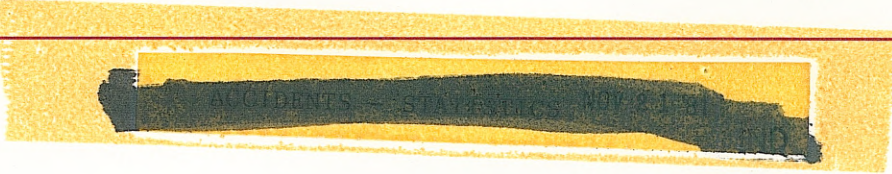


Injuries Related to Servicing Equipment

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U.S. Department of Labor
Bureau of Labor Statistics
October 1981
Bulletin 2115



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Injuries Related to Servicing Equipment



U.S. Department of Labor
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October 1981
Bulletin 2115



Injuries Related to Servicing Equipment

U.S. Department of Labor
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Preface

This report summarizes the results of a survey of workers injured while servicing equipment. The findings of this survey, which was conducted by the Bureau of Labor Statistics during 1980, will assist the Occupational Safety and Health Administration (OSHA) in developing safety standards, compliance strategy, and training programs for reducing work-related injuries.

The survey was conducted by the Bureau's Office of Occupational Safety and Health Statistics, William Mead, Acting Assistant Commissioner, in cooperation with 25 States: Arizona, Arkansas, California, Colorado, Delaware, Hawaii, Idaho, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Missouri, Montana, Nebraska, New Jersey, Ohio, Pennsylvania, Tennessee, Utah, Virginia, Washington, and Wisconsin. The BLS regional offices coordinated State operations. The Offices of Compliance, Standards Development, Statistical Studies Coordination and Analysis, and Training of OSHA and the Office of Safety Research of the National Institute for Occupational Safety and Health contributed to the planning and development of the survey. Lyn Pearson developed the computer pro-

grams, and Helen McDonald planned the survey and prepared the report under the direction of Herbert Schaffer.

The user should exercise caution in extrapolating survey data to population estimates because of limitations of the survey design. States participating in data collection may not represent the country as a whole; reporting requirements for workers' compensation reports, which are the source for selecting injuries for study, vary among States; and the 4-month collection period is not intended to represent the entire year. However, the data represent injured workers in the States surveyed during the period studied and are, therefore, valid for identifying injury patterns on a relative basis. For analytical purposes, the incidence of injuries incurred while servicing equipment cannot be generated or inferred from the data because information on exposure is not currently available.

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Summary of Survey Results

The survey of workers injured while servicing equipment showed that most injuries were caused by contact with moving machine parts because of failure to turn off the equipment. Injuries occurring to workers who turned off equipment were most frequently caused by accidental reactivation. The survey covered workers who were injured while cleaning, repairing, unjamming, or performing similar nonoperating tasks on industrial equipment and electrical and piping systems.¹

The injuries studied occurred to workers in almost every industry group, although 74 percent were in manufacturing. The four industries showing the higher proportions of injuries were food and kindred products, 15 percent; paper and allied products, 7 percent; printing and publishing, 7 percent; and fabricated metal products, 6 percent.

About as many injuries occurred in establishments with 100 or more employees as in smaller firms. One-fifth of the injured workers were employed in firms with 500 or more workers. Slightly more than one-half of the injured workers reported that their establishments had a safety officer. About one-fourth of the workers indicated that no safety officers were employed where they worked, while a like proportion did not know.

The predominant occupational class of workers injured was machine operatives, who accounted for close to one-half of those included in the survey. Craft workers followed, representing slightly more than one-third. The injuries were widely dispersed within these two occupational classes. Mechanics and repairers represented 10 percent and printing press operators, 7 percent.

Six hundred and eighty-six respondents reported that their injuries resulted in lost workdays. Nearly one-half of the estimates of time lost exceeded 15 workdays. Moreover, the average was 24 workdays for those workers who lost time.

Three out of four injuries were to the hands and fingers. Although cuts were the most common injury, accounting for 1 out of 3 cases, fractures and contusions each occurred in 1 out of 7 cases and amputations in 1 out of 10 cases. As text table 1 shows, amputations and fractures occurred most frequently in the food and kindred products industry, which recorded the largest proportion of injuries. The printing industry, which had

7 percent of the injuries, accounted for 11 percent of the fractures. The percentage of cuts was roughly proportionate to the overall percentage of injuries in each industry.

Nearly nine-tenths of the injuries resulted from contact with moving machine parts. Industrial equipment associated with the injury varied widely; printing presses, conveyors, and packaging machines were the more prevalent types, each accounting for about one-tenth. Other sources of injuries included electrical apparatus, saws, agitators, and slicers. Workers' descriptions of the equipment indicated that rollers were a common hazard with many types of machinery. One-half of the workers indicated that no emergency shutoff was within their reach at the time of the accident.

Five percent of the injuries were caused by contact with electrical current. Such injuries usually occurred while doing electrical repairs or installations. Occasionally, workers performing other activities, such as cleaning, received shocks because of faulty or exposed wiring.

Workers described the type of service work they were performing at the time of injury and how familiar the work was to them. The tasks that led to the greatest number of injuries were unjamming and cleaning activities, each accounting for about 30 percent of

Text table 1. Nature of injury by industry, selected States, August-November 1980

(Percents)

Industry	All injuries	Amputations	Contusions	Cuts	Fractures	Other
Total	100	100	100	100	100	100
Food and kindred products	15	21	15	18	12	11
Paper and allied products	7	2	12	7	8	5
Printing and publishing	7	6	10	6	11	6
Fabricated metal products	6	9	4	5	7	4
Machinery, except electrical ...	5	7	4	6	4	3
Electric and electronic equipment	4	5	3	3	6	5
Lumber and wood products	4	5	2	6	3	1
Rubber and miscellaneous plastics products	4	6	5	4	3	4
Stone, clay, and glass products	4	1	8	3	3	4
Wholesale trade—nondurable goods	4	3	2	5	4	3
Other industries	40	36	37	35	38	53

¹ See appendix A for types of injuries included in the survey.

the accidents. Twelve percent occurred while making adjustments to the equipment. Maintenance and repair work was involved in 13 percent of the injuries and set-up work, 7 percent. Less frequent activities were electrical work, installing, inspecting, and testing equipment.

Workers' lack of experience or familiarity with the job did not appear to be a contributing factor in most cases. Eighty-four percent of the respondents had done the task before on the same or similar equipment. The vast majority of the workers performed this type of work daily or weekly, and most had more than 1 year's experience.

Nearly 8 out of 10 workers surveyed failed to turn off the equipment before performing the service work that resulted in injury. It should be noted that some machines were equipped with activating controls, such as foot pedals or jog buttons, in addition to on/off switches. Sixty-one respondents commented that their accidents were caused by accidental activation of these auxiliary controls.

The reasons most frequently given for not turning off the equipment were that workers thought it was unnecessary at the time or that the task could not be done with the power off. The latter explanation, however, often reflected the difficulty rather than the impossibility of doing the work with the equipment shut down. For example, many workers injured while cleaning rollers remarked that wiping across rotating rolls was the most efficient way to do the job. One out of eight workers claimed that the company did not require the equipment to be turned off for the activity performed at the time of injury. Pressure to keep production on schedule was mentioned by 1 out of 5 workers, some of whom noted that deactivating a machine, such as a conveyor, would shut down an entire production system. In addition, 1 out of 10 reported that they did not realize the power was on. Comments by these workers often reflected lack of knowledge about such features as automatic cycling systems or multiple power sources.

About one-half of the workers who turned off the power were injured by accidental reactivation of equipment, most frequently by a co-worker who was unaware that the equipment was being serviced. More than one-fifth of the workers who turned the power off were injured by residual energy when either the moving parts continued to coast or the machinery moved when a jam-up was cleared. Most of the remaining injuries to workers who had turned off the power were the result of faulty power switches or valves which did not work properly.

Among those who were injured after turning off the power were nearly one-fifth who took additional steps such as disconnecting the main power source, breaking the circuit, or tagging² equipment. The extra precautionary measures were sometimes carried out for reasons other than safety. For example, in cases involving pipe systems, draining the system after closing the valve was simply a necessary step to accomplish the service work. Only two workers had attempted to fully lock out³ the equipment to prevent accidental reactivation or contact with electricity. These lockouts, however, were apparently not tested before servicing the equipment. In one case, the lockout had been done on the wrong power line and in the other, a second power line had been spliced into the wiring beyond the point of lockout.

The workers surveyed generally indicated little experience or training in lockout procedures. About two-thirds noted that they had never done a lockout and a nearly equal proportion had received no training on lockout procedures. Those most likely to have experience in lockouts were electricians and mechanics. Only one-fourth of the workers were aware of any policy their employers had for performing lockouts. About two-fifths did not know of any policy and one-third reported there was no lockout policy.

² Tagging refers to the attachment of tags on equipment's power sources to advise co-workers not to turn on power.

³ Lockout was defined as "disconnecting or shutting down and locking equipment controls in off position."

Table 1. Industry distribution: Injuries related to servicing equipment, selected States, August-November 1980

Industry	Workers	Percent
Total	833	100
Agriculture, forestry, and fishing	12	1
Agricultural production—crops	7	1
Agricultural production—livestock	1	(¹)
Agricultural services	4	(¹)
Mining ²	1	(¹)
Oil and gas extraction	1	(¹)
Construction	35	4
General building contractors	4	(¹)
Heavy construction contractors	8	1
Special trade contractors	23	3
Manufacturing	499	60
Food and kindred products	125	15
Tobacco manufactures	4	(¹)
Textile mill products	21	3
Apparel and other textile products	6	1
Lumber and wood products	30	4
Furniture and fixtures	18	2
Paper and allied products	58	7
Printing and publishing	62	7
Chemicals and allied products	22	3
Petroleum and coal products	6	1
Rubber and miscellaneous plastics products	37	4
Leather and leather products	17	2
Stone, clay, and glass products	33	4
Primary metal industries	18	2
Fabricated metal products	46	6
Machinery, except electrical	40	5
Electric and electronic equipment	33	4
Transportation equipment	16	2
Instruments and related products	10	1
Miscellaneous manufacturing industries	17	2
Transportation and public utilities	19	2
Trucking and warehousing	3	(¹)
Transportation by air	2	(¹)
Pipe lines, except natural gas	1	(¹)
Electric, gas, and sanitary services	13	2
Wholesale trade	57	7
Wholesale trade—durable goods	25	3
Wholesale trade—nondurable goods	32	4
Retail trade	31	4
Building materials and garden supplies	2	(¹)
General merchandise stores	3	(¹)
Food stores	6	1
Automotive dealers and service stations	1	(¹)
Eating and drinking places	16	2
Miscellaneous retail	3	(¹)
Finance, insurance, and real estate	8	1
Banking	1	(¹)
Insurance carriers	3	(¹)
Insurance agents, brokers, and service	1	(¹)
Real estate	2	(¹)
Holding and other investment offices	1	(¹)

See footnotes at end of table.

Table 1. Continued—Industry distribution: Injuries related to servicing equipment, selected States, August–November 1980

Industry	Workers	Percent
Services	43	5
Personal services	3	(¹)
Business services	9	1
Auto repair, services, and garages	1	(¹)
Miscellaneous repair services	1	(¹)
Amusement and recreation services	9	1
Health services	6	1
Legal services	1	(¹)
Educational services	6	1
Social services	3	(¹)
Membership organizations	1	(¹)
Miscellaneous services	3	(¹)
Other industries, not elsewhere classified	8	1

¹ Less than 0.5 percent.

² Limited to oil and gas extraction.

NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of

injuries included in the survey.

SOURCE: State workers' compensation reports.

Table 2. Nature of injury: Injuries related to servicing equipment, selected States, August–November 1980

Nature of injury	Workers	Percent
Total	833	100
Amputation or enucleation	87	10
Burn or scald (heat)	52	6
Burn (chemical)	10	1
Concussion—brain, cerebral	1	(¹)
Contusion, crushing, bruise—intact skin surface	114	14
Cut, laceration, puncture—open wound	293	35
Dislocation	4	(¹)
Electric shock, electrocution	21	3
Fracture	120	14
Poisoning, systemic	1	(¹)
Scratches, abrasions (superficial wounds)	10	1
Sprains, strains	9	1
Multiple injuries	62	7
Other injury, not elsewhere classified	1	(¹)
Nonclassifiable	48	6

¹ Less than 0.5 percent.

NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of

injuries included in the survey.

SOURCE: State workers' compensation reports.

Table 3. Part of body injured: Injuries related to servicing equipment, selected States, August-November 1980

Part of body	Workers	Percent
Total	833	100
Head	14	2
Neck	1	(¹)
Upper extremities	727	87
Upper extremities, unspecified	2	(¹)
Arm(s)	44	5
Arm(s), unspecified	17	2
Upper arm	3	(¹)
Elbow	1	(¹)
Forearm	17	2
Arm, multiple	3	(¹)
Arm, not elsewhere classified	3	(¹)
Wrist	15	2
Hand	140	17
Finger	487	58
Upper extremities, multiple	39	5
Trunk	9	1
Lower extremities	20	2
Multiple parts	42	5
Body system	19	2
Body system, unspecified	9	1
Nervous system	10	1
Nonclassifiable	1	(¹)

¹ Less than 0.5 percent.

NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of

injuries included in the survey.

SOURCE: State workers' compensation reports.

Table 4. Type of accident: Injuries related to servicing equipment, selected States, August-November 1980

Type of accident	Workers	Percent
Total	833	100
Struck against	65	8
Struck against, unspecified	1	(¹)
Stationary object	13	2
Moving object	51	6
Struck by	84	10
Struck by, unspecified	3	(¹)
Falling object	7	1
Flying object	7	1
Struck by, not elsewhere classified	67	8
Fall from elevation	2	(¹)
Fall on same level	2	(¹)
Caught in, under, between	594	71
Caught in, under, between, unspecified	88	11
Inrunning or meshing objects	202	24
Moving and stationary object	107	13
Two or more moving objects	76	9
Caught in, under, between, not elsewhere classified	121	15
Contact with electric current	47	6
Contact with temperature extremes	22	3
Contact with radiations, caustics, etc	12	1
By inhalation	1	(¹)
By absorption	11	1
Nonclassifiable	5	1

¹ Less than 0.5 percent.

NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of

injuries included in the survey.

SOURCE: State workers' compensation reports.

Table 5. Source of injury: Injuries related to servicing equipment, selected States, August-November 1980

Source of injury	Workers	Percent
Total	833	100
Boilers, pressure vessels	5	1
Boxes, barrels, containers,	2	(¹)
Chemicals, chemical compounds	11	1
Coal and petroleum products	3	(¹)
Conveyors	65	8
Electric apparatus	45	5
Flame, fire, smoke	4	(¹)
Hand tools, not powered	3	(¹)
Heating equipment (nonelectric), not elsewhere classified	1	(¹)
Liquids, not elsewhere classified	5	1
Machines	643	77
Machines, unspecified	30	4
Agitators, mixers	26	3
Agricultural machines, not elsewhere classified	6	1
Buffers, polishers, etc	15	2
Casting, forging, welding	11	1
Crushing, pulverizing	5	1
Drilling, boring	18	2
Highway construction	3	(¹)
Office	15	2
Packaging, wrapping	63	8
Picking, carding, etc	4	(¹)
Planers, shapers, molders	22	3
Presses (not printing)	44	5
Printing	78	9
Rolls	38	5
Saws	30	4
Screening, separating	3	(¹)
Shears, slitters, slicers	27	3
Stitching, sewing	6	1
Weaving, knitting, spinning	3	(¹)
Machines, not elsewhere classified	196	24
Mechanical power transmission apparatus	9	1
Metal items	13	2
Mineral items, nonmetallic, not elsewhere classified	1	(¹)
Pumps and prime movers	2	(¹)
Steam	5	1
Vehicles	1	(¹)
Wood items	1	(¹)
Working surfaces	2	(¹)
Miscellaneous, not elsewhere classified	8	1
Nonclassifiable	4	(¹)

¹ Less than 0.5 percent.

NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of

injuries included in the survey.

SOURCE: State workers' compensation reports.

Table 6. Age of worker: Injuries related to servicing equipment, selected States, August-November 1980

Age	Workers	Percent
Total	833	100
16—19 years	68	8
20—24 years	177	21
25—34 years	233	28
35—44 years	142	17
45—54 years	120	14
55—64 years	59	7
65 years or more	5	1
Not available	29	3

NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of injuries included in the survey.

SOURCE: State workers' compensation reports.

Table 7. Sex of worker: Injuries related to servicing equipment, selected States, August-November 1980

Sex	Workers	Percent
Total	833	100
Men	649	78
Women	184	22

SOURCE: State workers' compensation reports.

Table 8. Occupational distribution: Injuries related to servicing equipment, selected States, August-November 1980

Occupation	Workers	Percent
Total	833	100
Professional, technical, and kindred workers	12	1
Managers and administrators, excluding farm	13	2
Clerical and kindred workers	19	2
Craft and kindred workers	281	34
Bakers	1	()
Boilermakers	1	()
Bookbinders	2	()
Bulldozer operators	1	()
Cabinetmakers	2	()
Carpenters	1	()
Compositors and typesetters	1	()
Electricians	27	3
Electrician apprentices	1	()
Electric power line and cable installers and repairers	3	()
Excavating, grading, and road machine operators, excluding bulldozers	2	()
Blue-collar worker supervisors, not elsewhere classified	35	4
Forge and hammer operators	1	()
Glaziers	1	()
Inspectors, sealers, and graders, log and lumber	1	()
Inspectors, not elsewhere classified	1	()
Job and die setters, metal	6	1
Machinists	13	2
Machinist apprentices	2	()
Mechanics and repairers	83	10
Air conditioning, heating and refrigeration	4	()
Aircraft mechanics	1	()
Farm implement mechanics	1	()
Heavy equipment mechanics	38	5
Loom fixers	1	()
Office machine repairers	4	()
Miscellaneous mechanics and repairers	18	2
Mechanics and repairers, not specified	16	2
Millers; grain, flour, feed	2	()
Millwrights	5	1
Molders, metal	3	()
Opticians, lens grinders, polishers	1	()
Plumbers and pipefitters	5	1
Power station operators	1	()
Printing press operators	59	7
Printing press apprentices	2	()
Rollers and finishers, metal	1	()
Sheetmetal workers and tinsmiths	2	()
Stationary engineers	4	()
Structural metal workers	1	()
Tailors	1	()
Tool and die makers	6	1
Specified craft apprentices, not elsewhere classified	1	()
Craft and kindred workers, not elsewhere classified	2	()
Operatives, excluding transport	373	45
Asbestos and insulation workers	2	()
Assemblers	15	2
Bottling and canning operatives	6	1
Checkers, examiners, inspectors; manufacturing	4	()
Cutting operatives, not elsewhere classified	6	1
Drywall installers and lathers	1	()
Filers, polishers, sanders, buffers	5	1
Furnace tenders, smelters, and pourers; metal	1	()
Graders and sorters, manufacturing	1	()
Laundry and dry cleaning operatives, not elsewhere classified ..	2	()
Meat cutters and butchers, excluding manufacturing	1	()
Meat cutters and butchers, manufacturing	2	()
Mine operatives, not elsewhere classified	1	()
Mixing operatives	3	()

See footnotes at end of table.

Table 8. Continued—Occupational distribution: Injuries related to servicing equipment, selected States, August–November 1980

Occupation	Workers	Percent
Oilers and greasers, excluding auto	1	(¹)
Packers and wrappers, excluding retail	31	4
Painters, manufactured articles	2	(¹)
Photographic process workers	1	(¹)
Drill press operatives	3	(¹)
Grinding machine operatives	4	(¹)
Lathe and milling machine operatives	4	(¹)
Precision machine operatives, not elsewhere classified	2	(¹)
Punch and stamping press operatives	10	1
Riveters and fasteners	1	(¹)
Sawyers	8	1
Sewers and stitchers	6	1
Shoemaking machine operatives	5	1
Solderers	1	(¹)
Furnace tenders and stokers, excluding metal	1	(¹)
Carding, lapping, combing operative	1	(¹)
Knitters, loopers, toppers	1	(¹)
Spinners, twistors, winders	1	(¹)
Weavers	2	(¹)
Textile operatives, not elsewhere classified	2	(¹)
Welders and flame cutters	6	1
Winding operatives, not elsewhere classified	5	1
Machine operatives, miscellaneous specified	123	15
Machine operatives, not specified	30	4
Miscellaneous operatives	53	6
Operatives, not specified	19	2
Transport equipment operatives	10	1
Laborers, excluding farm	94	11
Construction laborers, excluding carpenter helpers	5	1
Freight, material handlers	8	1
Garbage collectors	1	(¹)
Gardeners and groundskeepers, excluding farm	3	(¹)
Stock handlers	2	(¹)
Vehicle and equipment cleaners	12	1
Warehouse laborers, not elsewhere classified	2	(¹)
Miscellaneous laborers	37	4
Laborers, not specified	24	3
Farm laborers and farm laborer supervisors	8	1
Service workers, excluding private household	19	2
Nonclassifiable	4	(¹)

¹ Less than 0.5 percent.
 NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of

injuries included in the survey.
 SOURCE: State workers' compensation reports.

Table 9. Activity at time of accident: Injuries related to servicing equipment, selected States, August-November 1980

Item	Workers	Percent
Which of the following best describes what you were doing when the accident occurred?		
Total	833	100
Unjamming object(s) from equipment	250	30
Cleaning equipment	245	29
Repairing equipment	77	9
Performing maintenance (oiling, etc.)	34	4
Installing equipment	13	2
Adjusting equipment	99	12
Doing set-up work	57	7
Performing electrical work	29	3
Inspecting equipment	15	2
Testing material or equipment	12	1
Other activity	2	(¹)
Was the task due to a breakdown during operation?		
Total	802	100
No	517	64
Yes	285	36
Had you done this type of task before?		
Total	798	100
No	81	10
Yes—on same or similar equipment	672	84
Yes—but on different equipment	45	6
How long would this task have taken to complete if you had not been injured?		
Total	814	100
Less than 2 minutes	328	40
2 to 15 minutes	253	31
15 minutes to 1 hour	124	15
1 to 8 hours	63	8
More than 8 hours	4	(¹)
Don't know	42	5
Estimate how often you do this type of task.		
Total	768	100
Daily	429	56
About once a week	110	14
About once a month	106	14
About once a year	42	5
First time you did this type of work	81	11
How did your injury occur?		
Total	833	100
Injured by machine parts that were in motion	735	88
Injured by contact with electrical current	45	5
Injured by chemicals, hot liquids, or other hazardous material	29	3
Injured by falling machine parts	10	1
Other	14	2

¹ Less than 0.5 percent.

NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of injuries included in the survey. Because incom-

plete questionnaires were used, the total number of responses may vary by question.

SOURCE: Survey questionnaire.

Table 10. Type of power: Injuries related to servicing equipment, selected States, August-November 1980

Item	Workers	Percent
Indicate all of the equipment's power sources.		
Total ¹	828	(')
Electric	751	91
Hydraulic	112	14
Pneumatic (air)	155	19
Pressurized (as in pipeline)	32	4
Steam	16	2
Gravity	5	1
Spring action	21	3
Gas or diesel engine	25	3
Don't know power source	27	3
If electric:		
Indicate voltage.		
Total	622	100
120 volts	76	12
More than 120 volts	283	45
Don't know voltage	263	42
Indicate type of power.		
Total	474	100
Single phase	61	13
Multiphase	190	40
Don't know type of power	223	47
Was there an emergency shutoff within your reach at the time of the accident?		
Total	819	100
No	411	50
Yes	380	46
Don't know	28	3
What kind of warning system, if any, did the equipment have to indicate it was activated or about to be activated?		
Total ¹	779	(')
None	596	77
Bells, alarms, or other audible warning system	54	7
Lights or other visual warning system	92	12
Don't know	43	6

¹ Because more than one response is possible, the sum of the responses and percentages may not equal the total. Percentages are calculated by dividing each response by the total number of persons who answered the question.

NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of injuries included in the survey. Because incomplete questionnaires were used, the total number of responses may vary by question.

SOURCE: Survey questionnaire.

Table 11. Extent of power shutdown: Injuries related to servicing equipment, selected States, August-November 1980

Item	Workers	Percent
Was the equipment turned off before doing the task?		
Total	833	100
No ¹	653	78
Yes	180	22
If equipment was not turned off, indicate reason(s).		
Total ²	592	(³)
Felt it would slow down production or take too long	112	19
Not required by company procedures	69	12
Didn't know how to	8	1
Didn't think it was necessary	209	35
Could not do task with equipment off	209	35
Did not realize power was on	62	10
Other reason	61	10
If equipment was turned off:		
a. Indicate what happened at the time of the injury.		
Total	176	100
You accidentally turned equipment or system back on	20	11
Co-worker accidentally turned equipment or system back on	15	9
Co-worker turned equipment or system back on, not knowing you were working on it	56	32
Equipment or material moved when jam-up was cleared	9	5
Parts were still in motion (coasting)	30	17
Other reason	46	26
b. Were any additional steps taken to shut down equipment before the accident?		
Total ^{2 3}	160	(³)
No—felt it would slow down production or take too long	8	5
No—not required by company procedures	23	14
No—didn't have supplies or tools to do this	4	2
No—didn't think it was necessary	49	31
No—other reason	20	13
No—reason not given	37	23
Disconnected main power	14	9
Tagged equipment power, valves, etc	6	4
Locked out equipment power, valves, etc	2	1
Removed fuse	-	-
Disconnected electrical line or broke circuits	5	3
Removed section of pipe	2	1
Drained pressure or hazardous materials from system	9	6
Installed blank flange	1	1
Restrained parts that could move, fall, or slide with blocks, chains, clamps, etc.	4	2
Other	4	2

¹ Of these, 61 reported accidental activation of auxiliary controls (e.g., foot pedals) and 19 reported using jog or inch controls.

² Because more than one response is possible, the sum of the responses and percentages may not equal the total. Percentages are calculated by dividing each response by the total number of persons who answered the question.

³ Includes 33 respondents who took addi-

tional steps to shut down equipment and 127 who took no further action.

NOTE: Dashes indicate that no data were reported. Due to rounding, percentages may not add to 100. See appendix A for types of injuries included in the survey. Because incomplete questionnaires were used, the total number of responses may vary by question.

SOURCE: Survey questionnaire.

Table 12. Lockout procedures and instruction: Injuries related to servicing equipment, selected States, August-November 1980

Item	Workers	Percent
Have you ever padlocked power controls or valves in "off" position before servicing or repairing equipment?		
Total ¹	655	(¹)
No	383	58
Yes—on equipment involved in accident	101	15
Yes—on other equipment	112	17
Yes—at another place of work	47	7
Don't know	45	7
Are the equipment controls designed for padlocking main power source or valve in "off" position?		
Total	694	100
No	246	35
Yes	273	39
Don't know	175	25
If equipment controls are designed for a lockout:		
a. Are the lockout controls within reaching distance or within sight of this equipment?		
Total	264	100
No	43	16
Yes	221	84
b. Would the lockout procedure for the equipment involved in the accident require any of the following?		
Total ¹	259	(¹)
A written permit	2	1
Supervisor's authorization or participation	34	13
Protective equipment (such as gloves)	11	4
Special tools other than locks (such as ladder, blocks, etc.)	6	2
Special skills (such as strength, electrical knowledge, etc.)	17	7
Help from co-workers	19	7
None of the above	172	66
Don't know	26	10
c. How long would it take to lock out this equipment?		
Total	262	100
2 minutes or less	225	86
2 to 15 minutes	22	8
15 minutes to one hour	6	2
One hour or more	-	-
Don't know	9	3
d. Would the lockout and restart be supervised?		
Total	264	100
No	183	69
Yes—by foreman or other supervisor	60	23
Yes—by safety officer	2	1
Don't know	19	7

See footnotes at end of table.

Table 12. Continued—Lockout procedures and instruction: Injuries related to servicing equipment, selected States, August–November 1980

Item	Workers	Percent
What type of policy, if any, does your employer have for locking out equipment before doing service or repair work?		
Total	653	100
Single lockout requirement covering all equipment	64	10
Specific lockout requirements for each type of equipment	107	16
No policy	210	32
Don't know	272	42
Were you provided any instructions on how to do a lockout of equipment power before servicing?		
Total ¹	554	(¹)
Provided printed instructions	25	5
Lockout procedures posted on equipment	37	7
Given instructions as part of on-the-job training	176	32
Given formal training at meetings, etc	28	5
Other	7	1
No instructions on lockout provided	340	61
If lockout instructions were provided:		
a. What did they include?		
Total ¹	183	(¹)
When to lock out	160	87
Where to place locks on equipment	91	50
Tagging in addition to locking out	48	26
Restraining parts that could move, fall, or slide with blocks, chains, clamps, etc	30	16
Clearing the area of personnel	16	9
Testing lockout to be sure power is off	52	28
Procedures for storing keys and removing locks	32	17
Controlling access to locks and keys	25	14
Lockout procedures covering change in work shifts	21	11
Group lockouts	18	10
b. When were the lockout instructions given to you?		
Total ¹	186	(¹)
After the accident	15	8
One to six months before the accident	36	19
Six months to a year before the accident	28	15
Upon hiring	84	45
Over a year ago	60	32

¹ Because more than one response is possible, the sum of the responses and percentages may not equal the total. Percentages are calculated by dividing each response by the total number of persons who answered the question.

NOTE: Dashes indicate that no data were

reported. Due to rounding, percentages may not add to 100. See appendix A for types of injuries included in the survey. Because incomplete questionnaires were used, the total number of responses may vary by question.

SOURCE: Survey questionnaire.

Table 13. Work information: Injuries related to servicing equipment, selected States, August-November 1980

Item	Workers	Percent
What are your regular job duties?		
Total ¹	814	(¹)
Operating equipment	532	65
Unjamming equipment	294	36
Making minor adjustments to equipment	330	41
Set-up work	296	36
Servicing equipment or systems	220	27
Electrical work	87	11
Plumbing or pipefitting work	61	7
Supervising other workers	136	17
Other	109	13
How long have you had these job duties at the place where you work?		
Total	801	100
Less than 6 months	174	22
6 months to a year	132	16
1 to 3 years	202	25
3 to 5 years	104	13
5 years or more	189	24
Are you paid on an incentive basis (piecework, production bonus, or profit sharing)?		
Total	768	100
No	659	86
Yes	109	14
How many people are employed at the place where you work?		
Total	794	100
1 to 19	159	20
20 to 49	123	15
50 to 99	120	15
100 to 499	234	29
500 or more	158	20
Does the place where you work have a safety officer or safety representative?		
Total	791	100
No	206	26
Yes	401	51
Don't know	184	23

¹ Because more than one response is possible, the sum of the responses and percentages may not equal the total. Percentages are calculated by dividing each response by the total number of persons who answered the question.

NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of injuries included in the survey. Because incomplete questionnaires were used, the total number of responses may vary by question.

SOURCE: Survey questionnaire.

Table 14. Estimated lost workdays: Injuries related to servicing equipment, selected States, August-November 1980

Item	Workers	Percent
How many workdays did you (or do you expect to) lose due to your injury? (NOTE: Do not count the day of injury, normal days off, or holidays.)		
Total	793	100
No time lost	107	13
1 to 5 workdays lost	132	17
6 to 10 workdays lost	95	12
11 to 15 workdays lost	75	9
16 to 20 workdays lost	47	6
21 to 25 workdays lost	47	6
26 to 30 workdays lost	60	8
31 to 40 workdays lost	49	6
41 to 60 workdays lost	54	7
More than 60 workdays lost	41	5
Number of workdays lost not estimated	86	11
Average days lost per lost workday case	24	

NOTE: Due to rounding, percentages may not add to 100. See appendix A for types of injuries included in the survey. Because incom-

plete questionnaires were used, the total number of responses may vary by question.
SOURCE: Survey questionnaire.

Appendix A: Survey Explanatory Note

The survey was designed to develop information on workers injured while servicing equipment. The scope of the survey was limited to contact with machinery and electrical or piping systems which were energized or contained hazardous materials. Injuries involving portable equipment or tools, such as lawnmowers, powered handtools, and noncommercial meat slicers, were excluded. Servicing activities included were: Unjamming, cleaning, repairing, maintenance, electrical work, set-up work, installing, adjusting, inspecting, or testing. The scope of the survey covered injured workers in all occupations in all industries except coal and metallic and nonmetallic mining. Cases were excluded from the survey if the injury resulted in a fatality or if more than 120 days had elapsed between the time of the injury and the beginning of the survey.

To identify equipment-servicing cases within the scope of the survey, participating State agency staff reviewed employers' reports of injuries required by State workers' compensation laws and mailed questionnaires to injured workers selected for the study. They requested cooperation on a voluntary basis. During the survey period, August- November 1980, 25 State agencies reviewed about 500,000 injury reports, of which 1,285 were within the scope of the survey. Sixty-five percent of the workers selected as within the scope of the study responded to the mail questionnaire.

Although data were aggregated for 25 States, it should be noted that the workers' compensation cases selected for study reflect differences in State reporting requirements. For example, some participating States require reporting of workers' compensation cases involving medical treatment regardless of lost time, while

others limit reporting to cases involving lost time ranging from 1 to 8 days.

In addition, no attempt was made to estimate all injuries related to equipment servicing for the occupations studied. Although participating States provided a broad geographical and industrial mix, they were not selected statistically to represent the country as a whole. Moreover, the survey period was terminated when responses exceeded 750 cases.

Characteristics of the injury and the person injured were classified and tabulated for all in-scope respondents based on information furnished by the employer in the workers' compensation report.

Questionnaires returned by the injured worker were reviewed for completeness and reliability. Respondents experienced difficulty in answering questions relating to lockout, which was defined as "disconnecting or shutting down and locking equipment controls in off position." For example, responses to question III.H, which asked about job tasks requiring a lockout, were considered unreliable because respondents apparently failed to relate their tasks with lockout requirements. Therefore, these responses were not tabulated. Difficulty was also experienced in Section II among some respondents who reported that the power was off when an activating control, other than an on/off switch, had not been depressed. All usable responses of incomplete questionnaires were used in the tabulations. No attempt was made to adjust the data for nonresponses.

Numerical values shown in the tables were actual counts while percentages were rounded to the nearest whole number.

Appendix B: Participating State Agencies

Arizona Industrial Commission
Arkansas Department of Labor
California Department of Industrial Relations
Colorado Department of Labor and Employment
Delaware Department of Labor
Hawaii Department of Labor and Industrial Relations
Idaho Industrial Commission
Indiana Division of Labor
Iowa Bureau of Labor
Kentucky Department of Labor
Maine Department of Manpower Affairs
Maryland Department of Licensing and Regulation
Massachusetts Department of Labor and Industries
Michigan Department of Labor

Missouri Department of Labor and Industrial Relations
Montana Department of Labor and Industry
Nebraska Workmen's Compensation Court
New Jersey Department of Labor and Industry
Ohio Industrial Commission
Pennsylvania Department of Labor and Industry
Tennessee Department of Labor
Utah Industrial Commission
Virginia Department of Labor and Industry
Washington Department of Labor and Industries
Wisconsin Department of Industry, Labor and Human Relations

III. Lockout Procedures

NOTE: The following questions ask about "lockout" which means disconnecting or shutting down and locking equipment controls in "off" position before doing service or repair work.

- A. Are the equipment controls designed for padlocking main power source or valve in "off" position (referred to as a "lockout")?
1. No 2. Yes 3. Don't know
- B. Are the lockout controls within reaching distance or within sight of this equipment?
1. No
2. Yes
3. Don't know where lockout controls are
- C. Have you ever padlocked power controls or valves in "off" position before servicing or repairing equipment (called a "lockout")?
1. No
2. Yes—on equipment involved in accident
3. Yes—on other equipment
4. Yes—at another place of work
5. Don't know
- D. Would the lockout procedure for the equipment involved in the accident require any of the following? (Check all that apply.)
1. A written permit
2. Supervisor's authorization or participation
3. Protective equipment (such as gloves)
4. Special tools other than locks (such as ladder, blocks, etc.)
5. Special skills (such as strength, electrical knowledge, etc.)
6. Help from co-workers
7. None of the above
8. Don't know
- E. How long would it take to lockout this equipment? (Check one.)
1. 2 minutes or less 4. One hour or more
2. 2 to 15 minutes 5. Don't know
3. 15 minutes to one hour
- F. Would the lockout and restart be supervised?
1. No
2. Yes—be foreman or other supervisor
3. Yes—by safety officer
4. Don't know
- G. What type of policy, if any, does your employer have for locking out equipment before doing service or repair work? (Check one.)
1. Single lockout requirement covering all equipment
2. Specific lockout requirements for each type of equipment
3. No policy
4. Don't know

IV. Work Information

- A. What are your regular job duties? (Check all that apply.)
1. Operating equipment 8. Supervising other workers
2. Unjamming equipment
3. Making minor adjustments to equipment 9. Other: (Describe) _____
4. Set up work _____
5. Servicing equipment or systems _____
6. Electrical work _____
7. Plumbing or pipe-fitting work _____
- B. How long have you had these job duties at the place where you work? (Check one.)
1. Less than 6 months 4. 3 to 5 years
2. 6 months to a year 5. 5 years or more
3. 1 to 3 years

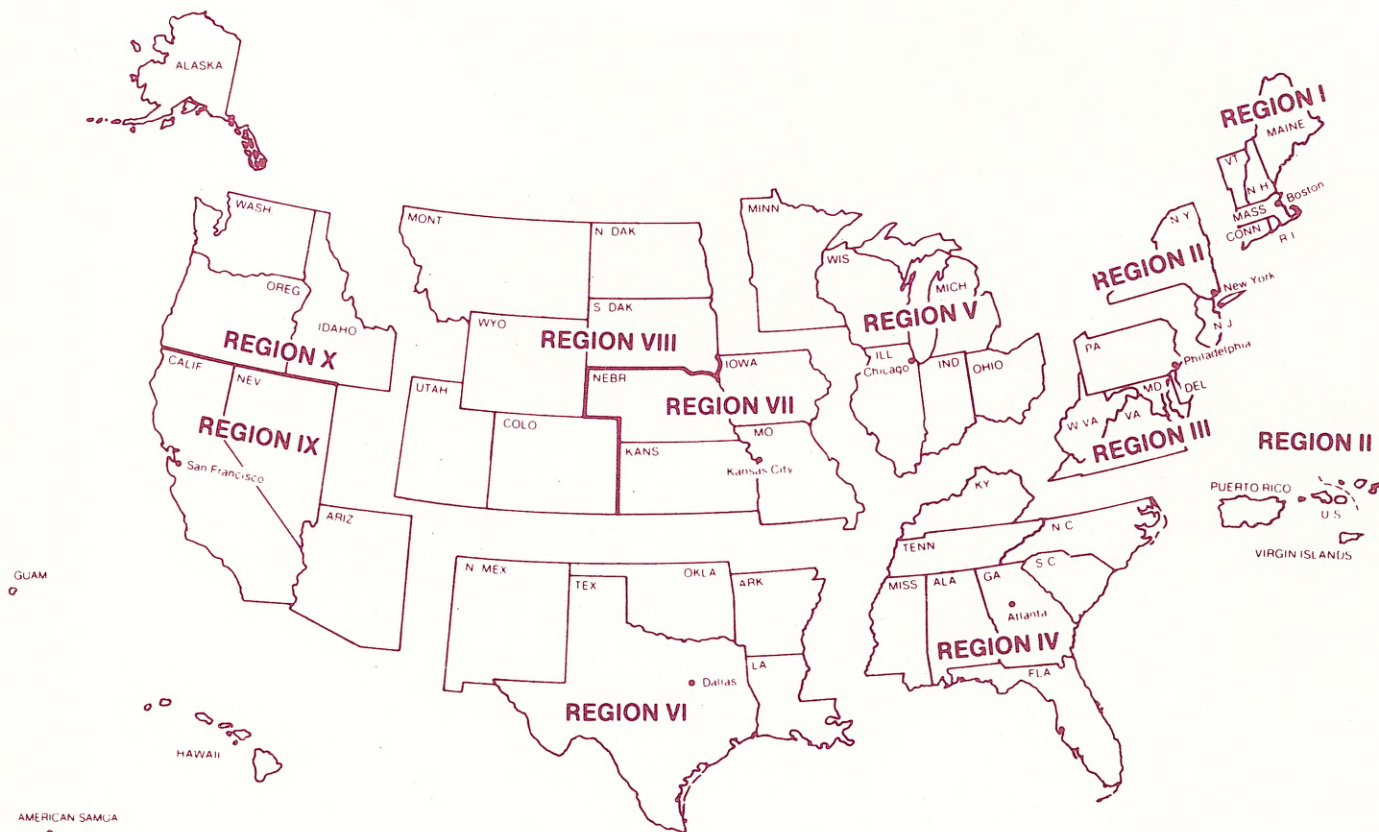
- H. Check which job tasks, if any, require a lockout of the equipment. (Check all that apply.)
1. Clearing jam-ups
2. Repairing equipment
3. Cleaning equipment
4. Performing maintenance (oiling, etc.)
5. Doing set up work
6. Other tasks requiring lockout: (Describe) _____
7. None
8. Don't know
- I. Were you provided any instructions on how to do a lockout of equipment power before servicing? (Check all that apply.)
1. Provided printed instructions
2. Lockout procedures posted on equipment
3. Given instructions as part of on-the-job training
4. Given formal training at meetings, etc.
5. Other: (Describe) _____
6. No instructions on lockout provided—Continue with Section IV.
- J. If lockout instructions were provided:
- a. What did they include? (Check all that apply.)
1. When to lockout
2. Where to place locks on equipment
3. Tagging in addition to locking out
4. Restraining parts that could move, fall or slide with blocks, chains, clamps, etc.
5. Clearing the area of personnel
6. Testing lockout to be sure power is off
7. Procedures for storing keys and removing locks
8. Controlling access to locks and keys
9. Lockout procedures covering change in work shifts
10. Group lockouts
- b. When were the lockout instructions given to you? (Check all that apply.)
1. After the accident
2. One to six months before the accident
3. Six months to a year before the accident
4. Upon hiring
5. Over a year ago

V. Describe the events leading to your accident.

VI. Do you feel that a lockout procedure should be followed for the task you were performing when injured? (Explain.)

Bureau of Labor Statistics

Regional Offices



Region I

1603 JFK Federal Building
Government Center
Boston, Mass. 02203
Phone: (617) 223-6761

Region IV

1371 Peachtree Street, N.E.
Atlanta, Ga. 30367
Phone: (404) 881-4418

Regions VII and VIII

911 Walnut Street
Kansas City, Mo. 64106
Phone: (816) 374-2481

Region II

Suite 3400
1515 Broadway
New York, N.Y. 10036
Phone: (212) 944-3121

Region V

9th Floor
Federal Office Building
230 S. Dearborn Street
Chicago, Ill. 60604
Phone: (312) 353-1880

Regions IX and X

450 Golden Gate Avenue
Box 36017
San Francisco, Calif. 94102
Phone: (415) 556-4678

Region III

3535 Market Street
P.O. Box 13309
Philadelphia, Pa. 19101
Phone: (215) 596-1154

Region VI

Second Floor
555 Griffin Square Building
Dallas, Tex. 75202
Phone: (214) 767-6971