Profiles in safety and health: work hazards of mobile homes

Mobile homes are an inexpensive alternative to site-built housing; but such "manufactured housing" offers little shelter from on-the-job injuries for the industry's largely inexperienced work force

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Homeownership, the great American dream, comes in many shapes and sizes. Traditionally, it is a detached home, townhouse, or condominium; but whatever that time-honored form, it is housing permanently built on a fixed site, in most instances by skilled construction workers and their helpers.

The mobile home, the subject of this article, does not square with this conventional image. It is built, not on location, but on factory assembly lines, and is then hauled on its wheels to a homeowner's site. Construction of mobile homes typically is carried out by workers trained on the job to do one of several standardized tasks, such as floor assembly.

Through the years, "manufactured housing" operations have experienced a high incidence of workplace accidents and injuries. Despite having been targeted for special study by Federal safety officials in the early 1970's, mobile home manufacturing has remained among the top 10 high-risk industries, as measured by Bureau of Labor Statistics annual surveys of occupational injuries and illnesses. At 28.9 per 100 full-time workers, the 1987 incidence rate of workplace injuries and illnesses in mobile homes was double that for construction industries (14.7)—the most hazardous major industry group—and more than triple that for private industries as a whole (8.3).[1] (See table 1.)

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Industry description

Mobile home manufacturing was classified along with the manufacture of recreational vehicles until the early 1970's, when the former activity was assigned a separate industrial classification.[2] As distinguished from travel trailers, mobile homes are generally more than 35 feet long, at least 8 feet wide, and do not have facilities for storage of water or waste. Further, unlike modular homes and other prefabricated buildings, the mobile home is designed to be towed on its own chassis, affixed with removable wheels and axles. Such "mobility," however, is mainly for transportation from the factory to the owner's homesite; given the expense and logistics of hauling, only a small fraction of mobile homes are moved thereafter.[3]

In 1987, the industry employed about 45,000 workers in some 350 plants nationwide. Seven States—Indiana, California, Georgia, North Carolina, Florida, Alabama, and Texas—accounted for nearly seven-tenths of employment in mobile home manufacturing that year. Largely because of high transportation costs, the industry's markets are regional rather than national in character. Also, among the four census regions, most mobile homes are manufactured and placed for residential use in the South, especially outside of metropolitan areas.[4]

Product profile

Through the years, the number of mobile homes has increased dramatically. Today, the estimated 5 to 6 million mobile/manufactured homes in place constitute about 5 percent of the Nation's housing stock. In recent years, annual shipments of about a quarter million mobile homes have accounted for 10 to 15 percent of new additions to housing, defined as manufactured housing shipments plus private single-family housing starts. More strikingly, at an average 1987 price of $23,700, mobile homes dominate the lower end of the housing market.[5]

The size of most mobile homes has increased well beyond the definition of the minimum dimensions of a mobile home (8 by 35 feet), as buyers continue to demand more floor space and various amenities—fireplaces and central air conditioning, for example—often found in site-built new homes.[6] In 1987, the typical "single-section" mobile home was 12 to 14 feet wide and 48 to 76 feet long; even larger were "multi-section" homes (primarily "double-wides"), which commonly added 50 percent more floor space to the single-wide model. Such multisections accounted for two-fifths of total mobile home shipments in 1987 and averaged slightly more than 1,400 square feet of floor space, three-fourths the average for site-built one-family houses completed that year.[7]

Table 1. **Occupational injury and illness rates, 1978–87, BLS Annual Surveys**

Year	Incidence rates per 100 full-time workers[1]			Ranking of rate for mobile homes[2]
	Total private	Construction	Mobile homes	
1978 ...	9.4	16.0	34.8	2
1979 ...	9.5	16.2	31.6	3
1980 ...	8.7	15.7	27.5	7
1981 ...	8.3	15.1	29.3	3
1982 ...	7.7	14.6	27.4	2
1983 ...	7.6	14.8	29.8	2
1984 ...	8.0	15.5	30.7	2
1985 ...	7.9	15.2	27.6	4
1986 ...	7.9	15.2	29.8	2
1987 ...	8.3	14.7	28.9	5

[1] See footnote 1 to text for method of calculation.

[2] The following industries ranked higher than mobile homes in the past five years: 1983, 1984, and 1986—meatpacking plants; 1985—meatpacking plants, special-product sawmills, and structural wood members; 1987—shipbuilding and repairing, meatpacking plants, metal sanitary ware, and prefabricated wood buildings.

Manufacturing process

The typical mobile home plant employs 50 to 250 workers at fixed work stations on an assembly line that is not highly automated. The homes are manufactured from bottom up and framed from interior out as they move through the line on their own wheel assemblies. Simply stated, the first steps include constructing and mounting (1) the floor assembly on the chassis frame, (2) the wall system, (3) the roof/ceiling assembly, and (4) the trim, including windows and doors. Mechanical service systems, such as plumbing, electrical, and heating systems, are also installed at these stages.

Once the structural box is complete, the unit moves to other work stations for its interior work (including cabinetry), for appliance installation, and for final inspection before the HUD-code label is affixed.[8] From start to finish, assembly of a unit takes 1 to 3 days, depending on plant schedules and the size and complexity of the products.[9]

Workplace accidents and exposures

Historically, the hazardous work activities and conditions that have been associated with mobile home manufacturing have included manual handling and lifting of heavy floor, wall, and ceiling partitions; assembling and working in or around unstable building structures; and handling or operating tools and equipment. These and other problems are reflected in safety statistics for the industry.

Safety and health measures. Over a recent 10-year period, the Bureau of Labor Statistics basic measure of workplace safety and health generally trended lower, but the improvement for mobile home manufacturing was relatively small. The following tabulation illustrates this point, using injury and illness incidence rates per 100 full-time workers:

	Annual average 1978–82	1983–87
Private sector	8.7	7.9
Manufacturing	12.1	10.7
Mobile homes	30.1	29.4

The 1983–87 average incidence rate of injury and illness for mobile home manufacturing was 2 percent lower than its 1978–82 rate; this compares with corresponding declines of 9 percent for private industry and 12 percent for all manufacturing. Thus, mobile home manufacturing remains among the most hazardous of workplace settings, with an injury and illness rate over 2.5 times the manufacturing average.

Table 2. **Occupational injuries and illnesses by type of case, 1987 Annual Survey**

Industry	Incidence rates per 100 full-time workers[1]				Average lost workdays per lost workday case
	Total cases[2]	Nonfatal cases without lost workdays	Lost workday cases	Lost workdays	
Private sector[3]	8.3	4.4	3.8	69.9	18
Construction	14.7	7.9	6.8	135.8	20
Manufacturing	11.9	6.7	5.3	95.5	18
Mobile homes, U.S. total[4]	28.9	17.0	12.0	187.1	16
Alabama	39.6	25.1	14.5	216.1	15
Florida	34.0	19.2	14.8	225.7	15
California	27.7	17.7	10.0	143.0	14
Indiana	24.0	13.1	10.9	179.6	16
North Carolina	23.7	16.2	7.5	143.0	19

[1] See footnote 1 to text for method of calculation.

[2] Includes fatalities. Because of rounding, the difference between the total and the sum of the rates for lost workday cases and nonfatal cases without lost workdays may not reflect the fatality rate.

[3] Includes data for major industry divisions in addition to construction and manufacturing. Excludes farms with fewer than 11 employees.

[4] Includes data for States in addition to the five States shown separately.

Other Bureau safety measures reflect the incidence of injuries severe enough to require workers to take time off from work or to be restricted in work activity. (See appendix for definitions.) In 1987, these measures recorded mixed results for the mobile home industry. While the industry's rates for lost workday cases and lost workdays were relatively high, its average number of days lost per case was 2 to 4 days lower than corresponding averages recorded for the private sector as a whole, for manufacturing, and for construction. (See table 2.) In addition, the proportion of cases that involved lost workdays, at roughly two-fifths, was in line with the comparable national figure.

Reflecting differing risk levels, incidence rates varied considerably for five centers of mobile home manufacturing permitting comparison in 1987. For total cases, State rates ranged from about 24 injuries and illnesses per 100 full-time workers in Indiana and North Carolina to roughly 40 per 100 workers in Alabama. Also among the five States, wide variations were evident by type of case and severity measure. Finally, within the same State, rates commonly varied widely from one establishment to another.

Injury and illness characteristics. The Bureau's Supplementary Data System (SDS) provides information on the characteristics of a cross-section of injury and illness cases in mobile homes for which reports were filed with State workers' compensation agencies. Unlike the annual survey, the SDS does not produce nationwide estimates and lacks a uniform treatment among States of what is a recordable workplace injury or illness.[10] However, despite several analytical and statistical limitations, the SDS does help in spotting general patterns (or a lack thereof) in the worker and case characteristics of occupational injuries and illnesses.

For 1986, the SDS files of 22 participating States and the Virgin Islands contained about 1,500 current cases in mobile homes. (Current cases are injuries or illnesses which involved at least 1 lost workday and which either occurred in 1986 or were reported to the State agencies that year.)[11] An analysis of the SDS file for mobile home manufacturing and the corresponding file for all manufacturing points up several similarities (and a few differences) in case characteristics. (Such comparisons, however, are subject to the same types of limitations previously ascribed to the SDS.)

The two major *types of accident or exposure* were overexertion (usually from lifting objects) and being struck by or striking against an object. Together, these accounted for about three-fifths of all cases in mobile homes and a similar proportion in all manufacturing. Falls, especially from one level to another, constituted another one-fifth of the case total for mobile homes. Injuries due to falls were somewhat more prevalent in manufacturing mobile homes than in other factory settings.

The leading *sources of injury or illness* in manufacturing mobile homes were metal items (such as fasteners from air-powered tools) and working surfaces (floor, ground, and so on). These two sources were responsible for one-third of the recorded cases in mobile home manufacturing, in line with the corresponding figure for all manufacturing. A variety of other sources were reported in mobile home accidents, including worker motion (slips, trips); walls, doors, and other building structures; hammers, knives, and other hand tools; and lumber and other wood items.

Sprains and strains was by far the leading item in the category *nature of injury and illness*. This item accounted for two-fifths of the cases of injury and illness in mobile home manufacturing and a similar proportion in all manufacturing. Cuts, lacerations, and punctures were next in frequency—affecting one-fifth of the injured or ill workers—followed by bruises (including contusions and crushing injuries) and fractures, each cited in about one-tenth of the cases in mobile home manufacturing. Only a handful of the industry's cases were occupational illnesses.

Progress in preventing accidents is evident: some plants are using hoists and pulleys to assist with lifting and pulling heavy objects.

The back and other components of the trunk (abdomen, shoulder, and so on) were the major *part of the body affected* by injuries and illnesses. They were involved in about one-third of the mobile home cases, primarily taking the form of back sprains. Another one-half of the cases were divided evenly between two major body parts: the upper extremities (particularly the fingers) and the legs and other lower extremities. Injuries to the lower extremities were somewhat more prevalent in mobile home manufacturing than in all manufacturing.

The major *occupational group* of the injured or ill worker was "operator, fabricator, and inspector," accounting for one-half of the injury and illness cases in mobile home manufacturing. The leading occupation of the injured or ill worker was assembler, by itself three-tenths of the industry's cases. Another one-fifth of the cases involved construction trades and other precision, production, and craft workers, and most of the remainder were various types of handlers, laborers, and helpers.

Worker characteristics. Previous research has shown that certain characteristics of injured workers—their age and work experience, for example—are correlated with occupational safety and health problems.[12] The following tabulation highlights the youth and inexperience of injured workers in manufacturing mobile homes, with the proportions shown based on SDS-recorded cases in 1986:[13]

	Mobile home manufacturing	*All manufacturing*
Age of injured:		
Less than 25 years	3/10	1/6
Less than 35 years	7/10	1/2
Months with employer:		
6 months or less	1/3	1/4
12 months or less	1/2	1/3

These results are consistent with the general hiring practices of the mobile home industry. Located primarily in nonmetropolitan areas, manufactured housing offers job opportunities to young and inexperienced persons in an industry whose wages are highly competitive, averaging nearly $20,000 per employee in 1987.[14] For many, however, the opportunities are short lived, as reflected in the industry's high rate of labor turnover.

As tracked by the Bureau of Labor Statistics through 1981, labor turnover rates were higher in mobile home manufacturing than in virtually any other manufacturing industry. The separation rate, which includes quits and layoffs, was 9.6 per 100 workers in 1981, more than two and one-half times the rate for all manufacturing (3.6). The accession rate, which includes new hires and recalls, was also much higher, 8.4 per 100 employees, compared with 3.2 in all manufacturing.

Clearly, high labor turnover and the prevalence of inexperienced workers are associated with the industry's safety and health problems. One analyst's observations of mobile home workers suggest a connection: "The process of construction relies on unskilled labor, employed year-round at fixed work stations on an assembly line. No necessary generic or transferable skills are presumed; training or retraining for specific tasks occurs within the factory."[15] Such inexperienced, untrained workers tend to be more accident prone, especially when doing work for which there are no recognized safety standards, such as handling heavy objects.

Accident prevention

Most types of industrial accidents are considered preventable—through classroom and on-the-job training and by following safety standards prescribed by Government, industry, and labor. Heavy lifting and other manual exertions that commonly lead to manufactured housing accidents, however, are difficult to control.

Progress is evident, though: some plants are using hoists and pulleys to assist with lifting and pulling heavy objects.[16]

Outside of manual lifting, most other safety problems in mobile home manufacturing, such as eye, hand, and leg injuries, are addressed by established industry and Federal Government standards; and probably, those problems would respond favorably to traditional preventive actions.

Such actions would include extensive use of safety goggles and other personal protective equipment, better safeguarding of portable powered tools and machines, appropriate railings, ladders, and scaffolds for walking and working surfaces, and adherence to safety standards for electrical systems.[17] These and other measures, such as increased training and closer supervision, are effective ways to minimize safety and health hazards, especially those facing inexperienced workers. □

Footnotes

[1] *Incidence rates* represent the number of injuries or illnesses, or both, per 100 full-time workers and were calculated as

$$\frac{N}{EH} \times 200{,}000$$

where

N = number of injuries and/or illnesses;
EH = total hours worked by all employees of the industry during the calendar year; and
200,000 = base for 100 full-time equivalent workers (working 40 hours per week, 50 weeks per year).

A variety of useful incidence rates may be computed by making N equal to the number of injuries only, or the number of lost workday cases, or the number of lost workdays, and so forth. In each instance, the result is an estimate of the number of cases or days per 100 full-time workers.

Relative standard errors, which are a measure of the sampling error in the incidence rate, are in the 3 to 4 percent range for mobile homes. Therefore, year-to-year tracking of changes in the industry's rates should be avoided.

[2] The mobile homes industry is designated by the Office of Management and Budget as SIC 2451 in the *Standard Industrial Classification Manual*, 1972 edition, 1977 supplement. In prior manuals, it was part of SIC 3791, trailer coaches. The industry received special attention in the early 1970's when President Nixon first included mobile homes as housing additions to help meet congressional goals established under the Housing Act of 1968.

The industry is known for its manufactured housing, a term often interchangeable with mobile homes. However, 5 to 10 percent of the total value of shipments ($3.6 billion) of the mobile home industry in 1982, the year of the most recent Census of Manufactures, was for nonresidential uses, primarily office and other commercial mobile buildings.

[3] For more information on the transportation and siting of mobile homes, see *How to Buy a Manufactured Home* (Arlington, VA, Manufactured Housing Institute, 1986). For an early work on the sociological aspects of mobility, see Donald O. Cowgill, *Mobile Homes: A Study of Trailer Life* (Washington, American Council on Public Affairs, 1941).

Besides their chassis, mobile homes differ from modular homes in building code requirements. Effective in 1976, the former were covered by the Manufactured Home Construction and Safety Standards Act, the only national building code; the latter, not unlike site-built housing, must conform to prevailing State and local codes.

[4] For a comprehensive account of the industry structure and the distribution of mobile homes, see Renee Mathieu, "Manufactured Housing: The Industry in the Eighties," *Construction Review*, May–June 1986.

[5] Based on extrapolations from *Characteristics of New Housing: 1987*, series C-25 (Washington, Bureau of the Census, 1988). Excluding land costs, mobile homes were a large majority of all new single-family houses sold for under $50,000 in 1987.

Data relating to new additions to housing were taken from *Housing Starts*, series C-20 (Washington, Bureau of the Census, 1988).

[6] The mobile home industry dates back to the mid-1930's, when Wilbur Schult began manufacturing 8- by 25-foot versions of house trailers in Elkhart, Indiana, now a major hub of mobile home manufacturing. For a brief history of changes in the dimensions and configuration of the mobile home, see *The Mobile Home Industry in California and the Nation* (United California Bank, 1972).

[7] See *1988 Quick Facts about the Manufactured Housing Industry* (Arlington, VA, Manufactured Housing Institute, 1988); and *Characteristics of New Housing: 1987*, tables 15, 28, 29, and 30.

[8] The HUD standards for manufactured housing cover room requirements and other planning considerations, fire safety, body and frame construction, testing (structural loads, roof trusses, and the like), thermal protection, plumbing systems, heating systems (including cooling and fuel burning), electrical systems, and transportation.

[9] The break-even point for a typical plant, according to industry sources, is two to three units a day. For a detailed account of industry organization, see Arthur D. Bernhardt, *Building Tomorrow: The Mobile/Manufactured Housing Industry* (Boston, Massachusetts Institute of Technology Press, 1980).

[10] The Supplementary Data System is not statistically representative of the Nation as a whole because the data cover only the jurisdictions participating in the system. In 1986, the latest year for which detailed information is available, these were the Virgin Islands and the following 22 States: Alaska, Arizona, California, Colorado, Hawaii, Indiana, Iowa, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Missouri, Nebraska, New Mexico, Ohio, Oregon, Tennessee, Virginia, Washington, Wisconsin, and Wyoming.

States differ, moreover, in the kinds of cases they require by law to be reported to workers' compensation agencies. While some States require reports for all occupational injuries and illnesses, regardless of the length of disability, others require reports only for cases of sufficient duration to qualify for indemnity compensation payments, and still other States require reporting of cases involving a specific number of lost workdays, regardless of the indemnity "waiting period." Thus, the SDS file is not a complete census of all "disabling" injuries and illnesses in the jurisdictions studied.

The SDS, however, does standardize the classification of data by using the *1972 Standard Industrial Classification Manual*, the *1980 Census of Population, Alphabetical Index of Industries and Occupations*, and the 1962 *American National Standard Method of Recording Basic Facts Relating to the Nature and Occurrence of Work Injuries*, published by the American National Standards Institute (ANSI) and often referred to as the Z16.2–1962 Standard, or simply, Z16.2.

[11] The total for the 23 SDS jurisdictions is slightly more than one-fourth of the annual survey estimate of 5,550 lost workday cases in mobile homes in 1986. See footnote 10 for some limitations pertaining to the range of cases included in SDS. An examination of patterns in case characteristics for California and Indiana—two major centers of mobile home manufacturing covered by the 1986 SDS—showed marked similarities to those reported for the 23 jurisdictions combined.

[12] For example, see Olivia S. Mitchell, "The relation of age to workplace injuries," *Monthly Labor Review*, July 1988, pp. 8–13; also, Norman Root and Michael Hoefer, "The first work injury data available from new BLS study," *Monthly Labor Review*, January 1979, pp. 76–80.

[13] Proportions for age are based on the full 1986 SDS case file; those for work experience, defined here as months with employer (or on the job) when injured, relate to cases in the 15 SDS jurisdictions recording such data.

[14] *Employment and Wages, Annual Averages, 1987*, BLS Bulletin 2314 (Bureau of Labor Statistics, 1988), p. 155.

[15] Renee Mathieu, *Manufactured Housing*, p. 7.

[16] For a compendium of research papers on manual materials handling, see *Safety in Manual Materials Handling*, DHEW (NIOSH) Publication 78–185 (Washington, National Institute for Occupational Safety and Health, 1978).

[17] Based on 156 inspections conducted by the U.S. Department of Labor's Occupational Safety and Health Administration between January 1987 and February 1989, many mobile home plants did not fully comply with one or more of these safety measures.

APPENDIX: Work injury definitions

In this article, definitions of occupational injuries and illnesses and lost workdays conform to the recording and reporting requirements of the Occupational Safety and Health Act of 1970 and Part 1904 of Title 29, Code of Federal Regulations. Supplemental information pertaining to these definitions is in the booklet, *Recordkeeping Guidelines for Occupational Injuries and Illnesses* (Bureau of Labor Statistics, 1986).

Recordable occupational injuries and illnesses are:

1. occupational deaths, regardless of the time between injury and death, or the length of the illness; or
2. nonfatal occupational illnesses; or
3. nonfatal occupational injuries which involve one or more of the following: loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment (other than first aid).

Occupational injury is any injury, such as a cut, fracture, sprain, amputation, and so forth, which results from a work accident or from exposure involving a single incident in the work environment.

Occupational illness is any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or disease which may be caused by inhalation, absorption, ingestion, or direct contact.

Lost workday cases are cases which involve days away from work, or days of restricted work activity, or both.

1. *Lost workday cases involving days away from work* are those cases which result in days away from work, or a combination of days away from work and days of restricted work activity.
2. *Lost workday cases involving restricted work activity* are those cases which result in restricted work activity only.

Lost workdays—away from work are the number of workdays (consecutive or not) on which the employee would have worked but could not because of occupational injury or illness.

Lost workdays—restricted work activity are the number of workdays (consecutive or not) on which, because of injury or illness:

1. The employee was assigned to another job on a temporary basis; or
2. The employee worked at a permanent job less than full time; or
3. The employee worked at a permanently assigned job but could not perform all duties normally connected with it.

The number of days away from work or days of restricted work activity does not include the day of injury or onset of illness or any days on which the employee would not have worked even though able to work.