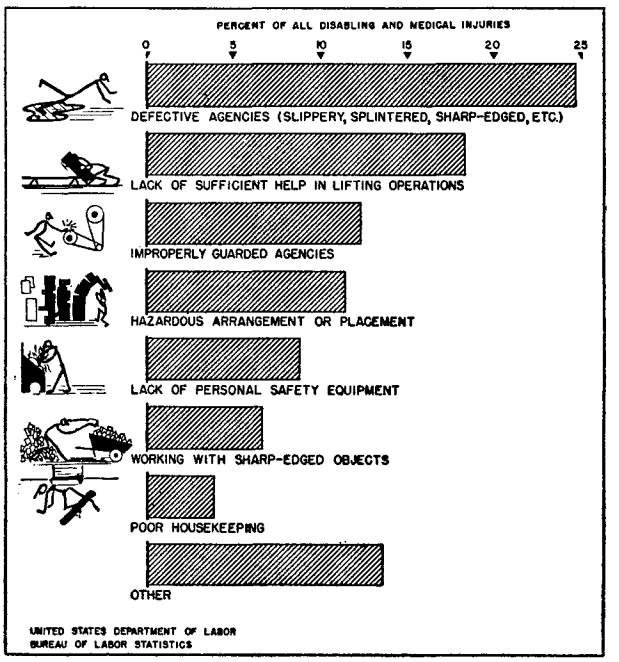
Ranking fifth among the agencies of injury, machines produced about 1 in every 13 of the reported injuries. About a third of the accidents in this group were cases in which the workers were struck by objects thrown off by machines, particularly chips and flying particles emanating from grinders. A fourth of the group consisted of cases in which the injured workers bumped into the machines. The prevalence of these accidents again points to the need for better plant lay-out to provide more clear working space. Another fourth of the machine-inflicted injuries arose from the workers becoming caught in, on, or between moving machine parts. This group of accidents generally produced the most severe injuries.

Point-of-operation cases were common, but were considerably outnumbered by injuries arising from contact with gears, belts, pulleys, and other moving machine parts. This record strongly points to a need for an improved program of machine guarding.

Other items ranking high as injury producers include hand tools, working surfaces, lumber, chemicals, pallets or skids, containers, and conveyors. The hand tool accidents were mostly cases in which the workers were struck by the tools or by chips of material thrown off by the tools. Those in which the injuries were inflicted by lumber, containers, pallets, and skids were generally cases in which the objects fell or were dropped on the workers, or pinched their fingers in piling operations. The chemical injuries were mostly burns or dermatoses resulting from the splashing of chemicals on the workers. Injuries inflicted by conveyors resulted primarily from workers becoming caught in moving parts and generally tended to be quite serious. The injuries experienced through contact with working surfaces generally resulted from falls.

Falls produced about 1 in every 13 of the recorded injuries. Falls on the same level were most common, but falls from one level to another produced the more severe injuries. Slips and stumbles which just missed being actual falls were nearly as common as falls in producing injuries.

Chart 4.—Major Types of Unsafe Working Conditions in the Clay Construction Products Industry, 1948



Accident Causes

Modern accident prevention is based upon two premises—first, that there is an identifiable cause for every accident; and second, that when an accident cause is known, it is generally possible to eliminate or to counteract that particular cause as the probable source of future accidents of the same character. In many instances, it is true that a variety of circumstances contribute to the occurrence of an accident, and the line which accident prevention should take may seem confused because of the multiplicity of the possible courses of action. It is generally recognized, however, that every accident may be traced to some unsafe working condition, to the commission of an unsafe act by some individual, or to a combination of these accident-producing factors. In the analysis of individual accidents for the purpose of establishing an effective safety program, therefore, it is essential to give particular attention to the identification of these elements in the chain of circumstances leading to the accidents. Concentration upon the elimination of the unsafe conditions and practices identified by such analysis, with emphasis upon the elimination of the elements which are found to have contributed to many accidents, will almost invariably result in improved safety records.

The correction of unsafe working conditions generally is entirely within management's powers. The avoidance of unsafe acts, on the other hand, requires cooperation and understanding by both management and workers. Management must take the lead, however, 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.

Unsafe Working Conditions

A great majority of the unsafe working conditions revealed by the analysis fell into four general groups: Unsafe working procedures (responsible for 37 percent of the accidents); defective agencies (25 percent); improperly guarded agencies (12 percent); and hazardous arrangement or placement (11 percent).

Unsafe Working Procedures.—More than half of the accidents caused by unsafe procedures were directly due to the lack of sufficient help in lifting or moving heavy objects. These were primarily cases of overexertion in lifting or turning heavy product items, such as sewer pipes, or in pushing and pulling loaded vehicles, particularly dryer and kiln cars. Overlifting was also responsible for many of the accidents in which workers dropped heavy objects on their feet or crushed their fingers as they attempted to set the objects down. These unsafe procedures were particularly important sources of injury in the sewer pipe plants where they were responsible for one in every four accidents. In general, the practice of overlifting was most common in the drying, setting, finishing, and yards departments.

The necessity of manually handling sharp-edged and rough objects was also a prime source of accidents. Many clay products develop sharp edges or rough surfaces in the normal course of manufacturing. The injuries attributable to these hazards commonly consist of cuts or lacerations on the hands, and most commonly occur in piling and unpiling operations. Greater use of gloves or hand leathers probably would reduce the volume of these accidents, but these protective devices may themselves create additional and more serious hazards when used around moving machinery. Accidents resulting from handling sharp-edged materials were particularly common in the sewer pipe plants. Departmentally, they tended to be concentrated in the drawing and wheeling departments.

The practice of tossing bricks to setters resulted in a considerable volume of accidents in the setting departments of the brick plants. In this operation, the setter usually stands upon the partially completed pile of bricks and catches the bricks which are thrown to him by the tosser standing below. The setters were most commonly injured by being struck by the thrown bricks. Tossers were frequently struck by bricks which fell back when the setter failed to catch them. The tossers, however, also experienced a number of strains from overexertion in throwing the materials.

Defective Agencies.—Poorly designed, poorly constructed, and poorly maintained equipment constituted the outstanding hazards involved in defective agencies. Because of defective trackways, dryer and kiln cars frequently jumped the tracks and struck nearby workers, or drifted together to pinch or crush workmen who were trying to move them. In other instances, the workers strained themselves while attempting to move the cars over uneven tracks. Poor design in the vehicles themselves was also a frequent accident cause—particularly in respect to the coupling equipment on the dryer and kiln cars.

Low material strength of objects led to a large number of accidents in which workers were struck by falling objects as well as to a considerable number of falls. The defective objects most frequently were finished products, machines, pallets or skids, hand tools, and vehicles. Frequently internal weaknesses in bricks and sewer pipes caused these products to break as they were being handled. Sewer-pipe press dies and hand tools, which had become hardened or crystallized through extended use, often chipped and workers were injured by the flying particles. Pallets, skids, and ladders, weakened through prolonged use, frequently broke under the load. Revised material handling procedures and greater attention to the maintenance of equipment appear to be essential for the prevention of this class of accidents.

Slippery working surfaces were responsible for a large number of slips and falls. In large measure these slippery conditions resulted from clay or sand spilled or dropped in the working areas. There were, however, a number of accidents which resulted from the use of smooth steel plates as gangways for access to boxcars and kilns. These dockboards normally have diamond-shaped corru-

gations on their surfaces, but after long use become very smooth. The elimination of these accident-producing conditions lies in improved housekeeping and better maintenance procedures.

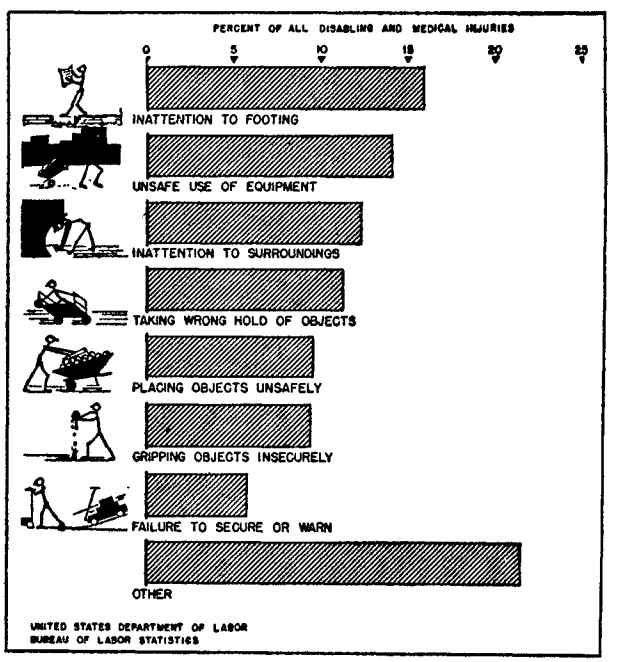
The large number of accidents involving contact with projecting splinters, slivers, nails, and bolts also points strongly to the need for better housekeeping and more adequate maintenance of equipment. The defective agencies involved in these accidents were primarily pallets, skids, vehicles, and hand tools which had been damaged in use and should have been removed from service for repair. Projecting nails in dunnage and scrap lumber, and projecting bolts on vehicles and other equipment also led to a number of accidents.

Improperly Guarded Agencies.—Accidents resulting from inadequate guarding of hazardous operations and conditions were very common throughout the industry. Point-of-operation guards were often found to be entirely lacking on presses, grinders, and cutting tools. Pulleys, gears, and drive belts on conveyors and other machines were often unprotected. Workers were often injured because there were no baffle boards on belt conveyors or no toe boards on elevated working surfaces to prevent materials from falling. Vehicles frequently moved unexpectedly to strike or pinch workers because no facilities were provided for braking or locking them in position. The absence of guard rails around elevated working surfaces led to many falls, and inadequate bracing or shoring permitted a number of roof falls and cave-ins in the clay mines and pits. In the wheeling and drawing departments, the simple provision of handle guards would have prevented many finger and hand injuries.

Hazardous Arrangement or Placement.—Improperly piled materials, which fell onto the workers, and improperly placed materials or equipment, which obstructed aisles or passageways or created tripping hazards, were very common accident causes. Much of the improper piling occurred in the loading of vehicles and culminated in spilling all or part of the loads when the vehicles turned or passed over rough surfaces. The general practice of laying the tracks for dryer and kiln cars directly upon the surface of the working area instead of sinking the rails flush with the surface had much to do with the high volume of tripping accidents.

Lack of Personal Safety Equipment.—The accident records of the clay construction products industry are replete with cases in which it is obvious that the use of personal protective devices, such as safety shoes, impact goggles, hand leathers, gloves, or safety helmets, would have prevented or minimized the injuries which occurred. Wider use of these devices in the industry unquestionably is desirable. In the great majority of cases, however, the use or non-use of these devices has no bearing upon the occurrence of the accident itself. As accident analysis is primarily concerned with determining the factors which led to the accident as contrasted to the injury resulting from the accident, the absence of personal protective devices is seldom indicated as a hazardous working condition. However, certain types of operations involve hazards that can be overcome only through the use of proper protective equipment. Typical of these operations is the use of grinding wheels in which the wearing of impact goggles is essential if eye injuries are to be avoided. The failure to

Chart 5.—Major Types of Unsafe Acts in the Clay Construction Products Industry, 1948



provide goggles for this operation was quite common throughout the industry. As a result, a relatively large number of eye injuries was directly attributable to this unsafe condition.

Other instances were found in which the lack of personal protective equipment contributed to the occurrence of accidents. They included cases in which workers were not provided with respirators or safety belts and lines when they entered tanks or other closed areas, or were required to enter hot areas or to handle acids without being provided with proper protective clothing. These accidents tended to produce severe injuries, but were not particularly common.

Unsafe Acts

For the purpose 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 should be designated as unsafe unless there was a reasonable and less hazardous alternative procedure. For example, the use of an unguarded machine for which no guard was provided was classified as an unsafe condition, but not as an unsafe act. On the other hand, the operation of a grinder without the use of goggles which were provided was classified as an unsafe act because in this instance there was a less hazardous alternative procedure. The analysis, however, does not imply that the alternative safe procedure must have been known to the person who acted in an unsafe manner, nor that his unsafe act was the result of a considered choice between two possible procedures. In many of the accidents studied in this survey it was apparent that the individual knew the safe procedure, but consciously decided not to follow it. In other cases, circumstances indicated that the person acted unsafely simply because he did not know the alternative safe method. The first step toward the elimination of unsafe acts, therefore, is to make sure that all workers are thoroughly instructed in the safe methods of performing their duties and that they are familiar with the hazards connected with deviations from those methods. The second essential step is to exercise strict supervision to see that safe procedures are followed.

Of the accidents attributed to unsafe acts, 39 percent resulted from employees assuming unsafe positions; 32 percent were due to unsafe loading, placing, or mixing; and 17 percent resulted from the unsafe use of equipment.

Unsafe Position or Posture.—Inattention to footing or surroundings accounted for nearly three-fourths of the accidents caused by unsafe position or posture. Failure to observe normal caution in getting on or off equipment, ascending or descending ladders, or in merely walking across floors or yards was the most common fault. Poor housekeeping which permitted the working areas to be cluttered with loose materials and debris was a contributing factor in a large proportion of these cases. Most commonly, the accidents consisted of slipping, stumbling, or falling over comparatively small objects on the floor. There was, however, a considerable number of instances in which workers simply walked into or bumped against large piles of materials, machines, and other objects which should have been quite visible and avoidable.

Lifting with bent back or from an awkward position was next in importance in this group of unsafe acts. Most of the injuries resulting from these unsafe acts were strains, sprains, or hernias. The most common cases in the group were those in which the worker attempted to lift a heavy object while standing on an irregular or unsecure surface or while stretching or reaching to such an extent as to throw himself off balance. Cases in which the accident could be ascribed definitely to lifting with the back bent were relatively few. This was probably due to the fact that the records on lifting accidents are seldom explicit in describing how the lifting was done. Actual observance in the plants, however, disclosed that many of the workers regularly bend from the hips and keep their knees straight in lifting. It is reasonable to assume, therefore that this unsafe practice contributed to the occurrence of many more lifting accidents than is shown by the records.

Unsafe Loading, Placing, and Mixing.—Three specific types of unsafe acts were responsible for nearly all of the accidents resulting from unsafe loading, placing, and mixing—taking the wrong hold on objects, arranging or placing objects unsafely, and gripping objects insecurely.

Taking the wrong hold on objects was responsible for many crushed fingers and hands. In most of these accidents, the workers' fingers or hands were crushed or pinched under or between the objects which they were placing or piling. However, in a considerable number of cases, workers experienced hand injuries because they were pushing vehicles while holding on to the corner posts or side frames instead of keeping their hands behind the vehicle.

Unsafe arranging or placing of objects was a very common cause of injury. In most instances the specific fault was that of placing materials in insecure piles, or placing them close to the edge of benches or platforms, from which they fell onto the worker. A high percentage of these accidents occurred in loading vehicles. In many instances, also, workers parked vehicles or placed materials in such a manner as to create obstructions and tripping hazards in the workplaces.

The accidents which resulted from gripping objects insecurely most commonly were cases in which the workers dropped objects on their own feet. In many of these the fault lay in attempting to lift too many objects at one time or in using only one hand instead of two. In others workers attempted to lift irregular, rough, slippery, or hot objects by grasping only a small section and found it impossible to hold them because they were off balance.

Unsafe Use of Equipment.—The use of hand tools and other equipment for purposes other than those for which they were designed was a very frequent accident cause, particularly in the refractory plants. Among the more common unsafe acts of this category were the practices of separating clay products which had become fused by striking them with a hammer and of using screwdrivers or the handles of other tools as prys. Additional examples of the misuse of equipment included operating vehicles at excessive speeds, backing trucks without making sure of clearances, and carelessness in handling vehicles at blind corners. Basically, all of these unsafe acts indicate inadequate supervision.

Suggestions for the Prevention of Typical Accidents

To illustrate the general types of accident problems in the clay construction products industry, some typical accidents were selected for detailed study. These accidents were analyzed by a member of the safety-engineering staff of the United States Department of Labor's Bureau of Labor Standards and suggestions were made to indicate how these accidents could have been prevented.

The aim of this section is not to make all-inclusive recommendations nor to attempt to propound authoritative safety rules for the industry. It is to point out, rather, that there is a simple approach to the prevention of nearly every type of accident. Many safety engineers would, no doubt, attack the problems involved in these accidents in different ways and would achieve equally good results. The method of prevention, however, is secondary as long as it achieves its purpose. Nevertheless, it is significant that these recommendations repeatedly stress the need for greater attention in training workers in safe procedures and in closer supervision to insure that the safe procedures are followed.

Brief descriptions of these accidents are given on the following pages, accompanied by recommendations of the Bureau of Labor Standards' Safety Specialist for the prevention of the accidents.

Clay Pits and Mines

1. An employee was operating a steam shovel in the clay pit. As he stepped down from the shovel, he lost his balance and fell. A ring, which he was wearing, caught on the door latch and tore the flesh from his finger.

Investigation disclosed that there were no steps or hand grips on the steam shovel.

(a) *Adequate steps and hand grips should be provided on steam shovels and similar equipment to facilitate safe access to, and exit from, the cabs of such equipment.*

(b) *Employees should not wear rings while they are at work.*

2. An employee, who was operating a steam shovel, in the clay pit, stepped from the shovel

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to oil the tripping mechanism. As he did, a large rock fell from the face of the pit and struck him, pinning him against the shovel.

Investigation disclosed that no schedule was maintained for oiling the shovel.

(a) *Best practice requires that steam shovels and similar equipment be oiled either at the beginning or at the end of each working day.*

(b) *If it becomes necessary to oil or repair the shovel during the day's operations, the shovel should be backed a safe distance from the face of the clay pit before starting such work. Depending on existing conditions, the minimum distance should be from 20 to 50 feet.*

3. An employee who was operating a caterpillar tractor in the clay pit misunderstood signals given by men who were setting off a charge of dynamite, and drove his tractor into the area. In the explosion the employee was struck by flying stones and particles of rock and clay.

Investigation disclosed that only oral signals had been given and that the operator could not hear the signals clearly owing to the noise of his tractor.

(a) *A simple signal system should be adopted and the signals given by a horn or similar device which could be heard under all circumstances. The signals should be given at least 3 minutes before the actual blasting operations.*

(b) *Watchmen should be posted to prevent workmen from entering the blasting area.*

(c) *When it is practical, blasting should be conducted before or after the day's normal operations.*

4. An employee who was setting off a charge of dynamite was struck by a large piece of clay during the explosion.

Investigation disclosed that the employee was using short fuses to explode the dynamite. The fuse, which he was using, was approximately 16 inches in length and did not permit him sufficient time to move a safe distance from the charge.

Safe procedures should be developed and rigidly followed in all blasting operations. The minimum length of fuse to be used for different types of blasting should be established by management and the blasters should be thoroughly trained to recognize the conditions under which a fuse longer than the specified minimum should be used. All blasting should be under the direct supervision of experienced personnel.

5. While an employee was tending a conveyor belt, a rock fell from the belt and struck his foot.

Where rocks or large pieces of clay are carried by conveyor belts, baffle-boards at least 8 inches in width should be placed along the belt to prevent the rocks or pieces of clay from rolling or falling from the belt.

6. An employee was coupling two clay cars. His finger was mashed between the coupling and the pin.

Investigation disclosed that a common 8-inch bolt was being used for a coupling pin.

Only devices designed for use as coupling pins should be used in coupling clay cars. The coupling pins should be at least 18 inches in length and constructed so that the head of the pin is ring-shaped, permitting it to be used as a handle during the coupling operation.

Preparation Departments

7. An employee working in a clay bin was struck by clay which was being dumped into the bin from an overhead bucket.

(a) *Where workers are required to enter bins, they should personally inform crane or scraper operators who should be instructed not to put materials into the bin until notified by the same person. A "watcher" should be posted at the top of the bin to prevent other persons from putting materials into the bin.*

(b) *Precautions should also be taken to prevent anyone from dumping bin while worker is inside.*

(c) *Workers in bins should be provided with safety belts and life lines.*

8. An employee was using a pick to break pieces of clay in the crusher. When the handle of the pick struck the frame of the machine, it was deflected and struck the workman.

Investigation disclosed that an iron bar had been provided for this work but the employee was not using it at the time of the accident.

Employees should be carefully instructed in the proper use of hand tools and supervisors should make sure that the safe procedures are followed.

9. An employee was cleaning clay from the pulley of a grinding machine by striking it with an iron bar while the machine was in operation. The belt caught the bar and the employee's hand was drawn into the pulley.

(a) *Employees should never be permitted to oil or clean machinery while it is in motion.*

(b) *All pulleys and belts should be adequately guarded.*

10. While feeding a conveyor belt for the grinder an employee was injured when a large piece of clay rolled from the pile and struck his foot.

Investigation disclosed that the employee had undercut the pile.

Close supervision and adequate job training are necessary to prevent accidents of this type. Safe practice in breaking down a pile of clay requires that the working surface of the pile be maintained at an angle less than 45°.

Molding Departments

11. A granulator operator was cleaning his machine. When he jumped down into the granulator, his foot slipped and he struck his knee on the granulator knife.

A ladder designed for this work should be provided and supervisors should enforce its use.

12. Clay had become packed in the hopper of a mixer. An employee entered the hopper to loosen the clay and, as he was working, the clay slid and smothered him.

Investigation disclosed that it was common practice for employees to work in these hoppers without safety belts and lines and without other employees being present.

(a) *Safety belts and lines which will not permit employees to work below the top level of the clay in the hoppers should be provided and supervisors should make sure that such equipment is used in this work.*

(b) *When an employee is working in a bin, a "watcher" should be stationed at the top of the bin (1) to prevent material being dropped into it, and (2) to assure the safety of the worker in the bin.*

13. While an employee was pushing a rack car to the drier, one of the racks loosened and fell on his thumb.

Investigation disclosed that the racks had not been placed properly in the car when it was loaded.

Employees should be carefully instructed in the proper methods of loading rack cars and close supervision should be provided to assure that safe procedures are followed.

14. While an employee was loading a 9 by 13-inch flue lining on a truck, the flue lining broke and fell on his foot.

Investigation disclosed that the flue lining broke when it struck the truck which the employee was loading.

(a) *Safe procedures should be developed for piling "green" products. Employees should be thoroughly trained in these procedures and supervisors should make sure that they are rigidly followed.*

(b) *Workers handling heavy objects should wear steel-toed safety shoes.*

15. As an employee was moving a rack car to the drier, the car behind him rolled forward and pinned him between the cars.

Investigation disclosed that the tracks were constructed on a slight incline and that the cars were seldom blocked to prevent them from drifting.

(a) *Wherever possible, the tracks should be constructed on the level to prevent cars from rolling.*

(b) *Safe procedures should be developed for the blocking of cars.—Employees should be carefully instructed in these safe procedures and supervisors should make sure that they are rigidly followed.*

16. An employee was using a pinch bar to change the die on a press. When he struck the bar with a hammer, a small piece of steel chipped off and punctured his arm.

Investigation disclosed that the head of the bar was mushroomed owing to extended use and that a common claw hammer was used to strike the bar.

All tools should be inspected frequently and maintained in safe condition.

17. While a transfer operator was pulling the cable on the transfer to hook it to a drier car, a sliver of steel penetrated his finger.

Investigation disclosed that the operator was not wearing gloves.

(a) *Cables should be inspected frequently and, if worn, should be replaced.*

(b) *Workers engaged in this work should be required to wear leather gloves.*

18. While crossing the transfer tracks, an employee stumbled over one of the rails and fell.

Investigation disclosed that the employee ac-

tually stepped on the rail while crossing the tracks.

Safe procedures should be developed to eliminate, so far as possible, the need for crossing the transfer tracks. In addition, all employees should be carefully instructed as to the hazards of crossing the tracks and warned specifically not to step on the rails because of the danger of slipping.

19. An employee was cleaning the die on a dry press with a steel brush. While engaged in this work, some fine particles became embedded in his eye.

Employees engaged in this work should be required to wear safety goggles or face shields.

20. An employee was cleaning mud from a conveyor while it was in motion. His finger was fractured when it was caught between the rollers.

Investigation disclosed that the employee violated a plant rule that machinery should not be oiled or cleaned while it is in motion.

Close supervision is necessary to prevent accidents of this type.

21. An employee was changing the die on a sewer pipe press. As he stooped to pick up a nut from the floor the clay in the die came loose and fell, striking the employee on the head.

Investigation disclosed that the employee was attempting to change the die without properly cleaning the die and bell.

Careful instruction in the safe method of changing the die should be given to all employees engaged in this work. Close supervision should be provided to make sure that the safe procedures are strictly followed.

22. An employee was using a wrench to adjust the feeder belt on a press. The belt caught the wrench and pulled the employee's hand into it.

No adjustments or repairs should be made on equipment while it is in operation. Supervisors should be required to enforce this rule strictly.

23. An employee was removing blocks from a conveyor belt. When his foot slipped on some sand lying on the floor, the employee strained himself.

Investigation disclosed that the sand had been spilled on the floor several hours before the accident.

Good housekeeping is essential to accident prevention. Floors should be cleaned frequently and employees instructed to remove immediately any materials dropped on the floor. Foremen should be responsible for the housekeeping within their respective departments.

Drying Departments

24. As an employee was helping to move a drier car into the drier, the car caught on the door of the drier. The employee pulled on the car to release it, and when it came free, the car moved forward rapidly, pinning the employee between it and a car on the adjoining track.

Investigation disclosed that the door of the drier had not been opened completely. As a result there was insufficient clearance between the side of the car and the door.

All employees should be carefully instructed in the safe performance of their jobs and supervisors should see that workers follow these instructions. In this case, (a) the door should have been opened sufficiently to permit the entrance of the car into the drier and (b) the car should have been pushed instead of pulled.

25. While an employee was pushing a rack car into the drier, his finger was caught between the car and the frame of the drier.

Investigation disclosed that the employee was pushing the rack car with his fingers bent around the side frames of the car.

Employees should be trained to place their hands on the end frame of the cars instead of the side frames.

26. A transfer operator was standing on the transfer pulling a car of bricks toward him while his co-workers were pushing the car. When his foot slipped, the transfer operator fell under the car.

Employees should be carefully instructed in the safe performance of their duties. Cars should be pushed instead of pulled.

27. While an employee was pushing a car of bricks at the drier shed, the end row of bricks fell from the car and struck his foot.

Investigation disclosed that broken brickbats lying on the tracks had jarred the bricks loose as the car passed over them.

(a) *A regular cleaning schedule should be developed and rigidly followed. In addition, em-*

ployees should be trained to remove promptly any material dropped from cars while it is being transferred.

(b) *Employees handling bricks should wear steel-toed safety shoes.*

Setting Departments

28. An employee was setting bricks in a kiln. While catching bricks, one slipped from his hand and struck his wrist.

Investigation disclosed that the setter had been standing in an awkward position while attempting to catch the bricks.

(a) *Workers should be carefully trained in safe procedures. In this work, the setter should have a secure footing so that he can handle the bricks efficiently.*

(b) *Employees handling bricks should be furnished, and required to wear, hand leathers.*

29. An employee, who was setting bricks on the floor of the kiln, was struck by a brick dropped by an employee working above him.

Safe procedures should be developed for all operations. In this case the foreman should have planned the work to eliminate the necessity of having one employee working immediately under another workman.

30. An employee lost his footing and fell from the bench on which he was working.

Investigation disclosed that several loose bricks were lying on the narrow bench on which the employee was standing.

(a) *Employees should be instructed in the safe performance of their duties and supervisors should make sure that workmen strictly follow the safe work methods. Benches should be kept free of loose bricks and should be at least 30 inches in width. Employees should not work near the edge of these benches.*

(b) *For better footing while working on piles of bricks, the employees should work from platforms.*

31. An employee, who was catching tile, momentarily lost his balance and owing to the weight of the tile, strained his back.

Investigation disclosed that the tile had been thrown away from the employee so that in reaching for it he lost his balance.

In this work coordination is essential to the safe and efficient handling of tiles. Setters should make sure that their footing is secure; tossers should carefully throw the tiles so that the setters can reach them easily.

32. A tosser threw some bricks when the setter was not looking. The bricks struck the setter's arm.

Coordinated teamwork is essential to the safety of these operations. Before throwing bricks, the tosser should make sure that the setter is ready to receive them.

33. A setter was working directly above the tosser. When he failed to catch the bricks thrown to him, they fell on the tosser's head.

Investigation disclosed that the setter could not reach the bricks thrown to him.

Careful instruction and close supervision are necessary to prevent accidents of this type. To avoid being struck by falling bricks, tossers should not work directly under the setters. In addition, they should be thoroughly trained in the safe method of tossing bricks.

Burning Departments

34. While pulling a loaded kiln car, an employee strained his back.

Investigation disclosed that the employee was attempting to move the loaded kiln car without assistance.

(a) *Loaded kiln cars should be moved mechanically instead of manually.*

(b) *Where it is necessary to move loaded kiln cars by hand, at least two men should be employed owing to the weight involved. The cars should be pushed instead of pulled.*

35. A loaded kiln car had been derailed. While attempting to lift the car onto the tracks, an employee strained his back.

Investigation disclosed that he had attempted to lift the car onto the tracks without assistance.

Careful instruction and close supervision should be provided for all lifting operations. Supervisors should provide sufficient help for the lifting of heavy or bulky objects. In this case several men should have been used in lifting the kiln car.

36. An employee was charging a tunnel kiln. As he pulled a loaded drier car on the track beside

him, the car caught on an extension cord attached to a floor fan. The fan toppled over and struck the employee's leg.

Investigation disclosed that the extension cord could have been plugged in at another location away from the working area.

(a) *Employees should be instructed to watch for possible hazards when placing portable equipment. In this instance the extension cord should have been plugged into the other available outlet.*

(b) *Electric outlets should be placed so that electric cords attached to these outlets will not present tripping hazards.*

37. While firing a kiln, an employee turned his ankle on a piece of coal lying near the kiln.

Investigation disclosed that housekeeping in the area was generally poor.

Good housekeeping is essential to safety in any operation. Coal should be kept neatly piled near the kilns and workers should immediately remove any pieces of coal which are dropped during the firing operation.

38. As an employee opened the kiln door, the heat from the kiln burned his face and arms.

Investigation disclosed that the kiln was being opened before it had cooled sufficiently.

Before the door of a kiln is removed, the kiln should be tested by a responsible employee to make sure that it has cooled sufficiently.

39. An employee was removing the door of a kiln. As he reached for a brick his leather glove caught on another brick and turned back. As a result, his hand was burned when it touched a hot brick.

Investigation disclosed that the gloves which the employee was using were badly worn and did not afford the protection they normally provided.

All personal safety equipment should be inspected frequently and, if defective, should be replaced.

40. A transfer operator was moving kiln cars onto a storage track by means of a winch. The cable broke, snapped, and struck the employee's foot.

Investigation revealed that (a) there were no regular inspections of equipment in the plant and (b) the cable was badly worn.

All cables should be inspected regularly and if worn or frayed should be replaced immediately.

Drawing and Wheeling Departments

41. While placing bricks in a wheelbarrow, an employee cut his hand on the sharp edge of a broken brick.

Investigation disclosed that the employee was not using the hand leathers which had been provided.

Employees should be instructed in safe work methods. Supervisors should see that employees use the protective equipment provided for them.

42. An employee burned his arm while pushing a hot kiln car from a tunnel kiln.

Investigation disclosed that the employee was wearing a short-sleeved shirt.

(a) *Kiln cars should be removed from the kilns mechanically instead of manually.*

(b) *Employees who are required to handle hot kiln cars should be required to wear adequate personal safety equipment.*

43. An employee was drawing a kiln. As he was rolling a 36-inch sewer pipe his hand was squeezed between the pipe and the kiln door.

Investigation disclosed that several broken bats were scattered on the floor at the entrance to the kiln. When the pipe struck one of these pieces it turned and pinched the employee's hand between the pipe and the kiln door.

Good housekeeping is essential to safety. Broken pieces of pipe and other loose objects should be removed to a safe place as soon as they are discovered.

44. An employee was pushing a wheelbarrow loaded with sewer pipes. The wheelbarrow tipped and the employee's hand was caught between the handle of the wheelbarrow and a pile of pipe.

Investigation disclosed that the wheelbarrow had been improperly loaded.

(a) *Employees engaged in this work should be carefully instructed in the safe method of loading and handling wheelbarrows.*

(b) *Knuckle guards should be provided on all wheelbarrows.*

45. As an employee was wheeling a load of bricks through a narrow door he bumped his knuckles on the door frame.

Investigation disclosed that the doorway was too narrow for the safe passage of wheelbarrows.

(a) *Supervisors should plan and lay out each operation for efficiency and safety. Employees should then be instructed in these procedures and supervisors should make sure that the instructions are obeyed. In this instance an alternative trucking route should have been established to eliminate the necessity for using the narrow doorway.*

(b) *Knuckle guards should be provided on all wheelbarrows.*

46. While drawing bricks from a kiln an employee was overcome by the heat remaining in the kiln.

Investigation disclosed that because the plant was under pressure to fill a rush order, the drawing operations had been started before the kiln had cooled sufficiently to permit the safe entry of workers.

Kilns should never be drawn until they have cooled. Supervisors should be responsible for determining when kilns may be entered safely.

47. An employee was unloading 6-inch sewer pipes from a kiln. While attempting to catch a pipe thrown to him by another worker, the employee lacerated his hand on a sharp edge of the pipe.

Investigation disclosed that the employee was not wearing hand leathers at the time of the accident.

(a) *In drawing kilns, pipes should be passed, not thrown.*

(b) *Employees engaged in this work should be required to wear adequate hand protection. This equipment should be inspected frequently and, if defective, should be replaced.*

48. An employee was drawing bricks from a kiln. A brick from the unit he was lifting fell and struck his toe.

Investigation disclosed that (a) the employee was handling five bricks as a unit and (b) he was not wearing safety shoes.

(a) *The number of bricks that can be handled safely under varying conditions should be determined and that standard should be maintained. Under ordinary circumstances, employees should not attempt to handle more than three bricks at a time.*

(b) *Employees engaged in this work should be required to wear steel-toed safety shoes.*

49. An employee was loading flue liners on a wheelbarrow. The jagged edge of one of the liners penetrated his gloves and lacerated his fingers.

Investigation disclosed that the employee was wearing light canvas gloves.

Employees engaged in this work should be required to wear proper hand leathers or gloves with leather palms.

50. As an employee picked up a brick a splinter from the brick punctured his hand.

Investigation disclosed that the employee was not wearing gloves or hand leathers.

Employees engaged in this work should be required to wear proper hand leathers or gloves with leather palms.

51. An employee stood on a wheelbarrow to remove a 12-inch sewer pipe from the top of a kiln. When his foot slipped he fell and strained his back.

Investigation disclosed that (a) no assistance had been provided for lifting the pipe and (b) no equipment had been provided for reaching the top of the kiln.

Sewer pipe of this size should be handled mechanically instead of manually. If mechanical equipment is not available, several men trained to work as a team should be assigned to this work.

52. An employee, who was drawing bricks from a kiln, found two that had become fused. In attempting to separate them he struck them against another brick. As he did so a chip flew from one of the bricks and struck his eye.

Investigation disclosed that no provision had been made for separating bricks which were fused during the burning operation.

Bricks should never be separated by striking them against other objects. Instead, a hammer and chisel should be provided for this purpose. Employees engaged in this work should also be required to wear proper goggles.

53. An employee was pulling a fan into position by grasping the blades. When a coworker turned the control switch the employee's fingers were caught in the fan.

Investigation disclosed that the fan blades were not guarded and the control switch was located so that the fan and the injured employee could not have been seen.

(a) *The fan blades should be properly guarded.*

(b) *Employees should be carefully instructed as to the hazards of their jobs. In this case the*

employee should not have moved the fan before disconnecting it.

(c) *Switches should be installed on electrical equipment or should be located so that the equipment is in full view at all times.*

54. An employee was wheeling brick through a shed. When the wheelbarrow struck a brick on the floor the handle of the wheelbarrow turned and struck him.

Investigation disclosed that (a) on cloudy days the natural lighting was limited in this area, (b) artificial lights were inadequate, and (c) housekeeping was generally poor throughout the area.

(a) *A thorough study should be made to determine the adequacy of existing lighting facilities. Where the lighting is inadequate additional fixtures should be provided.*

(b) *A regular cleaning schedule should be developed to maintain good housekeeping. In addition, employees should be instructed to remove immediately, any bricks which have fallen during wheeling operations. The necessary supervision should also be provided to assure the enforcement of these safe procedures.*

55. An employee pushed several trailers through an open door in front of a second workman who was walking along a shipping dock. To escape being struck by the trailers, the second employee jumped off the dock and strained his back.

Investigation disclosed that the employee who was pushing the trailers gave no signals before entering the dock area nor did he enter the area at a reduced speed.

(a) *Mirrors should be installed at blind corners to provide a view of approaching traffic.*

(b) *Employees engaged in trucking operations should be carefully trained regarding the hazards of their work. Before entering any blind intersection truckers should slow down, sound a warning and enter the intersection cautiously. Supervisors should enforce these instructions rigidly.*

56. While trying to prevent a loaded wheelbarrow from overturning, an employee strained his side.

Investigation disclosed that the wheelbarrow had been improperly loaded and that the employee was attempting to avoid a collision with another worker at a blind corner at the time of the accident.

(a) *Employees should be thoroughly trained in the correct method of loading wheelbarrows.*

(b) *Mirrors should be installed at all blind corners to provide a view of approaching traffic.*

(c) *Employees should be trained to enter blind intersections cautiously to avoid collisions.*

57. An employee was wheeling bricks in an aisle running between two piles of bricks. To permit another wheeler to pass, he pushed his wheelbarrow to the side of the aisle. As he did, his wheelbarrow tipped and, to avoid spilling his load, he jerked the wheelbarrow upright and struck his hand against the corner of a pile of bricks.

Investigation disclosed that the aisle was not wide enough for wheelbarrows to pass safely.

(a) *Supervisors should plan and lay out each operation for efficiency and safety. In this case, the aisle should have been restricted to one-way traffic since it was not wide enough for wheelers to pass safely.*

(b) *Knuckle guards should be installed on the handles of all wheelbarrows.*

Shipping Departments

58. While wheeling bricks into a box car, an employee slipped on the metal runway and sprained his knee.

Investigation disclosed that the metal runway had become very slippery owing to prolonged use.

Metal runways should have diamond tread or other rough surfaces. They should be inspected regularly and if worn should be replaced.

59. A splinter from a wire-bound box punctured the finger of an employee who was crating bricks.

Investigation disclosed that (a) the crate had been damaged and (b) the employee was not wearing gloves.

(a) *All crates should be carefully inspected and damaged ones should be removed.*

(b) *Employees engaged in this work should be required to wear hand leathers or gloves.*

60. An employee was wheeling a load of bricks into a boxcar. The wheelbarrow broke through the floor of the car, throwing the employee against the side of the car.

Investigation disclosed that the floor of the car was badly worn.

Before loading any boxcar it should be inspected

for defects. If the defects are likely to cause an accident or to damage the products en route, they should be repaired before loading operations begin.

61. As an employee was placing a steel runway into position at a boxcar, he pinched his finger between the runway and the car-door facing.

Investigation disclosed that the runway was too heavy for one person to place into position safely.

Sufficient help, trained to work as a team, should be provided for lifting or moving all heavy or bulky objects.

62. While an employee was sorting tile a jagged piece cut his hand.

Investigation disclosed that the employee was not wearing the hand leathers which had been provided.

Careful instruction and close supervision are necessary to prevent accidents of this type.

63. An employee stepped on a hoe lying on the floor of a boxcar. The handle of the hoe flew up and struck his elbow.

Investigation disclosed that the hoe had been used for cleaning the boxcar.

All hand tools should be returned to their designated storage places as soon as possible. They should never be permitted to lie on floors or in aisles.

64. An employee was riding on top of a load of 6-inch pipe. The load of pipe toppled from the truck and fell on him.

Investigation disclosed that the employee was riding on the load to steady it.

(a) *The load should be secured so as to make it unnecessary for employees to ride in this position.*

(b) *Employees should never be permitted to ride on loads of pipe, brick, tile, etc. Supervisors should rigidly enforce this rule.*

Maintenance Departments

65. An employee was repairing the speed reducer of a spraying machine. A second employee started the machine and the maintenance worker's hand was caught in the belt.

Before repair work is started on any machine or mechanical equipment, the starting switch should be locked in an open position and tagged.

66. A maintenance worker was soldering a gasoline tank. The heat from the soldering iron caused the tank to explode, burning the employee.

Investigation disclosed that the tank had not been steamed before the soldering operations began.

Before soldering or welding operations are begun on any tank which has contained combustible material, the tank should be purged with steam. This fact should be definitely established by the supervisor.

67. A welder raised his shield to chip a weld. While chipping, a piece of slag entered his eye.

Investigation disclosed that the welder was not wearing impact goggles at the time of the accident.

For this work welders should be required to wear impact goggles under their welding shields.

Miscellaneous Departments

68. An employee was opening a paperboard box with a knife. The knife slipped from the box and struck the employee's leg.

Investigation disclosed that the employee was using a pocket knife.

A knife specifically designed for opening paperboard boxes should be used in this work.

69. An employee stepped into a hole in a concrete floor and sprained his ankle.

Investigation disclosed that there were several holes in the floor as a result of extended use without proper maintenance.

All floors should be inspected periodically and, if necessary, repaired. If the defective areas cannot be repaired immediately, they should be barricaded until the repairs are made.

70. While an employee was walking along the dock, he fell into the transfer pit.

Investigation disclosed that the employee stumbled over several broken brickbats that were lying on the dock in this area.

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 remove promptly any material dropped from cars or wheelbarrows while it is being transferred. Supervisors should be required to rigidly enforce these procedures.

71. Employees, who were removing the bracing from the crown of a kiln, dropped the boards to the ground. Another employee, who was draw-

ing bricks from a nearby kiln, stepped on a nail projecting from one of the boards.

(a) *The area in which the boards were being dropped should have been roped off or barricaded.*

(b) *Nails projecting from scrap lumber or other material should be removed or bent over promptly and the material should be stacked properly and neatly, as soon as possible.*

72. While an employee was mounting tile, a splinter from the mounting board punctured his finger.

Investigation disclosed that the mounting board was worn and splintered owing to extended use.

All such equipment should be inspected regularly and, if worn or defective, should be replaced or repaired immediately.

73. While an employee was sorting tile, a piece of glaze punctured his hand.

Investigation disclosed that the employee was wearing light canvas gloves.

All employees engaged in this work should be required to wear proper hand leathers or gloves with heavy leather palms.

74. While an employee was using a grinder to trim refractory bricks, some fine particles of clay entered his eye.

Employees engaged in this work should be required to wear protective goggles or face shields.

75. As an employee was closing the gates on an elevator the rope holding the counterweight broke and the gate fell on his hand.

Investigation disclosed that the rope had become frayed through extended use.

All such equipment should be inspected regularly and, if found defective, should be repaired immediately.

Appendix.—Statistical Tables

TABLE 1.—Industrial Injury Rates for 675 Establishments Manufacturing Clay Construction Products, Classified by Kind of Product and by Extent of Disability, 1948

Product[1]	Number of establishments	Number of employees	Employee-hours worked (thousands)	Number of disabling injuries				Frequency rates of[2]—				Severity		
				Total	Resulting in—			All disabling injuries	Death and permanent-total disability	Permanent-partial disability	Temporary-total disability	Average number of days lost or charged per injury		Severity rate[4]
					Death or permanent-total disability[3]	Permanent-partial disability	Temporary-total disability					All disabling injuries	Temporary-total disability	
All products	675	52,995	107,965	4,169	(2) 21	108	4,040	38.6	0.2	1.0	37.4	75	14	2.9
Structural brick	369	18,497	36,907	1,698	(2) 13	46	1,639	46.0	.4	1.2	44.4	93	14	4.3
Drain tile	62	1,821	3,718	192	1	4	187	51.6	.3	1.1	50.2	51	14	2.6
Roofing, floor, and wall tile	22	4,797	9,905	238	----	2	236	24.0	----	.2	23.8	16	13	.4
Structural tile: Total	40	5,106	11,066	362	1	4	357	32.7	.1	.4	32.2	44	14	1.4
Unglazed	24	1,413	3,190	162	1	1	160	50.8	.3	.3	50.2	72	11	3.7
Glazed	16	3,693	7,876	200	----	3	197	25.4	----	.4	25.0	22	17	.5
Sewer pipe	36	5,115	10,638	571	2	11	558	53.7	.2	1.0	52.5	66	15	3.6
Terra cotta	7	669	1,337	51	1	2	48	38.1	.7	1.5	35.9	146	9	5.6
Clay refractories	111	12,999	26,239	855	3	27	825	32.6	.1	1.0	31.5	66	16	2.2

[1] Totals include figures not shown separately because of insufficient data.

[2] Figures in parentheses indicate the number of permanent-total disability cases included.

[3] The frequency rate is the average number of industrial injuries for each million employee-hours worked.

[4] The severity rate is the average number of days lost for each thousand employee-hours worked.

TABLE 2.—Industrial Injury Rates for 675 Establishments Manufacturing Clay Construction Products, Classified by Area, State, Product, and by Extent of Disability, 1948

Area, State, and product[1]	Number of establishments	Number of employees	Employee-hours worked (thousands)	Number of disabling injuries				Frequency rates of[2]—				Severity			
				Total	Resulting in—			All disabling injuries	Death and permanent-total disability	Permanent-partial disability	Temporary-total disability	Average number of days lost or charged per injury			Severity rate[4]
					Death or permanent-total disability[3]	Permanent-partial disability	Temporary-total disability					All disabling injuries	Permanent-partial disability	Temporary-total disability	
United States: Total	675	52,995	107,965	4,169	(2) 21	108	4,040	38.6	0.2	1.0	37.4	75	1,183	14	2.9
New England: Total	27	1,010	1,505	80	----	----	80	53.1	----	----	53.1	12	----	12	.6
Structural brick	23	817	1,119	61	----	----	61	54.5	----	----	54.5	12	----	12	.7
Middle Atlantic: Total	139	11,487	23,719	1,153	1	26	1,126	48.6	----	1.1	47.5	41	1,021	13	2.0
Structural brick	63	3,843	8,180	504	1	13	490	61.6	.1	1.6	59.9	60	1,373	13	3.7
Roofing, floor, and wall tile	8	1,381	2,983	73	----	----	73	24.5	----	----	24.5	13	----	13	.3
Structural tile, glazed	3	765	1,662	69	----	1	68	41.5	----	.6	40.9	18	300	14	.8
Sewer pipe	5	706	1,412	93	----	3	90	65.9	----	2.1	63.8	21	300	12	1.4
Clay refractories	43	4,022	7,920	323	----	5	318	40.8	----	.6	40.2	19	340	14	.8
New Jersey: Total	22	2,069	4,291	192	----	7	185	44.7	----	1.6	43.1	47	921	14	2.1
Structural brick	8	668	1,289	89	----	2	87	69.0	----	1.6	67.4	61	2,150	13	4.2
Roofing, floor, and wall tile	3	546	1,206	29	----	----	29	24.1	----	----	24.1	13	----	13	.3
Clay refractories	8	657	1,356	46	----	3	43	33.9	----	2.2	31.7	41	367	19	1.4
New York: Total	15	1,292	2,850	139	1	11	127	48.8	.4	3.9	44.5	156	1,232	17	7.6
Structural brick	12	953	2,068	126	1	11	114	60.9	.5	5.3	55.1	171	1,232	18	10.4
Pennsylvania: Total	102	8,126	16,578	822	----	8	814	49.6	----	.5	49.1	20	819	12	1.0
Structural brick	43	2,232	4,823	289	----	----	289	59.9	----	----	59.9	11	----	11	.7
Roofing, floor, and wall tile	4	506	1,015	31	----	----	31	30.5	----	----	30.5	14	----	14	.4
Structural tile, glazed	3	765	1,662	69	----	1	68	41.5	----	.6	40.9	18	300	14	.8
Sewer pipe	5	706	1,412	93	----	3	90	65.9	----	2.1	63.8	21	300	12	1.4
Clay refractories	34	3,364	6,562	277	----	2	275	42.2	----	.3	41.9	16	300	14	.7
East North Central: Total	183	16,189	32,983	1,262	7	17	1,238	38.3	.2	.5	37.6	66	1,229	16	2.5
Structural brick	69	4,360	8,507	376	2	6	368	44.2	.2	.7	43.3	67	1,267	15	2.9
Drain tile	41	1,337	2,705	131	----	1	130	48.4	----	.4	48.0	18	300	16	.9
Roofing, floor, and wall tile	5	2,269	4,709	94	----	2	92	20.0	----	.4	19.6	21	300	15	.4
Structural tile, glazed	10	2,692	5,715	112	----	1	111	19.6	----	.2	19.4	23	300	21	.5
Sewer pipe	18	2,728	5,652	335	2	4	329	59.3	.4	.7	58.2	83	2,525	17	4.9
Clay refractories	30	2,061	4,012	146	2	3	141	36.4	.5	.7	35.2	113	667	18	4.1

See footnotes at end of table.

TABLE 2.—Industrial Injury Rates for 675 Establishments Manufacturing Clay Construction Products, Classified by Area, State, Product, and by Extent of Disability, 1948—Continued

Area, State, and product[1]	Number of establishments	Number of employees	Employee-hours worked (thousands)	Number of disabling injuries				Frequency rates of[2]—				Severity			
					Resulting in—							Average number of days lost or charged per injury			Severity rate[4]
				Total	Death or permanent-total disability[3]	Permanent-partial disability	Temporary-total disability	All disabling injuries	Death and permanent-total disability	Permanent-partial disability	Temporary-total disability	All disabling injuries	Permanent-partial disability	Temporary-total disability	
East North Central: Total—Con.															
Illinois: Total	36	2,314	4,632	285	--------	2	283	61.5	--------	0.4	61.1	16	300	14	1.0
Structural brick	21	1,439	2,769	160	--------	2	158	57.8	--------	.7	57.1	20	300	16	1.1
Indiana: Total	39	2,771	5,325	176	--------	2	174	33.1	--------	.4	32.7	27	1,050	15	.9
Structural brick	15	835	1,440	69	--------	--------	69	47.9	--------	--------	47.9	13	--------	13	.6
Drain tile	15	427	828	24	--------	1	23	29.0	--------	1.2	27.8	26	300	14	.7
Structural tile, glazed	3	638	1,274	55	--------	--------	55	43.2	--------	--------	43.2	18	--------	18	.8
Ohio: Total	91	10,625	22,279	777	6	13	758	34.9	0.3	.6	34.0	87	1,400	17	3.0
Structural brick	24	1,748	3,828	128	1	4	123	33.4	.3	1.0	32.1	115	1,750	14	3.9
Drain tile	14	612	1,293	56	--------	--------	56	43.3	--------	--------	43.3	22	--------	22	.9
Roofing, floor, and wall tile	4	1,798	3,734	88	--------	2	86	23.6	--------	.5	23.1	22	300	15	.5
Structural tile, glazed	7	2,054	4,441	57	--------	1	56	12.8	--------	.2	12.6	28	300	23	.4
Sewer pipe	15	2,408	5,007	316	2	3	311	63.1	.4	.6	62.1	82	2,767	18	5.2
Clay refractories	22	1,628	3,121	79	2	3	74	25.3	.6	1.0	23.7	199	667	23	5.0
West North Central: Total	64	6,967	14,876	517	3	15	499	34.8	.2	1.0	33.6	66	657	12	2.3
Structural brick	29	1,078	2,368	139	2	3	134	58.7	.8	1.3	56.6	106	300	13	6.2
Structural tile, unglazed	9	543	1,277	72	--------	--------	72	56.4	--------	--------	56.4	12	--------	12	.7
Sewer pipe	4	533	1,188	53	--------	--------	53	44.6	--------	--------	44.6	14	--------	14	.6
Clay refractories	9	4,141	8,509	185	--------	10	175	21.7	--------	1.2	20.5	53	745	13	1.1
Iowa: Total	20	1,064	2,476	140	1	2	137	56.5	.4	.8	55.3	58	300	11	3.3
Structural tile, unglazed	6	454	1,059	65	--------	--------	65	61.4	--------	--------	61.4	11	--------	11	.7
Kansas: Total	10	549	1,172	47	--------	1	46	40.1	--------	.9	39.2	21	300	15	.8
Missouri: Total	22	4,831	10,046	265	2	11	252	26.4	.2	1.1	25.1	87	705	13	2.3
South Atlantic: Total	71	5,276	11,472	343	(1) 2	14	327	29.9	.2	1.2	28.5	131	2,018	14	3.9
Structural brick	54	3,132	6,711	199	(1) 2	7	190	29.7	.3	1.0	28.4	122	1,407	13	3.6
Clay refractories	7	1,050	2,382	57	--------	3	54	23.9	--------	1.3	22.6	228	4,000	18	5.4
Georgia: Total	9	1,684	3,872	103	--------	3	100	26.6	--------	.8	25.8	72	2,033	14	1.9
Structural brick	5	697	1,557	59	--------	1	58	37.9	--------	.6	37.3	18	300	13	.7
Maryland: Total	9	667	1,374	56	--------	--------	56	40.8	--------	--------	40.8	12	--------	12	.5
Structural brick	7	400	883	30	--------	--------	30	34.0	--------	--------	34.0	12	--------	12	.4
North Carolina: Total	14	959	1,987	54	--------	1	53	27.2	--------	.5	26.7	18	300	12	.5
Structural brick	12	566	1,151	18	--------	--------	18	15.6	--------	--------	15.6	7	--------	7	.1
South Carolina: Total	10	498	1,096	24	(1) 2	2	20	21.9	1.8	1.8	18.3	651	1,650	17	14.3
Structural brick	9	481	1,058	21	(1) 2	2	17	19.9	1.9	1.9	16.1	743	1,650	18	14.8
Virginia: Total	13	560	1,221	51	--------	4	47	41.8	--------	3.3	38.5	61	638	12	2.6
Structural brick	12	545	1,191	49	--------	3	46	41.2	--------	2.5	38.7	57	750	12	2.4
West Virginia: Total	12	817	1,737	45	--------	4	41	25.9	--------	2.3	23.6	377	4,000	23	9.8
Structural brick	7	392	761	22	--------	1	21	28.9	--------	1.3	27.6	198	4,000	17	5.7
East South Central: Total	45	2,425	4,588	157	(1) 5	6	146	34.2	1.1	1.3	31.8	223	425	17	7.6
Structural brick	30	1,166	2,132	76	(1) 4	2	70	35.7	1.9	.9	32.9	343	450	17	12.2
Clay refractories	8	864	1,692	59	1	3	55	34.9	.6	1.8	32.5	145	450	21	5.0
Alabama: Total	16	1,278	2,643	72	2	5	65	27.2	.8	1.9	24.5	211	390	19	5.7
Structural brick	9	568	1,187	27	1	1	25	22.7	.8	.8	21.1	245	300	12	5.6
Clay refractories	5	545	1,101	40	1	3	36	36.3	.9	2.7	32.7	204	450	23	7.4
Kentucky: Total	15	756	1,264	58	1	--------	57	45.9	.8	--------	45.1	123	--------	20	5.6
West South Central: Total	44	2,482	5,199	256	1	8	247	49.2	.2	1.5	47.5	91	1,675	16	4.5
Structural brick	36	1,890	3,946	204	1	8	195	51.7	.3	2.0	49.4	112	1,675	17	5.8
Arkansas: Total	8	648	1,393	53	--------	2	51	38.0	--------	1.4	36.6	66	900	33	2.5
Structural brick	7	544	1,179	53	--------	2	51	45.0	--------	1.7	43.3	66	900	33	2.9
Oklahoma: Total	9	359	786	37	--------	1	36	47.1	--------	1.3	45.8	73	2,400	9	3.5
Texas: Total	22	1,334	2,827	162	1	5	156	57.3	.4	1.8	55.1	105	1,840	11	6.0
Structural brick	16	886	1,891	115	1	5	109	60.8	.5	2.6	57.7	144	1,840	13	8.8
Rocky Mountain: Total	35	1,354	2,563	101	--------	2	99	39.4	--------	.8	38.6	25	525	15	1.0
Structural brick	27	653	1,140	44	--------	1	43	38.6	--------	.9	37.7	38	750	21	1.4
Colorado: Total	16	796	1,576	78	--------	1	77	49.5	--------	.6	48.9	16	300	12	.8
Pacific: Total	67	5,805	11,060	300	2	20	278	27.1	.2	1.8	25.1	138	1,260	15	3.7
Structural brick	38	1,558	2,804	95	1	6	88	33.9	.4	2.1	31.4	137	967	14	4.7
Roofing, floor, and wall tile	7	806	1,525	54	--------	--------	54	35.4	--------	--------	35.4	13	--------	13	.5
California: Total	42	5,141	9,782	256	2	15	239	26.2	.2	1.5	24.5	137	1,320	13	3.6
Structural brick	22	1,081	1,880	80	1	6	73	42.6	.5	3.2	38.9	161	967	15	6.9
Roofing, floor, and wall tile	7	806	1,525	54	--------	--------	54	35.4	--------	--------	35.4	13	--------	13	.5
Washington: Total	10	390	812	42	--------	4	38	51.7	--------	4.9	46.8	145	1,275	26	7.5

[1] Totals include figures not shown separately because of insufficient data.
[2] Figures in parentheses indicate the number of permanent-total disability cases included.
[3] The frequency rate is the average number of industrial injuries for each million employee-hours worked.
[4] The severity rate is the average number of days lost for each thousand employee-hours worked.

TABLE 3.—Industrial Injury Rates for 675 Establishments Manufacturing Clay Construction Products, Classified by Product, Size of Plant and by Extent of Disability, 1948

Product and size of plant[1]	Number of establishments	Number of employees	Employee-hours worked (thousands)	Number of disabling injuries				Frequency rates of [2]—				Severity			
					Resulting in—							Average number of days lost or charged per injury			Severity rate[4]
				Total	Death or permanent-total disability[3]	Permanent-partial disability	Temporary-total disability	All disabling injuries	Death and permanent-total disability	Permanent-partial disability	Temporary-total disability	All disabling injuries	Permanent-partial disability	Temporary-total disability	
Total	675	52,995	107,965	4,169	(2) 21	108	4,040	38.6	0.2	1.0	37.4	75	1,183	14	2.9
Less than 25 employees	160	2,154	3,627	122	(1) 4	8	110	33.6	1.1	2.2	30.3	267	869	15	9.0
25 to 49 employees	206	7,250	1,436	611	4	15	592	42.5	.3	1.0	41.2	77	1,033	13	3.3
50 to 74 employees	102	6,021	12,367	596	(1) 4	10	582	48.2	.3	.8	47.1	83	1,825	13	4.0
75 to 99 employees	71	6,034	12,347	589	5	13	571	47.7	.4	1.1	46.2	91	1,192	14	4.3
100 to 249 employees	107	15,279	31,605	1,367	4	38	1,325	43.3	.1	1.2	42.0	67	1,263	15	2.9
250 employees and over	29	16,257	33,656	884	----	24	860	26.3	----	.7	25.6	43	981	16	1.1
Structural brick : Total	369	18,497	36,907	1,698	(2) 13	46	1,639	46.0	.4	1.2	44.4	93	1,240	14	4.3
Less than 25 employees	85	1,271	1,996	65	(1) 3	3	59	32.6	1.5	1.5	29.6	354	1,450	11	11.5
25 to 49 employees	144	5,054	9,606	429	3	11	415	44.7	.3	1.1	43.3	80	964	14	3.6
50 to 74 employees	73	4,304	8,729	433	(1) 3	8	422	49.6	.3	.9	48.4	87	1,744	14	4.3
75 to 99 employees	39	3,323	6,914	336	2	7	327	48.6	.3	1.0	47.3	76	1,371	12	3.7
100 to 249 employees	24	3,194	6,671	293	2	15	276	43.9	.3	2.2	41.4	114	1,137	15	5.0
250 employees and over	4	1,351	2,991	142	----	2	140	47.5	----	.7	46.8	33	750	23	1.6
Structural tile : Total	40	5,106	11,066	362	1	4	357	32.7	.1	.4	32.2	44	1,225	14	1.4
Less than 50 employees	16	520	1,216	47	----	----	47	38.7	----	----	38.7	9	----	9	.4
50 to 99 employees	11	739	1,518	74	1	----	73	48.7	.7	----	48.0	92	----	11	4.5
100 to 249 employees	10	1,632	3,776	176	----	4	172	46.6	----	1.1	45.5	42	1,225	15	2.0
250 employees and over	3	2,215	4,556	65	----	----	65	14.3	----	----	14.3	22	----	22	.3
Sewer pipe : Total	36	5,115	10,638	571	2	11	558	53.7	.2	1.0	52.5	66	1,582	15	3.6
Less than 100 employees	10	740	1,531	87	----	3	84	56.8	----	2.0	54.8	107	2,767	12	6.1
100 to 249 employees	23	3,523	7,340	366	2	7	357	49.9	.3	1.0	48.6	72	1,257	16	3.6
250 employees and over	3	852	1,767	118	----	1	117	66.8	----	.6	66.2	17	300	15	1.2
Clay refractories : Total	111	12,999	26,239	855	3	27	825	32.6	.1	1.0	31.5	66	948	16	2.2
Less than 50 employees	41	1,025	2,045	56	----	3	53	27.4	----	1.5	25.9	40	367	22	1.1
50 to 74 employees	10	574	1,164	49	----	----	49	42.1	----	----	42.1	10	----	10	.4
75 to 99 employees	20	1,696	3,324	135	3	5	127	40.6	.9	1.5	38.2	165	380	19	6.7
100 to 249 employees	33	4,652	9,212	391	----	9	382	42.4	----	1.0	41.4	54	1,717	15	2.3
250 employees and over	7	5,052	10,494	224	----	10	214	21.3	----	1.0	20.3	45	715	14	1.0

[1] Totals include figures not shown separately because of insufficient data.
[2] Figures in parentheses indicate the number of permanent-total disability cases included.
[3] The frequency rate is the average number of industrial injuries for each million employee-hours worked.
[4] The severity rate is the average number of days lost for each thousand employee-hours worked.

TABLE 4.—Industrial Injury Rates for 650 Establishments Manufacturing Clay Construction Products, Classified by Kind of Safety Organization and by Extent of Disability, 1948

Kind of safety organization[1]	Number of establishments	Number of employees	Employee-hours worked (thousands)	Number of disabling injuries				Frequency rates of[2]—				Severity			
				Total	Resulting in—			All disabling injuries	Death and permanent-total disability	Permanent-partial disability	Temporary-total disability	Average number of days lost or charged per injury			Severity rate[4]
					Death or permanent-total disability[2]	Permanent-partial disability	Temporary-total disability					All disabling injuries	Permanent-partial disability	Temporary-total disability	
Total	650	52,002	106,019	4,073	(1) 20	105	3,948	38.4	0.2	1.0	37.2	73	1,143	15	2.8
Establishments with safety engineers	21	6,469	13,246	245	1	19	225	18.5	.1	1.4	17.0	140	1,276	18	2.6
And with safety committees	17	6,009	12,383	210	--------	19	191	17.0	--------	1.5	15.5	131	1,276	17	2.2
Composed of supervisory workers	5	2,384	5,061	34	--------	4	30	6.7	--------	.8	5.9	67	413	21	.5
Composed of supervisory and nonsupervisory workers	11	3,529	7,138	176	--------	15	161	24.7	--------	2.1	22.6	143	1,507	16	3.5
Establishments without safety engineers	629	45,533	92,773	3,828	(1) 19	86	3,723	41.3	.2	.9	40.2	69	1,113	14	2.8
But with safety committees	187	21,195	43,418	1,593	7	41	1,545	36.7	.2	.9	35.6	65	906	15	2.4
Composed of nonsupervisory workers	10	1,804	3,751	52	--------	2	50	13.9	--------	.5	13.4	103	2,150	21	1.4
Composed of supervisory workers	65	7,532	15,482	568	4	23	541	36.7	.3	1.5	34.9	100	1,093	14	3.7
Composed of supervisory and nonsupervisory workers	101	11,308	23,159	942	3	16	923	40.7	.1	.7	39.9	43	481	16	1.7
And without safety committees	442	24,338	49,355	2,235	(1) 12	45	2,178	45.3	.2	.9	44.2	72	1,302	14	3.2

[1] Totals include figures not shown separately because of insufficient data.
[2] Figures in parentheses indicate the number of permanent-total disability cases included.
[3] The frequency rate is the average number of industrial injuries for each million employee-hours worked.
[4] The severity rate is the average number of days lost for each thousand employee-hours worked.

TABLE 5.—Industrial Injury Rates for 675 Establishments Manufacturing Clay Construction Products Classified by Department and Extent of Disability, 1948

Department[1]	Number of establishments	Number of employees	Employee-hours worked (thousands)	Number of disabling injuries				Frequency rates of[3]—				Severity			
				Total	Resulting in—			All disabling injuries	Death and permanent-total disability	Permanent-partial disability	Temporary-total disability	Average number of days lost or charged per injury			Severity rate[4]
					Death or permanent-total disability[2]	Permanent-partial disability	Temporary-total disability					All disabling injuries	Permanent-partial disability	Temporary-total disability	
Total	675[5]	52,995	107,965	4,169	(2) 21	108	4,040	38.6	0.2	1.0	37.4	75	1,183	14	2.9
Clay pit	388	1,436	2,873	121	(1) 4	6	111	42.1	1.4	2.1	38.6	271	1,100	20	11.4
Clay mine	94	1,147	2,375	177	--------	2	175	74.5	--------	.8	73.7	36	1,350	21	2.7
Preparation	434	2,323	4,843	229	(1) 3	11	215	47.3	.6	2.3	44.4	169	1,559	16	8.0
Molding	611	8,991	17,992	603	3	22	578	33.5	.2	1.2	32.1	76	820	16	2.5
Soft-mud process	149	1,918	3,778	154	--------	8	146	40.8	--------	2.1	38.7	60	856	16	2.4
Stiff-mud process	332	4,083	8,141	315	3	9	303	38.7	.4	1.1	37.2	104	1,078	17	4.0
Dry-press	100	2,289	4,615	102	--------	3	99	22.1	--------	.7	21.4	25	300	16	.5
Drying	257	849	1,678	80	1	3	76	47.7	.6	1.8	45.3	107	467	16	5.1
Setting	500	4,365	8,712	373	1	5	367	42.8	.1	.6	42.1	50	1,580	13	2.1
Burning	511	3,958	8,399	228	2	7	219	27.1	.2	.8	26.1	129	1,971	16	3.5
Drawing and wheeling	421	4,421	9,077	547	--------	1	546	60.3	--------	.1	60.2	12	300	12	.7
Storage and shipping	367	3,851	7,978	441	--------	5	436	55.3	--------	.6	54.7	29	1,460	13	1.6
Glazing	62	905	1,829	26	--------	--------	26	14.2	--------	--------	14.2	15	--------	15	.2
Administration and service	1,288	7,700	16,356	443	5	13	425	27.1	.3	.8	26.0	106	885	12	2.9
Administrative and clerical	470	3,351	7,061	21	--------	1	20	3.0	--------	.1	2.9	24	300	11	.1
Plant maintenance	457	3,093	6,673	357	3	11	343	53.5	.4	1.6	51.5	93	991	12	5.0
Power	126	403	839	24	1	1	22	28.6	1.2	1.2	26.2	273	300	12	7.8

[1] Totals include figures not shown separately because of insufficient data.
[2] Figures in parentheses indicate the number of permanent-total disability cases included.
[3] The frequency rate is the average number of industrial injuries for each million employee-hours worked.
[4] The severity rate is the average number of days lost for each thousand employee-hours worked.
[5] Number of establishments reporting.

TABLE 6.—Distribution of Industrial Injury-Frequency Rates of 675 Establishments Manufacturing Clay Construction Products, Classified by Product and Size of Plant, 1948

Product and size of plant [1]	Total number of establishments	Number of establishments with frequency rates of [2]—													
		0	1 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to 79	80 to 89	90 to 99	100 to 124	125 to 149	150 and over
Total	675	204	13	59	71	48	47	55	39	26	36	14	28	20	15
Less than 25 employees	160	106		1	5	4	5	6	6	3	3	3	4	6	8
25 to 49 employees	206	69		22	18	12	16	13	11	5	11	4	13	8	4
50 to 74 employees	102	13	2	11	20	7	8	9	5	6	6	4	7	2	2
75 to 99 employees	71	8	1	6	8	7	7	8	6	6	8	1	4	1	
100 to 249 employees	107	8	5	13	19	14	6	14	9	6	8	1		3	1
250 employees and over	29		5	6	1	4	5	5	2			1			
Structural brick	369	121	4	28	35	23	22	26	23	13	20	10	21	15	8
Less than 25 employees	85	57			2	4	2	2	2	2	2	2	2	5	3
25 to 49 employees	144	48		14	14	8	9	8	7	4	7	4	11	7	3
50 to 74 employees	73	8	2	7	12	6	6	9	5	3	4	3	5	1	2
75 to 99 employees	39	6		4	3	2	3	4	5	3	6		3		
100 to 249 employees	24	2	2	3	4	2	1	3	2	1	1	1		2	
250 employees and over	4					1	1		2						
Structural tile	40	9	1	4	5	6	4	4		3	2		1	1	
Less than 50 employees	16	6		1	2	2	2	1			1		1		
50 to 99 employees	11	2		1	2	2		1		1	1			1	
100 to 249 employees	10	1		1	1	2	1	2		2					
250 employees and over	3		1	1			1								
Sewer pipe	36	1		3	6	3	5	6	2	1	7	2			
Less than 100 employees	10	1		1	1		2	2			2	1			
100 to 249 employees	23			2	5	3	2	3	2	1	5				
250 employees and over	3						1	1				1			
Clay refractories	111	26	5	15	16	11	6	10	5	6	4	1	2	2	2
Less than 50 employees	41	21		5	2	1	3	3		2	3				1
50 to 74 employees	10	1		2	4					1		1	1		
75 to 99 employees	20	2	1	2	4	3	2	1	1	2			1	1	
100 to 249 employees	33	2	2	3	6	7	1	4	4	1	1			1	1
250 employees and over	7		2	3				2							

[1] Totals include figures not shown separately because of insufficient data.
[2] The frequency rate is the average number of industrial injuries for each million employee-hours worked.

TABLE 7.—Disabling and Medical Injuries in 133 Establishments Manufacturing Clay Construction Products, Classified by Nature of Injury and Extent of Disability, 1948

Nature of injury	Number of disabling injuries					Average number of days lost per—		Number of medical injuries		Average number of medical injuries per disabling injury
	Total		Resulting in—			Disabling injury	Temporary-total disability	Number	Percent [1]	
	Number	Percent [1]	Death or permanent-total disability [2]	Permanent-partial disability	Temporary-total disability					
Total	2,114	100.0	(6) 12	55	2,047	76	14	3,568	100.0	1.7
Amputations, enucleations	27	1.3		27		444				
Bruises, contusions	617	29.2		2	615	17	10	1,052	29.4	1.7
Without infection	579	27.4		2	577	17	10	1,024	28.6	1.8
With infection	38	1.8			38	12	12	28	.8	.7
Burns, scalds (except chemicals)	46	2.2			46	11	11	96	2.7	2.1
Chemical burns	8	.4			8	9	9	22	.6	2.8
Cuts, lacerations, punctures	354	16.8		8	346	43	10	924	25.9	2.6
Without infection	308	14.6		8	300	47	10	859	24.1	2.8
With infection	46	2.2			46	14	14	65	1.8	1.4
Foreign bodies, not elsewhere classified	69	3.3			69	6	6	683	19.2	9.9
Without infection	63	3.0			63	4	4	675	19.0	10.7
With infection	6	.3			6	26	26	8	.2	1.3
Fractures	246	11.6	3	16	227	214	28	86	2.4	.3
Hernias	72	3.4			72	50	50			
Industrial diseases	20	.9	(6) 6		14	1,813	19	13	.4	.7
Sprains, strains	628	29.7		2	626	19	11	638	17.9	1.0
Welder's flash	6	.3			6	2	2	13	.4	2.2
Other	20	.9	3		17	913	16	38	1.1	1.9
Unclassified; insufficient data	1				1	1	1	3		3.0

[1] Percents are based on classified cases only.
[2] Figures in parentheses show the number of permanent-total disability cases included.

TABLE 8.—Disabling and Medical Injuries in 133 Establishments Manufacturing Clay Construction Products, Classified by Nature of Injury and Kind of Plant, 1948

Nature of injury	Total number of disabling and medical injuries [1]		Kind of product									
			Structural brick plants		Roofing, floor, and wall tile plants		Structural tile plants		Sewer pipe plants		Clay refractory plants	
	Number [2]	Percent [3]	Number	Percent [3]	Number	Percent [3]	Number	Percent [3]	Number	Percent [3]	Number	Percent [3]
Total	5,682	100.0	1,593	100.0	683	100.0	687	100.0	1,163	100.0	1,485	100.0
Amputations, enucleations	27	.5	6	.4	3	.4	4	.6	5	.4	7	.5
Bruises, contusions	1,669	29.5	550	34.6	193	28.3	181	26.4	274	23.6	447	30.1
Burns, scalds (except chemicals)	142	2.5	50	3.1	15	2.2	12	1.7	35	3.0	30	2.0
Chemical burns	30	.5	8	.5	3	.4	3	.4	3	.3	12	.8
Cuts, lacerations, punctures	1,278	22.5	295	18.5	159	23.3	167	24.3	262	22.6	380	25.6
Foreign bodies, not elsewhere classified	752	13.2	189	11.9	99	14.5	94	13.7	179	15.4	187	12.6
Fractures	332	5.8	91	5.7	26	3.8	44	6.4	87	7.5	74	5.0
Hernias	72	1.3	21	1.3	11	1.6	9	1.3	16	1.4	15	1.0
Industrial diseases	33	.6	10	.6	8	1.2	2	.3	1	.1	12	.8
Strains, sprains	1,266	22.3	348	21.9	155	22.7	160	23.3	286	24.7	302	20.3
Welder's flash	19	.3	7	.4	1	.1	3	.4	2	.2	6	.4
Other	58	1.0	18	1.1	10	1.5	8	1.2	9	.8	13	.9
Unclassified; insufficient data	4								4			

[1] A disabling injury is one that results in death, in permanent impairment, or in an inability to work for at least one full day after the day of injury. A medical injury is a nondisabling injury requiring treatment by a physician or surgeon.

[2] Totals include figures not shown separately because of insufficent data.

[3] Percents are based on classified cases only.

TABLE 9.—Disabling and Medical Injuries in 133 Establishments Manufacturing Clay Construction Products, Classified by Nature of Injury and Department, 1948

Department [1]	Total number of disabling and medical injuries [2]		Nature of injury												
			Amputations, enucleations	Bruises, contusions	Burns, scalds	Chemical burns	Cuts, lacerations, punctures	Foreign bodies, not elsewhere classified	Fractures	Hernias	Industrial diseases	Strains, sprains	Welder's flash	Other	Unclassified
Total	Number	5,682	27	1,669	142	30	1,278	752	332	72	33	1,266	19	58	4
	Percent	100.0	.5	29.5	2.5	.5	22.5	13.2	5.8	1.3	.6	22.3	.3	1.0	
Clay pit	Number	144	1	38	4	3	32	14	16	2		29	2	3	
	Percent	100.0	.7	26.4	2.8	2.1	22.2	9.7	11.1	1.4		20.1	1.4	2.1	
Clay mine	Number	158	1	46	4		35	15	18	6	1	29		3	
	Percent	100.0	.6	29.1	2.5		22.2	9.5	11.4	3.8	.6	18.4		1.9	
Preparation	Number	359	1	112	4		78	51	18	5	2	83	1	4	
	Percent	100.0	.3	31.2	1.1		21.7	14.2	5.0	1.4	.6	23.1	.3	1.1	
Molding	Number	830	8	256	5	2	169	89	48	12	9	223		9	
	Percent	100.0	1.0	30.8	.6	.2	20.4	10.7	5.8	1.4	1.1	26.9		1.1	
Soft-mud process	Number	71	1	29			13	7	3		1	17			
	Percent	100.0	1.4	40.8			18.3	9.9	4.2		1.4	23.9			
Stiff-mud process	Number	360	2	105	2		68	39	21	9	4	107		3	
	Percent	100.0	.6	29.2	.6		18.9	10.8	5.8	2.5	1.1	29.7		.8	
Dry-press	Number	185	3	63	1	2	41	24	14	1	3	33			
	Percent	100.0	1.6	34.1	.5	1.1	22.2	13.0	7.6	.5	1.6	17.8			
Hand	Number	105	1	29			18	9	5	1	1	39		2	
	Percent	100.0	1.0	27.6			17.1	8.6	4.8	1.0	1.0	37.0		1.9	
Drying	Number	160	2	60	3		25	8	10	2	1	46		3	
	Percent	100.0	1.3	37.4	1.9		15.6	5.0	6.3	1.3	.6	28.7		1.9	
Setting	Number	404	1	121	3	1	66	25	25	14	1	142		4	1
	Percent	100.0	.2	30.1	.7	.2	16.4	6.2	6.2	3.5	.2	35.3		1.0	
Burning	Number	372		102	24		69	65	14	6	2	83		6	1
	Percent	100.0		27.5	6.5		18.6	17.5	3.8	1.6	.5	22.4		1.6	
Drawing and wheeling	Number	639	2	186	5		188	85	34	1		135		3	
	Percent	100.0	.3	29.1	.8		29.4	13.3	5.3	.2		21.1		.5	
Storage and shipping	Number	850	2	278	11	4	198	102	51	9	3	188		3	1
	Percent	100.0	.2	32.7	1.3	.5	23.3	12.0	6.0	1.1	.4	22.1		.4	
Glazing	Number	88		19	1		20	13	4	1	4	22		4	
	Percent	100.0		21.6	1.1		22.8	14.8	4.5	1.1	4.5	25.1		4.5	
Surface grinding and finishing	Number	70	1	16		1	20	9	2			21			
	Percent	100.0	1.4	22.9		1.4	28.6	12.9	2.9			29.9			
Administrative and service	Number	1,341	7	340	73	16	324	238	75	8	8	222	16	13	1
	Percent	100.0	.5	25.3	5.4	1.2	24.2	17.8	5.6	.6	.6	16.6	1.2	1.0	
Administrative and clerical	Number	63		21	2		10	10	3	1		14	1	1	
	Percent	100.0		33.2	3.2		15.9	15.9	4.8	1.6		22.2	1.6	1.6	
Plant maintenance	Number	941	6	229	58	15	239	185	54	5	7	120	15	7	1
	Percent	100.0	.6	24.4	6.2	1.6	25.5	19.7	5.7	.5	.7	12.8	1.6	.7	
Yard	Number	261		72	7		62	34	18	2	1	63		2	
	Percent	100.0		27.5	2.7		23.8	13.0	6.9	.8	.4	24.1		.8	

[1] Totals include figures not shown separately because of insufficient data. Percents are based on classified cases only.

[2] A disabling injury is one that results in death, in permanent impairment, or in an inability to work for at least one full day after the day of injury. A medical injury is a nondisabling injury requiring treatment by a physician or surgeon.

TABLE 10.—Disabling and Medical Injuries in 133 Establishments Manufacturing Clay Construction Products, Classified by Part of Body Injured and Extent of Disability, 1948

Part of body injured	Number of disabling injuries					Average number of days lost per—		Number of medical injuries		Average number of medical injuries per disabling injury
	Total		Resulting in—			Disabling injury	Temporary-total disability	Number	Percent[1]	
	Number	Percent[1]	Death or permanent-total disability[2]	Permanent-partial disability	Temporary-total disability					
Total	2,114	100.0	(6) 12	55	2,047	76	14	3,568	100.0	1.7
Head	195	9.2	3	2	190	118	7	1,006	28.2	5.2
Eye(s)	108	5.1		2	106	39	6	772	21.7	7.1
Brain or skull	21	1.0	2		19	580	10	54	1.5	2.6
Other	66	3.1	1		65	100	10	180	5.0	2.7
Trunk	655	31.0	(6) 6	3	646	74	16	592	16.6	.9
Chest (lungs), ribs, etc	119	5.6	(6) 6		113	311	11	155	4.3	1.3
Back	332	15.7		1	331	14	13	293	8.3	.9
Abdomen	90	4.3			90	41	41	35	1.0	.4
Hip(s) or pelvis	26	1.2		1	25	29	10	26	.7	1.0
Shoulder	76	3.6			76	15	15	72	2.0	.9
Other	12	.6		1	11	53	12	11	.3	.9
Upper extremities	551	26.1		39	512	77	11	1,336	37.5	2.4
Arm(s)	107	5.1		5	102	197	11	169	4.7	1.6
Hand(s)	162	7.7		1	161	31	13	386	10.8	2.4
Finger(s) and/or thumb(s)	282	13.3		33	249	57	10	781	22.0	2.8
Lower extremities	659	31.2		9	650	37	15	597	16.7	.9
Leg(s)	197	9.3		1	196	40	20	193	5.4	1.0
Foot or feet	282	13.4		3	279	39	13	239	6.7	.8
Toe(s)	180	8.5		5	175	31	13	165	4.6	.9
Body, general	53	2.5	3	2	48	440	17	36	1.0	.7
Unclassified; insufficient data	1				1	13	13	1		

[1] Percents are based on classified cases only.

[2] Figures in parentheses show the number of permanent-total disability cases included.

TABLE 11.—Disabling and Medical Injuries in 133 Establishments Manufacturing Clay Construction Products, Classified by Kind of Plant, 1948

Part of body injured	Total number of disabling and medical injuries[1]		Kind of product									
			Structural brick plants		Roofing, floor, and wall tile plants		Structural tile plants		Sewer pipe plants		Clay refractory plants	
	Number[2]	Percent[3]	Number	Percent[3]	Number	Percent[3]	Number	Percent[3]	Number	Percent[3]	Number	Percent[3]
Total	5,682	100.0	1,593	100.0	683	100.0	687	100.0	1,163	100.0	1,485	100.0
Head	1,201	21.1	349	21.9	139	20.4	152	22.1	266	22.9	289	19.5
Eye(s)	880	15.5	233	14.6	111	16.3	107	15.5	210	18.1	213	14.4
Brain or skull	75	1.3	41	2.6	7	1.0	4	.6	11	.9	12	.8
Other	246	4.3	75	4.7	21	3.1	41	6.0	45	3.9	64	4.3
Trunk	1,247	22.0	357	22.4	128	18.7	158	23.0	310	26.7	282	19.0
Chest (lungs), ribs, etc	274	4.8	78	4.9	34	5.0	34	4.9	60	5.2	67	4.5
Back	625	11.1	169	10.6	53	7.7	87	12.7	177	15.1	130	8.8
Abdomen	125	2.2	38	2.4	15	2.2	13	1.9	24	2.1	33	2.2
Hip(s) or pelvis	52	.9	9	.6	10	1.5	10	1.5	10	.9	13	.9
Shoulder	148	2.6	56	3.5	15	2.2	12	1.7	32	2.8	33	2.2
Other	23	.4	7	.4	1	.1	2	.3	7	.6	6	.4
Upper extremities	1,887	33.2	468	29.4	263	38.5	216	31.5	356	30.7	555	37.3
Arm(s)	276	4.9	77	4.8	35	5.1	25	3.6	61	5.3	75	5.1
Hand(s)	548	9.6	143	9.0	81	11.9	66	9.6	101	8.7	150	10.1
Finger(s) and/or thumb(s)	1,063	18.7	248	15.6	147	21.5	125	18.3	194	16.7	330	22.1
Lower extremities	1,256	22.1	389	24.4	143	20.9	149	21.7	213	18.3	340	22.9
Leg(s)	390	6.9	130	8.2	43	6.3	44	6.4	67	5.8	101	6.8
Foot or feet	521	9.1	163	10.2	49	7.2	67	9.8	84	7.2	146	9.8
Toe(s)	345	6.1	96	6.0	51	7.4	38	5.5	62	5.3	93	6.3
Body, general	89	1.6	30	1.9	10	1.5	12	1.7	16	1.4	19	1.3
Unclassified; insufficient data	2								2			

[1] A disabling injury is one that results in death, in permanent impairment, or in an inability to work for at least one full day after the day of injury. A medical injury is a nondisabling injury requiring treatment by a physician or surgeon.

[2] Totals include figures not shown separately because of insufficient data

[3] Percents are based on classified cases only.

TABLE 12.—Disabling and Medical Injuries in 133 Establishments Manufacturing Clay Construction Products, Classified by Part of Body Injured and Department, 1948

Department[1]	Total number of disabling and medical injuries[2]		Part of body injured																			
			Head				Trunk							Upper extremities				Lower extremities				Body general	Unclassified; insufficient data
			Total	Eye	Brain or skull	Other	Total	Chest	Back	Abdomen	Hip or pelvis	Shoulder	Other	Total	Arm	Hand	Finger	Total	Leg	Foot	Toe		
Total	Number	5,682	1,201	880	75	246	1,247	274	625	125	52	148	23	1,887	276	548	1,063	1,256	390	521	345	89	2
	Percent	100.0	21.1	15.5	1.3	4.3	22.0	4.8	11.1	2.2	.9	2.6	.4	33.2	4.9	9.6	18.7	22.1	6.9	9.1	6.1	1.6	
Clay pit	Number	144	37	25	4	8	24	4	14	2	------	3	1	48	4	11	33	31	8	12	11	4	
	Percent	100.0	25.7	17.3	2.8	5.6	16.7	2.8	9.7	1.4	------	2.1	.7	33.3	2.8	7.6	22.9	21.5	5.6	8.3	7.6	2.8	
Clay mine	Number	158	30	22	1	7	47	14	18	8	2	4	1	42	3	8	31	37	8	20	9	2	
	Percent	100.0	19.0	14.0	.6	4.4	29.7	8.9	11.3	5.1	1.3	2.5	.6	26.6	1.9	5.1	19.6	23.4	5.1	12.6	5.7	1.3	
Preparation	Number	359	85	55	7	23	83	16	42	9	6	8	2	113	16	26	71	73	26	32	15	5	
	Percent	100.0	23.7	15.4	1.9	6.4	23.1	4.5	11.6	2.5	1.7	2.2	.6	31.5	4.5	7.2	19.8	20.3	7.2	8.9	4.2	1.4	
Molding	Number	830	141	101	6	34	199	46	102	19	5	24	3	305	48	78	179	173	54	83	36	12	
	Percent	100.0	17.0	12.2	.7	4.1	24.0	5.5	12.3	2.3	.6	2.9	.4	36.8	5.8	9.4	21.6	20.8	6.5	10.0	4.3	1.4	
Soft-mud process	Number	71	9	7	2	------	18	3	11	------	------	3	1	24	5	6	13	20	3	12	5	------	
	Percent	100.0	12.7	9.9	2.8	------	25.4	4.2	15.6	------	------	4.2	1.4	33.7	7.0	8.5	18.2	28.2	4.2	17.0	7.0	------	
Stiff-mud process	Number	360	71	47	2	22	99	23	52	11	3	9	1	115	21	25	69	71	23	36	12	4	
	Percent	100.0	19.7	13.0	.6	6.1	27.5	6.4	14.4	3.1	.8	2.5	.3	32.0	5.8	6.9	19.3	19.7	6.4	10.0	3.3	1.1	
Dry-press	Number	185	33	26	------	7	27	13	8	3	------	2	1	83	11	24	48	37	8	18	11	5	
	Percent	100.0	17.8	14.0	------	3.8	13.0	5.5	4.3	1.6	------	1.1	.5	44.9	5.9	13.0	26.0	20.0	4.3	9.8	5.9	4.3	
Hand	Number	105	11	9	------	2	30	2	18	4	1	5	------	41	6	14	21	22	9	9	4	1	
	Percent	100.0	10.5	8.6	------	1.9	28.6	1.9	17.1	3.8	1.0	4.8	------	38.9	5.7	13.3	19.9	21.0	8.6	8.6	3.8	1.0	
Drying	Number	160	18	8	2	8	42	4	27	6	------	4	1	43	7	17	19	56	15	31	10	1	
	Percent	100.0	11.3	5.0	1.3	5.0	26.3	2.5	16.9	3.8	------	2.5	.6	26.9	4.4	10.6	11.9	34.9	9.4	19.2	6.3	.6	
Setting	Number	404	51	28	5	8	135	27	67	19	4	18	------	116	16	33	67	93	28	39	26	8	1
	Percent	100.0	12.7	7.0	1.2	4.5	33.4	6.7	16.5	4.7	1.0	4.5	------	28.8	4.0	8.2	16.6	23.1	6.9	9.7	6.5	2.0	
Burning	Number	372	99	75	8	16	92	14	43	11	7	14	3	89	21	28	40	81	32	32	17	11	
	Percent	100.0	26.6	20.1	2.2	4.3	24.7	3.8	11.4	3.0	1.9	3.8	.8	23.9	5.6	7.5	10.8	21.8	8.6	8.6	4.6	3.0	
Drawing and wheeling	Number	639	123	92	5	26	139	38	70	7	6	15	3	226	36	72	118	147	41	42	64	4	
	Percent	100.0	19.2	14.3	.8	4.1	21.8	5.9	11.1	1.1	.9	2.3	.5	35.4	5.6	11.3	18.5	23.0	6.4	6.6	10.0	.6	
Storage and shipping	Number	850	160	115	17	28	196	42	102	13	12	23	4	271	48	80	143	210	63	78	69	12	1
	Percent	100.0	18.8	13.5	2.0	3.3	23.1	4.9	12.1	1.5	1.4	2.7	.5	32.0	5.7	9.4	16.9	24.7	7.4	9.2	8.1	1.4	
Glazing	Number	88	15	13	1	1	19	2	13	1	------	1	2	39	6	14	19	14	3	6	5	1	
	Percent	100.0	17.0	14.8	1.1	1.1	21.6	2.3	14.8	1.1	------	1.1	2.3	44.4	6.8	15.9	21.7	15.9	3.4	6.8	5.7	1.1	
Surface grinding and finishing	Number	70	11	10	------	1	13	2	8	1	------	2	------	30	2	11	17	16	5	7	4	------	
	Percent	100.0	15.7	14.3	------	1.4	18.6	2.9	11.4	1.4	------	2.9	------	42.8	2.9	15.7	24.2	22.9	7.1	10.1	5.7	------	
Administrative and service	Number	1,341	368	293	11	64	205	49	104	16	8	26	2	485	62	144	279	258	89	108	61	25	
	Percent	100.0	27.4	21.8	.8	4.8	15.3	3.7	7.8	1.2	.6	1.9	.1	36.2	4.6	10.7	20.9	19.2	6.6	8.1	4.5	1.9	
Administrative and clerical	Number	63	15	12	------	3	7	2	2	1	1	1	------	21	3	7	11	18	5	12	1	2	
	Percent	100.0	23.8	19.0	------	4.8	11.1	3.1	3.2	1.6	1.6	1.6	------	33.3	4.8	11.1	17.4	28.6	7.9	19.1	1.6	3.2	
Plant maintenance	Number	941	288	237	8	43	117	35	53	9	7	11	2	361	43	101	217	158	59	67	32	17	
	Percent	100.0	30.6	25.1	.9	4.6	12.4	3.7	5.6	1.0	.7	1.2	.2	38.4	4.6	10.7	23.1	16.8	6.3	7.1	3.4	1.8	
Yard	Number	261	46	34	1	11	62	12	37	4	------	9	------	80	13	27	40	70	18	25	27	3	
	Percent	100.0	17.6	13.0	.4	4.2	23.8	4.6	14.3	1.5	------	3.4	------	30.7	5.0	10.3	15.4	26.8	6.9	9.6	10.3	1.1	

[1] Totals include figures not shown separately because of insufficient space. Percents are based on classified cases only.

[2] A disabling injury is one that results in death, in permanent impairment, or in an inability to work for at least one full day after the day of injury. A medical injury is a nondisabling injury requiring treatment by a physician or surgeon.

TABLE 13.—Disabling and Medical Injuries in 133 Establishments Manufacturing Clay Construction Products, Classified by Nature of Injury and Part of Body Injured, 1948

Part of body injured	Total number of disabling and medical injuries [1]	Nature of injury												
		Amputations, enucleations	Bruises, contusions	Burns, scalds	Chemical burns	Cuts, lacerations, punctures	Foreign bodies not elsewhere classified	Fractures	Hernia	Industrial diseases	Strains, sprains	Welder's flash	Other	Unclassified
Total	5,682	27	1,669	142	30	1,278	752	332	72	33	1,266	19	58	4
Head	1,201	1	104	42	20	219	752	7		6	15	19	15	1
Eye(s)	880	1	26	25	14	36	752			2	1	19	3	1
Brain or skull	75		21			51		3						
Other	246		57	17	6	132		4		4	14		12	
Trunk	1,247		248	7		18		58	72	6	835		3	
Chest (lungs), ribs, etc	274		126	1		3		47		6	89		2	
Back	625		40	4		4		3			574			
Abdomen	125		9			2			72		42			
Hip(s) or pelvis	52		21	1		5		3			22			
Shoulder(s)	148		38	1		2		3			103		1	
Other	23		14			2		2			5			
Upper extremities	1,887	23	603	68	5	872		104		12	180		19	1
Arm(s)	276		97	21	2	89		12		5	44		6	
Hand(s) (incl. wrist)	548		144	31	3	240		22		4	97		6	1
Finger(s) and/or thumb(s)	1,063	23	362	16		543		70		3	39		7	
Lower extremities	1,256	3	676	18	4	160		162		1	230		1	1
Leg(s)	390		208	8	2	78		18		1	73		1	1
Foot (incl. ankle) or feet	521		256	10	2	59		41			153			
Toe(s)	345	3	212			23		103			4			
Body, general	89		38	7	1	9		1		8	5			
Unclassified; insufficient data	2										1		20	1

[1] A disabling injury is one that results in death, in permanent impairment, or in an inability to work for at least one full day after the day of injury. A medical injury is a nondisabling injury requiring treatment by a physician or surgeon.

TABLE 14.—Types of Accidents and Agencies of Injury in Injury-Producing Accidents in 133 Establishments Manufacturing Clay Construction Products, 1948

Accident type	Total number of accidents	Agency of injury																				
		Bodily motion	Products				Vehicles					Foreign bodies not elsewhere classified	Machines			Hand tools			Working surfaces			Miscellaneous metal parts	Other agencies
			Total	Brick and structural tile	Sewer pipe	Wall and floor tile	Total	Drier and kiln cars	Hand trucks and wheelbarrows	Powered industrial trucks	Other vehicles		Total	Point-of-operation	Other parts	Total	Point-of-operation	Other parts	Total	Floor	Other surfaces		
Total	5,682	1,079	873	621	212	40	661	239	173	121	128	468	426	223	203	404	226	178	294	105	189	187	1,290
Striking against objects	788		181	101	59	21	124	43	32	10	39		116	45	71	28	6	22	31	12	19	36	272
Stepping on objects	31						1				1		1		1				6	4	2		23
Rubbing against objects	158		101	52	39	10	8	5	1	1	1		2		2	11		11	2	2		10	24
Bumping against products or materials	57		53	36	14	3																	4
Bumping against equipment	314						105	36	30	8	31		108	44	64	11	6	5	4		4	9	77
Bumping against walls, etc	45																		3	3			42
Striking against projecting nails, screws, etc	119		26	12	6	8	9	2	1	1	5		5	1	4	5		5	2		2	8	64
Other	64		1	1			1				1					1		1	14	3	11	9	38
Struck by objects	2,238		552	433	104	15	181	47	76	41	17	465	176	139	37	314	204	110	2		2	113	435
Falling objects	918		460	372	80	8	65	15	44	3	3		12	1	11	28		28				88	265
From hands of workers	256		145	114	26	5	4		3	1						7		7				34	66
From piles or storage places	202		129	126	3											2		2				6	65
From vehicles and other equipment	176		116	95	19	2	6	6								3		3				6	45
From other positions	284		70	37	32	1	55	9	41	2	3		12	1	11	16		16				42	89
Flying particles	847		36	24	5	7						465	130	125	5	128	125	3				10	78
Rolling objects	79						77	31	21	21	4												2
Thrown objects	45		35	31	4											1		1					9
Other moving objects	349		21	6	15		39	1	11	17	10		34	13	21	157	79	78	2		2	15	81
Caught in, on, or between	751	14	96	59	35	2	286	126	49	63	48		106	33	73	42	2	40	4		4	26	177
Gears, pulleys, belts, etc	53						2			2			23		23								28
Other moving parts of equipment	93						18			16	2		61	31	30	3	2	1					11
Two vehicles	72						72	47	8	9	8												
A vehicle and another object	155		15	14	1		128	56	34	27	11								1		1		11
A hand tool and another object	39						1				1					37		37					1
Handled objects	200		78	44	32	2	12	3	2	1	6		2		2	1		1	1		1	25	81
Other objects	139	14	3	1	2		53	20	5	8	20		20	2	18	1		1	2		2	1	45
Falls on same level	240	1	24	15	8	1	25	5	12	1	7		2		2	1		1	144	63	81	4	39
Falls to different levels	176		5	4	1		8	1	1		6		2		2				109	30	79	1	51
Slips or stumbles	324	231	8	4	4		28	12	3	3	10		12	2	10	1		1	4		4	1	39
Slips	304	217	8	4	4		26	11	2	3	10		12	2	10	1		1	3		3	1	36
Stumbles	20	14					2	1	1										1		1		3
Overexertion	835	833																					2
Lifting or carrying objects	467	467																					
Pushing objects	114	112																					2
Pulling objects	54	54																					
Throwing or swinging objects	64	64																					
Turning or rolling objects	54	54																					
Other	82	82																					
Contact with extreme temperatures	126		5	4	1		8	5		2	1	3	6	3	3	18	14	4				6	80
Inhalation, absorption, ingestion	112		1			1																	111
Other accident types	40						1			1			5	1	4								34
Unclassified; insufficient data	52		1	1									1		1								50

TABLE 15.—Types of Accidents Resulting in Injuries in 133 Establishments Manufacturing Clay Construction Products, Classified by Kind of Plant, 1948

Accident type	Total number of accidents		Kind of plant									
			Structural brick plants		Roofing, floor, and wall tile plants		Structural tile plants		Sewer pipe plants		Clay refractory plants	
	Number[1]	Percent[2]	Number	Percent[2]	Number	Percent[2]	Number	Percent[2]	Number	Percent[2]	Number	Percent[2]
Total	5,682	100.0	1,593	100.0	683	100.0	687	100.0	1,163	100.0	1,485	100.0
Striking against objects	788	14.0	183	11.6	123	18.2	85	12.5	166	14.4	216	14.6
Stepping on objects	31	.6	13	.8	4	.6	3	.4	6	.5	4	.3
Rubbing against objects	158	2.8	40	2.5	14	2.1	22	3.2	56	4.8	24	1.6
Bumping against products or materials	57	1.0	14	.9	3	.4	3	.4	17	1.5	20	1.4
Bumping against equipment	314	5.6	70	4.6	59	8.8	30	4.5	45	3.9	103	6.9
Bumping against walls, etc	45	.8	7	.4	5	.7	8	1.2	10	.9	14	.9
Striking against projecting nails, screws, etc	119	2.1	21	1.3	30	4.4	12	1.8	22	1.9	32	2.2
Other	64	1.1	18	1.1	8	1.2	7	1.0	10	.9	19	1.3
Struck by objects	2,238	39.8	610	38.8	245	36.2	284	41.5	463	40.1	614	41.7
Falling objects	918	16.4	277	17.6	93	13.7	127	18.6	161	14.0	249	17.0
From hands of workers	256	4.6	80	5.1	40	5.9	29	4.3	26	2.3	74	5.1
From piles or storage places	202	3.6	90	5.7	9	1.3	25	3.7	21	1.8	56	3.8
From vehicles and other equipment	176	3.1	50	3.2	12	1.8	24	3.5	36	3.1	52	3.5
From other positions	284	5.1	57	3.6	32	4.7	49	7.1	78	6.8	67	4.6
Flying particles	847	15.0	213	13.5	108	16.0	104	15.2	206	17.8	211	14.3
Rolling objects	79	1.4	30	1.9	10	1.5	4	.6	8	.7	26	1.8
Thrown objects	45	.8	23	1.5	2	.3	3	.4	6	.5	11	.7
Other moving objects	349	6.2	67	4.3	32	4.7	46	6.7	82	7.1	117	7.9
Caught in, on, or between	751	13.3	220	14.0	86	12.7	87	12.8	132	11.5	214	14.5
Gears, pulleys, belts, etc	53	.9	22	1.4	6	.9	4	.6	7	.6	13	.9
Other moving parts of equipment	93	1.7	24	1.5	18	2.7	15	2.2	12	1.0	23	1.6
Two vehicles	72	1.3	30	1.9	5	.7	12	1.8	10	.9	14	.9
A vehicle and another object	155	2.7	56	3.6	24	3.5	16	2.3	18	1.6	40	2.7
A hand tool and another object	39	.7	11	.7	1	.1	4	.6	7	.6	14	.9
Handled objects	200	3.5	41	2.6	24	3.6	21	3.1	46	4.0	65	4.5
Other objects	139	2.5	36	2.3	8	1.2	15	2.2	32	2.8	45	3.0
Falls on same level	240	4.3	70	4.5	27	4.0	29	4.3	48	4.2	61	4.1
Falls to different levels	176	3.1	71	4.5	11	1.6	28	4.1	30	2.6	36	2.4
Slips or stumbles	324	5.8	101	6.4	47	6.9	34	5.0	53	4.6	82	5.6
Slips	304	5.4	93	5.9	44	6.5	34	5.0	52	4.5	74	5.1
Stumbles	20	.4	8	.5	3	.4			1	.1	8	.5
Overexertion	835	14.8	228	14.5	101	14.9	105	15.4	212	18.4	181	12.3
Lifting or carrying objects	467	8.2	92	5.8	65	9.7	63	9.2	134	11.7	111	7.5
Pushing objects	114	2.0	58	3.7	7	1.0	8	1.2	18	1.6	23	1.6
Pulling objects	54	1.0	9	.6	15	2.2	9	1.3	7	.6	13	.9
Throwing or swinging objects	64	1.1	25	1.6	3	.4	9	1.3	21	1.8	5	.3
Turning or rolling objects	54	1.0	12	.8	4	.6	6	.9	19	1.6	10	.7
Other	82	1.5	32	2.0	7	1.0	10	1.5	13	1.1	19	1.3
Contact with extreme temperatures	126	2.2	46	2.9	10	1.5	7	1.0	33	2.9	30	2.0
Inhalation, absorption, ingestion	112	2.0	29	1.8	21	3.1	14	2.1	10	.9	37	2.5
Other accident types	40	.7	15	1.0	6	.9	9	1.3	5	.4	5	.3
Unclassified; insufficient data	52		20		6		5		11		9	

[1] Totals include figures not shown separately because of insufficient data.

[2] Percents are based on classified cases only.

TABLE 16.—Types of Accidents Resulting in Injuries in 133 Establishments Manufacturing Clay Construction Products, Classified by Department, 1948

Department [1]	Total number of accidents		Accident type																	
			Struck by moving objects			Overexertion			Striking against objects				Caught in, on, or between objects			Slip or stumble	Falls on same level	Falls to different level	Contact with extreme temperatures	Inhalation, absorption, ingestion
			Total	Falling objects	Flying particles	Total	Due to		Total	Bumping against equipment	Rubbing against objects	Striking against projecting nails, etc.	Total	Handled objects	A vehicle and other object					
							Lifting or carrying	Pushing												
Total	Number	5,682	2,238	918	847	835	467	114	788	314	158	119	751	200	155	324	240	176	126	112
	Percent	100.0	39.8	16.4	15.0	14.8	8.2	2.0	14.0	5.6	2.8	2.1	13.3	3.5	2.7	5.8	4.3	3.1	2.2	2.0
Clay pit	Number	144	57	21	25	14	8	----	9	4	----	2	32	9	4	10	3	6	5	6
	Percent	100.0	40.2	14.8	17.7	9.9	5.7	----	6.3	2.8	----	1.4	22.6	6.4	2.8	7.0	2.1	4.2	3.5	4.2
Clay mine	Number	158	72	35	21	19	15	2	13	3	3	2	22	4	10	14	6	3	1	2
	Percent	100.0	45.9	22.3	13.4	12.1	9.6	1.3	8.3	2.0	1.9	1.3	14.0	2.5	6.6	8.9	3.8	1.9	.6	1.3
Preparation	Number	359	142	50	57	47	22	8	52	32	2	7	45	4	6	29	19	11	4	8
	Percent	100.0	39.8	14.0	15.9	13.2	6.3	2.2	14.6	8.9	.6	2.0	12.6	1.1	1.7	8.1	5.3	3.1	1.1	2.2
Molding	Number	830	259	85	102	145	79	22	117	64	15	21	174	36	33	59	39	12	6	13
	Percent	100.0	31.4	10.3	12.3	17.6	9.6	2.7	14.2	7.9	1.8	2.5	21.1	4.4	4.0	7.2	4.7	1.5	.7	1.6
Soft-mud process	Number	71	27	9	8	13	3	3	4	3	----	----	17	6	5	4	4	----	----	1
	Percent	100.0	38.6	12.9	11.4	18.6	4.3	4.3	5.7	4.3	----	----	24.3	8.6	7.1	5.7	5.7	----	----	1.4
Stiff-mud process	Number	360	116	32	46	65	38	8	48	30	7	7	66	11	12	30	19	5	3	4
	Percent	100.0	32.7	9.0	13.0	18.3	10.8	2.2	13.5	8.3	2.0	2.0	18.5	3.1	3.4	8.4	5.3	1.4	.8	1.1
Dry-press	Number	185	61	27	26	19	9	5	31	18	1	8	46	5	9	12	7	4	----	5
	Percent	100.0	32.9	14.5	14.1	10.3	5.0	2.7	16.8	9.8	.5	4.4	24.8	2.7	4.9	6.5	3.8	2.2	----	2.7
Hand	Number	105	29	13	9	31	21	3	13	4	2	2	19	10	2	6	4	1	----	1
	Percent	100.0	27.9	12.4	8.7	29.7	20.1	2.9	12.5	3.9	1.9	1.9	18.3	9.7	1.9	5.8	3.8	1.0	----	1.0
Drying	Number	160	44	19	8	32	17	9	11	7	3	----	43	3	18	6	10	5	3	1
	Percent	100.0	27.8	12.0	5.1	20.3	10.8	5.7	7.0	4.5	1.9	----	27.2	1.9	11.3	3.8	6.3	3.2	1.9	.6
Setting	Number	404	123	70	25	111	69	15	42	22	6	8	52	14	12	28	21	17	3	3
	Percent	100.0	30.7	17.6	6.2	27.7	17.3	3.7	10.4	5.6	1.5	2.0	12.9	3.5	3.0	7.0	5.2	4.2	.7	.7
Burning	Number	372	155	60	72	57	12	11	31	9	10	5	29	3	12	20	26	15	22	7
	Percent	100.0	42.3	16.3	19.7	15.5	3.3	3.0	8.4	2.4	2.6	1.4	7.9	.8	3.3	5.4	7.1	4.1	6.0	1.9
Drawing and wheeling	Number	639	301	170	94	99	51	17	111	14	45	12	60	28	19	22	17	19	5	1
	Percent	100.0	47.1	26.6	14.8	15.6	8.0	2.7	17.5	2.2	7.1	1.9	9.4	4.4	3.0	3.5	2.7	3.0	.8	.2
Storage and shipping	Number	850	361	193	106	131	93	11	119	34	35	21	89	36	21	44	36	40	13	6
	Percent	100.0	43.0	23.0	12.7	15.6	11.0	1.3	14.1	4.0	4.2	2.5	10.6	4.3	2.5	5.2	4.3	4.8	1.5	.7
Glazing	Number	88	23	9	13	13	9	----	21	8	5	4	8	2	1	11	1	1	1	9
	Percent	100.0	26.2	10.2	14.9	14.8	10.3	----	23.9	9.1	5.7	4.5	9.1	2.3	1.1	12.5	1.1	1.1	1.1	10.2
Surface grinding and finishing.	Number	70	23	8	9	14	7	2	17	14	----	1	9	5	----	4	1	----	----	1
	Percent	100.0	33.4	11.6	13.1	20.3	10.2	2.9	24.7	20.5	----	1.4	13.0	7.3	----	5.8	1.4	----	----	1.4
Administrative and service.	Number	1,341	570	156	272	125	70	10	212	91	31	33	146	46	13	56	47	45	60	48
	Percent	100.0	42.9	11.7	20.6	9.4	5.2	.8	16.0	6.8	2.3	2.5	11.0	3.5	1.0	4.2	3.5	3.4	4.5	3.6
Administrative and clerical.	Number	63	15	2	11	3	----	----	11	5	1	1	8	1	2	7	8	4	3	1
	Percent	100.0	24.3	3.2	17.9	4.8	----	----	17.7	8.1	1.6	1.6	12.9	1.6	3.2	11.3	12.9	6.5	4.8	1.6
Plant maintenance	Number	941	424	97	215	65	37	7	154	72	17	24	102	28	6	29	29	30	44	42
	Percent	100.0	45.4	10.4	23.1	7.0	4.2	.7	16.5	7.8	1.8	2.6	10.9	3.0	.6	3.1	3.1	3.2	4.7	4.5
Yard	Number	261	112	54	37	41	28	2	34	8	9	7	29	16	5	14	9	8	8	2
	Percent	100.0	43.4	20.9	14.3	15.9	10.7	.8	13.2	3.1	3.4	2.7	11.2	6.1	1.9	5.4	3.5	3.1	3.1	.8

[1] Totals include figures not shown separately because of insufficient space. Percents are based on classified cases only.

TABLE 17.—Unsafe Working Conditions and Agencies of Accident in Injury-Producing Accidents in 133 Establishments Manufacturing Clay Construction Products, 1948

Unsafe working condition	Total number of accidents	Agency of accident																				
		Products			Vehicles			Working surfaces			Machines		Hand tools	Kilns	Containers	Metal parts not elsewhere classified	Pallets, skids	Raw materials	Conveyors	Chemicals	Other	Unclassified
		Total	Bricks	Sewer pipes	Total	Drier and kiln cars	Hand trucks	Total	Floor	Yards	Total	Points-of-operation										
Total	5,682	681	373	269	478	194	139	419	122	118	364	205	212	125	88	79	62	58	54	51	475	2,536
Unsafe working procedures	1,150	459	219	217	238	132	46	15	1	.....	35	.....	17	28	54	36	24	28	3	39	173	1
Lack of sufficient help	582	193	41	152	186	116	44	3	.....	.....	11	.....	8	.....	48	25	22	.....	2	.....	83	1
Working with sharp-edged bricks, etc	212	183	97	65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	11	.....	.....	.....	.....	17	.....
Throwing objects or materials	70	65	65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	.....	1	.....	.....	.....	.....	.....
Working with dangerous materials	67	6	4	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	1	.....	1	7	.....	36	15	.....
Other	219	12	12	.....	52	16	2	12	1	.....	23	.....	9	28	.....	.....	.....	21	1	3	58	.....
Defective agencies	777	38	10	26	166	38	61	205	74	48	76	9	37	31	20	22	23	1	15	.....	141	2
Poorly designed or constructed	143	.....	.....	.....	86	27	51	28	.....	.....	9	.....	.....	10	1	.....	.....	.....	3	.....	6	.....
Slippery	122	1	.....	1	8	.....	.....	102	34	38	1	.....	.....	3	.....	.....	.....	.....	.....	.....	7	.....
Low material strength	123	29	6	21	9	2	.....	5	1	.....	13	4	12	.....	2	2	12	1	1	.....	37	.....
Projecting splinters, slivers, etc	72	1	.....	1	7	1	1	4	2	.....	5	.....	6	3	6	7	8	.....	1	.....	22	2
Rough, burred, etc	60	1	.....	1	6	2	.....	44	28	10	1	.....	1	.....	1	1	.....	.....	.....	.....	5	.....
Sharp-edged	58	1	.....	1	14	5	3	.....	.....	.....	12	.....	1	3	6	7	.....	.....	2	.....	12	.....
Projecting nails, bolts, etc	52	2	2	.....	8	1	2	7	4	.....	2	.....	.....	4	3	1	2	.....	.....	.....	23	.....
Other	147	3	2	1	28	.....	4	15	5	.....	33	5	17	8	1	4	1	.....	8	.....	29	.....
Improperly guarded agencies	388	.....	.....	.....	47	19	21	38	2	.....	148	102	19	11	.....	2	.....	19	32	.....	72	.....
Lack of point-of-operation guards	109	.....	.....	.....	.....	.....	.....	.....	.....	.....	102	102	7	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lack of guard rails	65	.....	.....	.....	.....	.....	.....	31	2	.....	3	.....	.....	8	.....	.....	.....	.....	1	.....	22	.....
Lack of guards for gears, pulleys, etc	57	.....	.....	.....	2	.....	.....	.....	.....	.....	23	.....	.....	.....	.....	.....	.....	.....	16	.....	16	.....
Lack of bolts, locks, etc	36	.....	.....	.....	20	18	1	6	.....	.....	2	.....	2	.....	.....	2	.....	.....	1	.....	3	.....
Other	121	.....	.....	.....	25	1	20	1	.....	.....	18	.....	10	3	.....	.....	.....	19	14	.....	31	.....
Hazardous arrangement or placement	358	164	137	25	17	5	10	39	.....	.....	4	.....	9	10	9	19	15	6	3	1	62	.....
Fixed obstructions in passageways	72	.....	.....	.....	.....	.....	.....	39	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1	.....	31	.....
Materials unsafely piled on vehicles	62	45	42	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	1	1	3	.....	1	8	.....
Materials unsafely piled in kilns	55	52	40	40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	.....	.....	.....	1	.....
Other	169	67	55	12	17	5	10	.....	.....	.....	4	.....	9	9	6	17	13	3	2	.....	22	.....
Lack of personal safety equipment	278	20	7	1	1	.....	1	.....	.....	.....	94	94	129	4	3	.....	.....	4	1	10	12	.....
Goggles	259	16	5	.....	.....	.....	.....	.....	.....	.....	94	94	120	4	3	.....	.....	3	1	8	10	.....
Other	19	4	2	1	1	.....	1	.....	.....	.....	.....	.....	9	.....	.....	.....	.....	1	.....	2	2	.....
Poor housekeeping	122	.....	.....	.....	4	.....	.....	115	43	65	.....	.....	.....	3	.....	.....	.....	.....	.....	.....	.....	.....
Lack of equipment	57	.....	.....	.....	5	.....	.....	.....	.....	.....	6	.....	.....	35	2	.....	.....	.....	.....	.....	9	.....
Other unsafe conditions	16	.....	.....	.....	.....	.....	.....	7	2	5	1	.....	1	3	.....	.....	.....	.....	.....	1	3	.....
Unclassified; insufficient data	2,536	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	2,533

TABLE 18.—Types of Accidents and Unsafe Working Conditions in Injury-Producing Accidents in 133 Establishments Manufacturing Clay Construction Products, 1948

Accident type	Total number of accidents[1]	Unsafe working condition																			
		Unsafe working procedures					Defective agencies					Improperly guarded agencies					Lack of personal safety equipment					
		Total	Lack of sufficient help	Working with sharp-edged bricks, etc.	Throwing objects or materials	Working with dangerous materials	Total	Poorly designed or constructed	Slippery	Low material strength	Projecting splinters, slivers, etc.	Total	Lack of point-of-operation guards	Lack of guard rails	Lack of guards for gears, pulleys, etc.	Hazardous arrangement	Total	Goggles	Poor housekeeping	Lack of equipment	Other	Unclassified; insufficient data
Total	5,682	1,150	582	212	70	67	777	143	122	123	72	388	109	65	57	358	278	259	122	57	16	2,536
Striking against	788	201	5	180	4	1	198	7	1	3	69	43	38	1	2	39	8	.....	23	7	2	267
Stepping on objects	31	.....	.....	.....	.....	.....	10	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	17	.....	.....	3
Rubbing against objects	158	111	1	106	1	.....	22	3	.....	.....	4	.....	.....	.....	.....	.....	8	.....	1	.....	.....	16
Bumping into or against products or materials	57	40	1	37	1	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	13
Bumping into or against equipment	314	15	3	3	2	1	57	3	1	3	1	42	38	1	1	19	.....	.....	3	2	2	174
Bumping into or against walls, etc	45	2	.....	1	.....	.....	9	1	.....	.....	2	.....	.....	.....	.....	14	.....	.....	.....	1	.....	19
Striking against projecting nails, slivers, etc	119	28	.....	28	.....	.....	86	.....	.....	.....	61	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	4
Other	64	5	.....	5	.....	.....	12	.....	.....	.....	1	1	.....	.....	1	3	.....	.....	1	4	.....	38
Struck by objects	2,238	242	58	19	42	10	206	37	4	84	1	96	39	2	1	223	222	221	14	1	1	1,233
Falling objects	918	128	38	11	11	.....	98	29	1	43	1	47	1	2	.....	205	.....	.....	5	1	1	433
From hands of workers	256	42	22	4	3	.....	23	.....	.....	21	.....	.....	.....	.....	.....	2	.....	.....	.....	1	.....	188
From piles or storage places	202	32	1	2	2	.....	5	1	.....	4	.....	14	1	.....	.....	95	.....	.....	.....	.....	.....	56
From vehicles or other equipment	176	26	2	1	4	.....	15	5	.....	4	.....	14	.....	.....	.....	54	.....	.....	.....	.....	.....	67
From other positions	284	28	13	4	2	.....	55	23	1	14	1	19	.....	2	.....	54	.....	.....	5	.....	1	122
Flying particles	847	22	1	.....	1	10	48	.....	.....	17	.....	25	22	.....	.....	2	221	220	.....	.....	.....	529
Rolling objects	79	24	9	.....	.....	.....	9	6	1	1	.....	1	.....	.....	.....	5	.....	.....	.....	.....	.....	40
Thrown objects	45	34	.....	4	30	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10
Other	349	34	10	4	.....	.....	50	2	2	23	.....	23	16	.....	1	11	1	1	9	.....	.....	221
Caught, in, on, or between	751	97	50	13	2	.....	110	62	1	6	1	142	30	4	51	50	.....	.....	5	3	.....	344
Gears, pulleys, belts, etc	53	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	48	.....	.....	48	.....	.....	.....	.....	.....	.....	3
Other moving parts or equipment	93	3	.....	.....	.....	.....	10	2	.....	1	.....	51	30	1	3	.....	.....	.....	.....	.....	.....	29
Two vehicles	72	7	4	.....	.....	.....	40	39	.....	.....	.....	6	.....	.....	.....	2	.....	.....	.....	.....	.....	17
A vehicle and another object	155	23	12	1	.....	.....	18	11	.....	.....	.....	14	.....	.....	.....	29	.....	.....	2	.....	.....	69
A hand tool and another object	39	6	3	.....	.....	.....	3	1	.....	1	.....	1	.....	.....	.....	1	.....	.....	.....	.....	.....	28
Handled objects	200	50	29	12	2	.....	9	2	.....	2	1	.....	.....	.....	.....	10	.....	.....	.....	.....	.....	131
Other	139	8	2	.....	.....	.....	28	7	1	2	.....	22	.....	3	.....	8	.....	.....	3	3	.....	67
Falls on same level	240	14	7	.....	1	.....	79	5	53	6	1	9	.....	6	1	15	.....	.....	26	4	2	91
Falls to different levels	176	3	.....	.....	.....	.....	28	3	7	12	.....	55	.....	46	1	4	1	.....	1	29	.....	55
Slips or stumbles	324	27	21	.....	2	.....	78	.....	55	3	.....	7	.....	5	1	17	.....	.....	43	9	4	139
Slips	304	27	21	.....	2	.....	78	.....	55	3	.....	6	.....	5	.....	9	.....	.....	38	9	2	135
Stumbles	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	1	8	.....	.....	5	.....	2	4
Overexertion	835	473	439	.....	91	.....	43	26	1	5	.....	.....	.....	.....	.....	7	.....	.....	8	3	.....	301
Lifting or carrying objects	467	299	296	.....	2	.....	3	1	.....	1	.....	.....	.....	.....	.....	2	.....	.....	.....	2	.....	161
Pushing objects	114	91	88	.....	.....	.....	4	1	.....	1	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	18
Pulling objects	54	24	23	.....	.....	.....	4	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	26
Throwing or swinging objects	64	23	8	.....	14	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40
Turning or rolling objects	54	15	15	.....	.....	.....	23	20	1	.....	.....	.....	.....	.....	.....	1	.....	.....	7	1	.....	7
Other	82	21	9	.....	3	.....	8	4	.....	2	.....	.....	.....	.....	.....	3	.....	.....	1	.....	.....	49
Contact with extreme temperatures	126	35	1	.....	.....	4	10	2	.....	1	.....	16	2	1	.....	3	24	17	2	1	2	33
Inhalation, absorption, ingestion	112	53	.....	.....	.....	51	7	1	.....	2	.....	9	.....	.....	.....	.....	23	21	.....	.....	5	15
Other accident types	40	2	.....	.....	.....	1	18	.....	.....	1	.....	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	10
Unclassified; insufficient data	52	3	1	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	48

[1] Totals include figures not shown separately because of insufficient space.

TABLE 19.—Unsafe Working Conditions Involved in Injury-Producing Accidents in 133 Establishments Manufacturing Clay Construction Products, Classified by Kind of Plant, 1948

Unsafe working condition	Total number of accidents		Kind of plant									
			Structural brick plants		Roofing, floor, and wall tile plants		Structural tile plants		Sewer pipe plants		Clay refractory plants	
	Number[1]	Percent[2]	Number	Percent[2]	Number	Percent[2]	Number	Percent[2]	Number	Percent[2]	Number	Percent[2]
Total	5,682	100.0	1,593	100.0	683	100.0	687	100.0	1,163	100.0	1,485	100.0
Improperly guarded agencies	388	12.3	99	10.6	54	15.0	42	12.2	77	11.4	111	13.9
Lack of point-of-operation guards	109	3.5	9	1.0	26	7.2	13	3.8	29	4.4	30	3.8
Lack of guards for gears, pulleys, etc	57	1.8	23	2.5	6	1.7	5	1.4	7	1.0	15	1.9
Lack of guard rails	65	2.1	24	2.5	3	.8	11	3.2	15	2.2	12	1.5
Lack of bolts, locks, or other fasteners	36	1.1	20	2.1			2	.6	3	.4	11	1.4
Other	121	3.8	23	2.5	19	5.3	11	3.2	23	3.4	43	5.3
Defective agencies	777	24.7	201	21.5	104	28.9	93	27.0	168	24.9	198	24.8
Poorly designed or constructed	143	4.5	63	6.7	9	2.5	15	4.3	20	3.0	34	4.3
Slippery	122	3.9	45	4.8	13	3.6	15	4.3	26	3.9	21	2.6
Low material strength	123	3.9	17	1.8	23	6.4	19	5.6	33	4.9	29	3.6
Projecting splinters, slivers, etc	72	2.3	11	1.2	18	5.0	10	2.9	13	1.9	19	2.4
Rough, burred, etc	60	1.9	9	1.0	13	3.6	2	.6	17	2.5	17	2.1
Sharp-edged	58	1.8	15	1.6	5	1.4	5	1.4	14	2.1	18	2.3
Projecting nails, bolts, etc	52	1.7	13	1.4	5	1.4	5	1.4	10	1.5	16	2.0
Other	147	4.7	28	3.0	18	5.0	22	6.5	35	5.1	44	5.5
Hazardous arrangement or placement	358	11.4	113	12.1	48	13.3	51	14.8	55	8.2	86	10.8
Fixed obstructions in passageways or working areas	72	2.3	22	2.4	9	2.5	10	2.9	5	.7	25	3.1
Materials unsafely piled or placed on vehicles	62	2.0	21	2.2	5	1.4	10	2.9	6	.9	20	2.5
Materials unsafely piled or placed in kilns	55	1.7	32	3.4	4	1.1	4	1.2	9	1.3	4	.5
Other	169	5.4	38	4.1	30	8.3	27	7.8	35	5.3	37	4.7
Poor housekeeping	122	3.9	41	4.4	17	4.7	6	1.7	24	3.6	34	4.3
Lack of equipment	57	1.8	35	3.7	2	.6	3	.9	6	.9	10	1.3
Unsafe working procedures	1,150	36.6	369	39.5	91	25.3	111	32.1	285	42.2	283	35.4
Lack of sufficient help in lifting heavy loads	582	18.6	153	16.5	49	13.7	54	15.6	171	25.4	149	18.6
Working with sharp-edged or rough bricks, tiles, etc	212	6.7	49	5.2	21	5.8	23	6.7	77	11.4	39	4.9
Throwing objects or materials	70	2.2	49	5.2			9	2.6	3	.4	9	1.1
Working with or around dangerous materials	67	2.1	16	1.7	14	3.9	8	2.3	9	1.3	18	2.3
Other	219	7.0	102	10.9	7	1.9	17	4.9	25	3.7	68	8.5
Lack of personal safety equipment	278	8.8	72	7.7	44	12.2	38	11.0	55	8.2	69	8.7
Goggles	259	8.2	64	6.8	43	11.9	36	10.4	51	7.6	65	8.2
Other	19	.6	8	.9	1	.3	2	.6	4	.6	4	.5
Other	16	.5	5	.5			1	.3	4	.6	6	.8
Unclassified; insufficient data	2,536		658		323		342		489		688	

[1] Totals include figures not shown separately because of insufficient data.

[2] Percents are based on classified cases only.

TABLE 20.—Unsafe Working Conditions Involved in Injury-Producing Accidents in 133 Establishments Manufacturing Clay Construction Products, Classified by Department, 1948

Department[1]		Total number of accidents	Unsafe working condition																			
			Unsafe working procedures					Defective agencies					Improperly guarded agencies					Lack of personal safety equipment		Poor housekeeping	Lack of equipment	Other	Unclassied; insufficient data
			Total	Lack of sufficient help	Working with sharp-edged bricks, etc.	Throwing objects or materials	Working with dangerous materials	Total	Poorly designed or constructed	Slippery	Low material strength	Projecting splinters, slivers, etc.	Total	Lack of point-of-operation guards	Lack of guard rails	Lack of guards for gears, pulleys, etc.	Hazardous arrangement	Total	Goggles				
Total	Number	5,682	1,150	582	212	70	67	777	143	122	123	72	388	109	65	57	358	278	259	122	57	16	2,536
	Percent	100.0	36.6	18.6	6.7	2.2	2.1	24.7	4.5	3.9	3.9	2.3	12.3	3.5	2.1	1.8	11.4	8.8	8.2	3.9	1.8	.5	
Clay pit	Number	144	26	6	------	------	4	24	4	2	5	2	8	1	1	2	2	8	8	------	6	1	69
	Percent	100.0	34.6	8.0	------	------	5.3	32.0	5.3	2.7	6.6	2.7	10.7	1.3	1.3	2.7	2.7	10.7	10.7	------	8.0	1.3	
Clay mine	Number	158	35	15	1	------	4	23	5	5	5	2	18	------	1	------	9	14	13	2	1	------	56
	Percent	100.0	34.4	14.8	1.0	------	3.9	22.5	4.9	4.9	4.9	2.0	17.6	------	1.0	------	8.8	13.7	12.7	2.0	1.0	------	
Preparation	Number	359	56	16	2	------	7	60	8	7	5	7	33	6	2	13	10	11	11	8	1	1	179
	Percent	100.0	31.1	8.9	1.1	------	3.9	33.3	4.4	3.9	2.8	3.9	18.3	3.3	1.1	7.2	5.6	6.1	6.1	4.4	.6	.6	------
Molding	Number	830	146	98	10	3	11	143	25	20	22	14	85	32	10	15	42	16	14	14	1	2	381
	Percent	100.0	32.6	22.0	2.2	.7	2.4	31.8	5.6	4.5	4.9	3.1	18.9	7.2	2.2	3.3	9.4	3.6	3.2	3.1	.2	.4	------
Soft-mud process	Number	71	16	9	1	------	1	10	2	4	3	------	6	1	1	3	2	1	1	1	------	------	35
	Percent	100.0	44.3	24.9	2.8	------	2.8	27.8	5.6	11.1	8.3	------	16.7	2.8	2.8	8.3	5.6	2.8	2.8	2.8	------	------	
Stiff-mud process	Number	360	59	40	5	2	4	66	12	7	14	4	36	15	5	4	14	4	2	9	------	1	171
	Percent	100.0	31.2	21.2	2.6	1.1	2.1	35.0	6.3	3.7	7.4	2.1	19.0	8.0	2.6	2.1	7.4	2.1	1.0	4.8	------	.5	------
Dry press	Number	185	21	8	3	1	4	37	5	5	5	5	22	10	2	5	15	6	6	2	------	------	82
	Percent	100.0	20.4	7.7	2.9	1.0	3.9	36.0	4.9	4.9	4.9	4.9	21.3	9.6	1.9	4.9	14.6	5.8	5.8	1.9	------	------	------
Hand	Number	105	34	28	1	------	1	12	2	1	------	1	3	1	------	------	2	1	1	------	------	------	53
	Percent	100.0	65.4	53.9	1.9	------	1.9	23.1	3.8	1.9	------	1.9	5.8	1.9	------	------	3.8	1.9	1.9	------	------	------	------
Drying	Number	160	48	39	1	1	1	28	13	3	3	------	11	1	2	3	16	------	------	2	------	------	55
	Percent	100.0	45.7	37.0	1.0	1.0	1.0	26.7	12.2	2.9	2.9	------	10.5	1.0	1.9	2.8	15.2	------	------	1.9	------	------	------
Setting	Number	404	132	79	9	32	------	51	14	9	10	4	11	------	5	2	38	1	------	4	13	3	151
	Percent	100.0	52.2	31.3	3.6	12.6	------	20.2	5.4	3.6	4.0	1.6	4.3	------	1.9	.8	15.0	.4	------	1.6	5.1	1.2	------
Burning	Number	372	67	27	8	1	5	39	8	5	9	4	24	5	7	2	35	18	18	16	6	------	167
	Percent	100.0	32.7	13.2	3.9	.5	2.4	19.0	3.9	2.4	4.4	2.0	11.7	2.4	3.4	1.0	17.1	8.8	8.8	7.8	2.9	------	------
Drawing and wheeling	Number	639	188	74	82	16	1	73	28	11	16	3	20	3	5	------	73	8	7	21	11	1	244
	Percent	100.0	47.5	18.6	20.7	4.1	.3	18.5	7.0	2.8	4.1	.8	5.1	.8	1.3	------	18.5	2.0	1.7	5.3	2.8	.3	------
Storage and shipping	Number	850	192	102	54	12	3	92	11	18	16	9	39	6	17	------	59	15	12	20	7	2	424
	Percent	100.0	45.1	24.0	12.7	2.8	.7	21.6	2.6	4.1	3.8	2.1	9.2	1.4	4.1	------	13.8	3.5	2.8	4.7	1.6	.5	------
Glazing	Number	88	16	3	4	1	8	14	1	6	2	3	4	------	------	2	3	12	11	1	------	------	38
	Percent	100.0	32.0	6.0	8.0	2.0	16.0	28.0	2.0	12.0	4.0	6.0	8.0	------	------	4.0	6.0	24.0	22.0	2.0	------	------	------
Surface grinding and finishing	Number	70	13	10	1	------	1	6	------	1	1	1	10	10	------	------	4	7	7	------	------	------	30
	Percent	100.0	32.5	25.0	2.5	------	2.5	15.0	------	2.5	2.5	2.5	25.0	25.0	------	------	10.0	17.5	17.5	------	------	------	------
Administrative and service	Number	1,341	187	91	33	3	20	176	15	28	24	22	114	40	15	16	56	160	150	32	10	6	600
	Percent	100.0	25.2	12.2	4.5	.4	2.7	23.8	2.0	3.8	3.2	3.0	15.4	5.4	2.0	2.2	7.6	21.6	20.3	4.3	1.3	.8	------
Administrative and clerical	Number	63	9	2	3	------	------	8	------	4	1	------	6	2	2	------	3	1	1	4	------	1	31
	Percent	100.0	28.1	6.3	9.4	------	------	25.0	------	12.5	3.1	------	18.8	6.3	6.3	------	9.4	3.1	3.1	12.5	------	3.1	------
Plant maintenance	Number	941	111	47	15	2	17	123	12	12	19	20	94	33	9	14	35	144	137	18	7	3	406
	Percent	100.0	20.7	8.7	2.8	.4	3.2	23.0	2.2	2.2	3.6	3.8	17.6	6.2	1.7	2.6	6.5	26.9	25.6	3.4	1.3	.6	------
Yard	Number	261	59	36	14	1	2	35	2	11	3	2	8	2	3	1	15	7	5	8	3	------	126
	Percent	100.0	43.8	26.8	10.4	.7	1.5	25.9	1.5	8.1	2.2	1.5	5.9	1.5	2.3	.7	11.1	5.2	3.7	5.9	2.2	------	------

[1] Totals include figures not shown separately because of insufficient data. Percents are based on classified cases only.

TABLE 21.—Unsafe Acts and Types of Accidents Involved in Injury-Producing Accidents in 133 Establishments Manufacturing Clay Construction Products, 1948

Accident type [1]	Total number of accidents	Unsafe act																
		Assuming unsafe positions or postures					Unsafe loading, placing, mixing, etc.				Using unsafe equipment or equipment unsafely		Failure to secure or warn	Operating or working at an unsafe speed	Working on moving or dangerous equipment	Failure to wear safe attire	Other unsafe acts	Unclassified; insufficient data
		Total	Inattention to footing	Inattention to surroundings	Lifting with bent back	Exposure to moving equipment	Total	Taking wrong hold of objects	Placing objects unsafely	Gripping objects insecurely	Total	Unsafe use of equipment						
Total	5,682	1,072	436	338	69	69	885	307	263	259	453	387	159	70	45	42	18	2,938
Striking against	788	266	20	237		3	68	37	4	23	72	54	7	19	3	7	1	345
Stepping on objects	31	6	6													1		24
Rubbing against objects	158	9		8			14	6	1	6	3	2	1	2		5		124
Bumping into or against products or materials	57	35		35			4	2	1		5	3	1					12
Bumping into or against equipment	314	167	11	150		3	36	22	2	10	46	36	2	4	2			57
Bumping into or against walls, etc	45	28	1	26			1	1			5	4	1	1				9
Striking against projecting nails, slivers, etc	119	8		8			7	4		3	7	4		1		1		95
Other	64	13	2	10			6	2		4	6	5	2	11	1		1	24
Struck by	2,238	134	19	30		20	471	25	231	203	206	188	93	34	4	14	12	1,270
Falling objects	918	59	10	12		1	369	10	166	187	17	12	45	13		2		413
From hands of workers	256	10	5				182	2	13	163	5	3	5	10		1		43
From piles or storage places	202	17	1	3			47		46									138
From vehicles or other equipment	176	9		1			65		58	7	2		4	1				95
From other positions	284	23	4	8		1	75	8	49	17	10	9	36	2		1		137
Flying particles	847	8					54		50	1	17	8		3	2	11	7	745
Rolling objects	79	19	2	2		11	2		2		16	16	24			1		17
Thrown objects	45	3		3			9	6	1	2			1	12			1	19
Other	349	45	7	13		8	37	9	12	13	156	152	23	6	2		4	76
Caught in, on, or between	751	165	37	48		45	272	233	13	23	80	70	44	3	29	10	2	146
Gears, pulleys, belts, etc	53	7		4		3	11	11			5	2	1		17	3		9
Other moving parts of equipment	93	29	4	14		2	17	17			3		9	2	12	3	2	16
Two vehicles	72	22	4	6		6	20	19		1	5	4	8					17
A vehicle and another object	155	60	15	9		28	24	19	3	1	26	26	13	1		1		30
A hand tool and another object	39	2		1			5	4		1	29	28						3
Handled objects	200	19	1	11		1	148	122	6	18	3	2	8			1		21
Other	139	26	13	3		5	47	41	4	2	9	8	5			2		50
Falls on same level	240	104	94	4			2		2		10	9	2	2			1	119
Falls to different levels	176	113	84	2		1	3		2	1	16	10	3			1		40
Slips or stumbles	324	176	172	1			1				9	8		7		1		130
Slips	304	162	158	1			1				8	7		6		1		126
Stumbles	20	14	14								1	1		1				4
Overexertion	835	90	8	4	69		39	11	9	8	42	37	6	4		1		653
Lifting or carrying objects	467	71	5		64		25	7	2	6	4	3	3			1		363
Pushing	114	2	2				3	2		1	7	7	1					101
Pulling objects	54	4	1		3		1	1			21	18	1	1				26
Throwing or swinging objects	64	3			1		1				5	5		2				53
Turning or rolling objects	54	5		3	1		4		4		3	3						42
Other	82	5		1			5	1	3	1	2	1	1	1				68
Contact with extreme temperatures	126	21	2	12			20	1	1	1	15	10	1	1	3	5	1	59
Inhalation, absorption, ingestion	112	2					9		1		1		2			3	1	94
Other accident types	40										1	1	1		6			32
Unclassified; insufficient data	52	1									1							50

[1] Totals include figures not shown separately because of insufficient space.

TABLE 22.—Unsafe Acts Involved in Injury-Producing Accidents in 133 Establishments Manufacturing Clay Construction Products, Classified by Kind of Plant, 1948

Unsafe act	Total number of accidents		Kind of plant									
			Structural brick plants		Roofing, floor, and wall tile plants		Structural tile plants		Sewer pipe plants		Clay refractory plants	
	Number [1]	Percent [2]	Number	Percent [2]	Number	Percent [2]	Number	Percent [2]	Number	Percent [2]	Number	Percent [2]
Total	5,682	100.0	1,593	100.0	683	100.0	687	100.0	1,163	100.0	1,485	100.0
Failure to secure or warn	159	5.8	46	6.2	13	3.5	17	5.4	28	5.5	54	7.1
Failure to warn	57	2.1	23	3.1	7	1.9	2	.6	9	1.8	16	2.1
Failure to lock or block	102	3.7	23	3.1	6	1.6	15	4.8	19	3.7	38	5.0
Operating or working at unsafe speeds	70	2.6	20	2.7	11	3.0	6	1.9	14	2.7	19	2.5
Using unsafe equipment or equipment unsafely	453	16.5	109	14.7	61	16.6	40	12.7	77	15.0	159	20.9
Using defective equipment	22	.8	1	.1	1	.3			2	.4	17	2.2
Unsafe use of equipment	387	14.1	98	13.3	49	13.3	38	12.1	68	13.2	130	17.1
Hand tools	252	9.2	58	7.9	30	8.1	30	9.0	49	9.5	82	10.8
Vehicles	115	4.2	33	4.5	19	5.2	8	2.5	15	2.9	39	5.1
Other	20	.7	7	.9					4	.8	9	1.2
Other	44	1.6	10	1.3	11	3.0	2	.6	7	1.4	12	1.6
Unsafe handling	885	32.3	236	31.7	99	27.0	104	32.9	171	33.4	260	34.3
Arranging or placing objects unsafely	263	9.6	90	12.2	28	7.6	41	13.0	52	10.2	52	6.8
Gripping objects insecurely	259	9.4	65	8.7	32	8.7	27	8.5	42	8.2	86	11.4
Taking wrong hold of objects	307	11.3	68	9.1	32	8.8	34	10.8	59	11.5	106	14.0
Other	56	2.0	13	1.7	7	1.9	2	.6	18	3.5	16	2.1
Assuming unsafe positions or postures	1,072	39.0	304	40.8	165	45.0	137	43.3	206	40.2	238	31.3
Inattention to footing	436	15.9	133	17.8	61	16.6	63	19.9	82	16.1	89	11.7
While getting on or off equipment	58	2.1	20	2.7	3	.8	6	1.9	9	1.8	20	2.6
On trackways	50	1.8	17	2.3	10	2.7	7	2.2	1	.2	15	2.0
Other	328	12.0	96	12.8	48	13.1	50	15.8	72	14.1	54	7.1
Lifting with bent back or from awkward position	69	2.5	11	1.5	25	6.8	6	1.9	19	3.7	6	.8
Inattention to surroundings	338	12.3	82	11.0	62	16.9	44	13.9	54	10.5	88	11.6
Exposure to moving equipment	69	2.5	29	3.9	9	2.5	7	2.2	12	2.3	10	1.3
Other	160	5.8	49	6.6	8	2.2	17	5.4	39	7.6	45	5.9
Working on moving or dangerous equipment	45	1.6	16	2.2	2	.5	5	1.6	8	1.6	14	1.8
Failure to wear safe attire or personal protective equipment	42	1.5	9	1.2	11	3.0	4	1.3	7	1.4	11	1.4
Other	18	.7	4	.5	5	1.4	3	.9	1	.2	5	.7
Unclassified; insufficient data	2,938		849		316		371		651		725	

[1] Totals include figures not shown separately because of insufficient data.

[2] Percents are based on classified cases only.

TABLE 23.—Unsafe Acts Involved in Injury-Producing Accidents in 133 Establishments Manufacturing Clay Construction Products, Classified by Department, 1948

Department [1]	Total number of accidents		Unsafe act																				
			Assuming unsafe positions or postures						Unsafe handling					Using unsafe equipment or equipment unsafely				Failure to secure or warn	Operating or working at an unsafe speed	Working on moving or dangerous equipment	Failure to wear safe attire	Other unsafe acts	Unclassified; insufficient data
			Total	Inattention to footing	Inattention to surroundings	Lifting with bent back	Exposure to moving equipment	Other	Total	Taking wrong hold of objects	Placing objects unsafely	Gripping objects insecurely	Other	Total	Unsafe use of equipment	Using defective equipment	Other						
Total	Number	5,682	1,072	436	338	69	69	160	885	307	263	259	56	453	387	22	44	159	70	45	42	18	2,938
	Percent	100.0	39.0	15.9	12.3	2.5	2.5	5.8	32.3	11.3	9.6	9.4	2.0	16.5	14.1	.8	1.6	5.8	2.6	1.6	1.5	.7	------
Clay pit	Number	144	31	13	2	2	3	11	24	15	4	2	3	7	5	1	1	6	4	------	4	------	68
	Percent	100.0	40.7	17.1	2.6	2.6	3.9	14.5	31.6	19.8	5.3	2.6	3.9	9.2	6.6	1.3	1.3	7.9	5.3	------	5.3	------	------
Clay mine	Number	158	31	14	5	1	2	9	16	7	5	4	------	17	15	1	1	------	1	1	1	------	91
	Percent	100.0	46.2	20.8	7.5	1.5	3.0	13.4	23.9	10.4	7.5	6.0	------	25.4	22.4	1.5	1.5	------	1.5	1.5	1.5	------	------
Preparation	Number	359	84	29	26	4	4	21	32	14	5	11	2	42	32	5	5	8	4	7	2	1	179
	Percent	100.0	46.7	16.2	14.4	2.2	2.2	11.7	17.8	7.8	2.8	6.1	1.1	23.3	17.7	2.8	2.8	4.4	2.2	3.9	1.1	.6	------
Molding	Number	830	185	65	68	11	20	21	117	55	23	33	6	65	52	3	10	25	10	9	2	3	414
	Percent	100.0	44.5	15.7	16.4	2.6	4.8	5.0	28.1	13.3	5.5	7.9	1.4	15.6	12.5	.7	2.4	6.0	2.4	2.2	.5	.7	------
Soft-mud process	Number	71	11	2	4	1	2	2	16	8	4	3	1	4	4	------	------	4	2	2	------	------	32
	Percent	100.0	28.2	5.1	10.3	2.6	5.1	5.1	41.0	20.4	10.3	7.7	2.6	10.3	10.3	------	------	10.3	5.1	5.1	------	------	------
Stiff-mud process	Number	360	95	36	25	6	15	13	38	15	6	15	2	25	21	2	2	12	3	5	------	------	182
	Percent	100.0	53.5	20.3	14.1	3.4	8.4	7.3	21.3	8.4	3.4	8.4	1.1	14.0	11.8	1.1	1.1	6.7	1.7	2.8	------	------	------
Dry-press	Number	185	42	16	23	------	1	2	30	14	6	9	1	13	11	------	2	4	4	1	1	3	87
	Percent	100.0	42.8	16.3	23.5	------	1.0	2.0	30.6	14.3	6.1	9.2	1.0	13.3	11.3	------	2.0	4.1	4.1	1.0	1.0	3.1	------
Hand	Number	105	14	6	5	2	------	1	20	12	3	4	1	11	7	1	3	5	1	------	1	------	53
	Percent	100.0	26.9	11.6	9.6	3.8	------	1.9	38.5	23.1	5.8	7.7	1.9	21.2	13.5	1.9	5.8	9.6	1.9	------	1.9	------	------
Drying	Number	160	33	18	6	1	6	2	20	12	4	4	------	21	20	------	1	9	1	------	------	------	76
	Percent	100.0	39.3	21.5	7.1	1.2	7.1	2.4	23.8	14.2	4.8	4.8	------	25.0	23.8	------	1.2	10.7	1.2	------	------	------	------
Setting	Number	404	87	41	20	10	8	8	59	20	23	15	1	18	17	1	------	10	3	------	4	2	221
	Percent	100.0	47.6	22.4	10.9	5.5	4.4	4.4	32.2	10.9	12.6	8.2	.5	9.9	9.3	.5	------	5.5	1.6	------	2.2	1.1	------
Burning	Number	372	72	39	15	6	4	8	32	16	6	9	1	37	32	------	5	8	4	------	5	1	213
	Percent	100.0	45.4	24.7	9.4	3.8	2.5	5.0	20.1	10.0	3.8	5.7	.6	23.3	20.2	------	3.1	5.0	2.5	------	3.1	.6	------
Drawing and wheeling	Number	639	100	27	49	5	3	16	132	27	62	42	1	17	14	------	3	6	5	------	3	------	376
	Percent	100.0	38.0	10.3	18.6	1.9	1.1	6.1	50.2	10.3	23.5	16.0	.4	6.5	5.4	------	1.1	2.3	1.9	------	1.1	------	------
Storage and shipping	Number	850	163	70	55	14	7	17	200	44	73	71	12	44	38	2	4	18	15	------	1	1	408
	Percent	100.0	36.9	15.9	12.4	3.2	1.6	3.8	45.2	10.0	16.4	16.1	2.7	10.0	8.6	.5	.9	4.1	3.4	------	.2	.2	------
Glazing	Number	88	24	5	11	6	2	------	10	2	3	5	------	4	4	------	------	------	1	------	1	1	47
	Percent	100.0	58.6	12.2	26.9	14.6	4.9	------	24.4	4.9	7.3	12.2	------	9.8	9.8	------	------	------	2.4	------	2.4	2.4	------
Surface grinding and finishing	Number	70	18	6	9	1	1	1	16	10	2	4	------	8	6	1	1	------	1	1	------	------	26
	Percent	100.0	40.8	13.5	20.4	2.3	2.3	2.3	36.4	22.8	4.5	9.1	------	18.2	13.6	2.3	2.3	------	2.3	2.3	------	------	------
Administrative and service	Number	1,341	186	87	54	8	6	31	186	70	45	47	24	161	141	8	12	61	18	27	18	7	677
	Percent	100.0	28.0	13.1	8.1	1.2	.9	4.7	28.0	10.5	6.8	7.1	3.6	24.2	21.2	1.2	1.8	9.2	2.7	4.1	2.7	1.1	------
Administrative and clerical	Number	63	19	10	6	------	2	1	3	2	------	1	------	3	1	------	2	3	1	------	1	------	33
	Percent	100.0	63.4	33.4	20.0	------	6.7	3.3	10.0	6.7	------	3.3	------	10.0	3.3	------	6.7	10.0	3.3	------	3.3	------	------
Plant maintenance	Number	941	118	54	37	4	3	20	116	44	27	31	14	133	116	8	9	48	15	26	13	5	467
	Percent	100.0	24.9	11.5	7.8	.8	.6	4.2	24.5	9.3	5.7	6.5	3.0	28.0	24.4	1.7	1.9	10.1	3.2	5.5	2.7	1.1	------
Yard	Number	261	35	17	7	2	1	8	59	19	18	15	7	14	14	------	------	8	2	------	2	2	139
	Percent	100.0	28.7	14.0	5.7	1.6	.8	6.6	48.4	15.6	14.8	12.3	5.7	11.5	11.5	------	------	6.6	1.6	------	1.6	1.6	------

[1] Totals include figures not shown separately because of insufficient space. Percents are based on classified cases only.

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