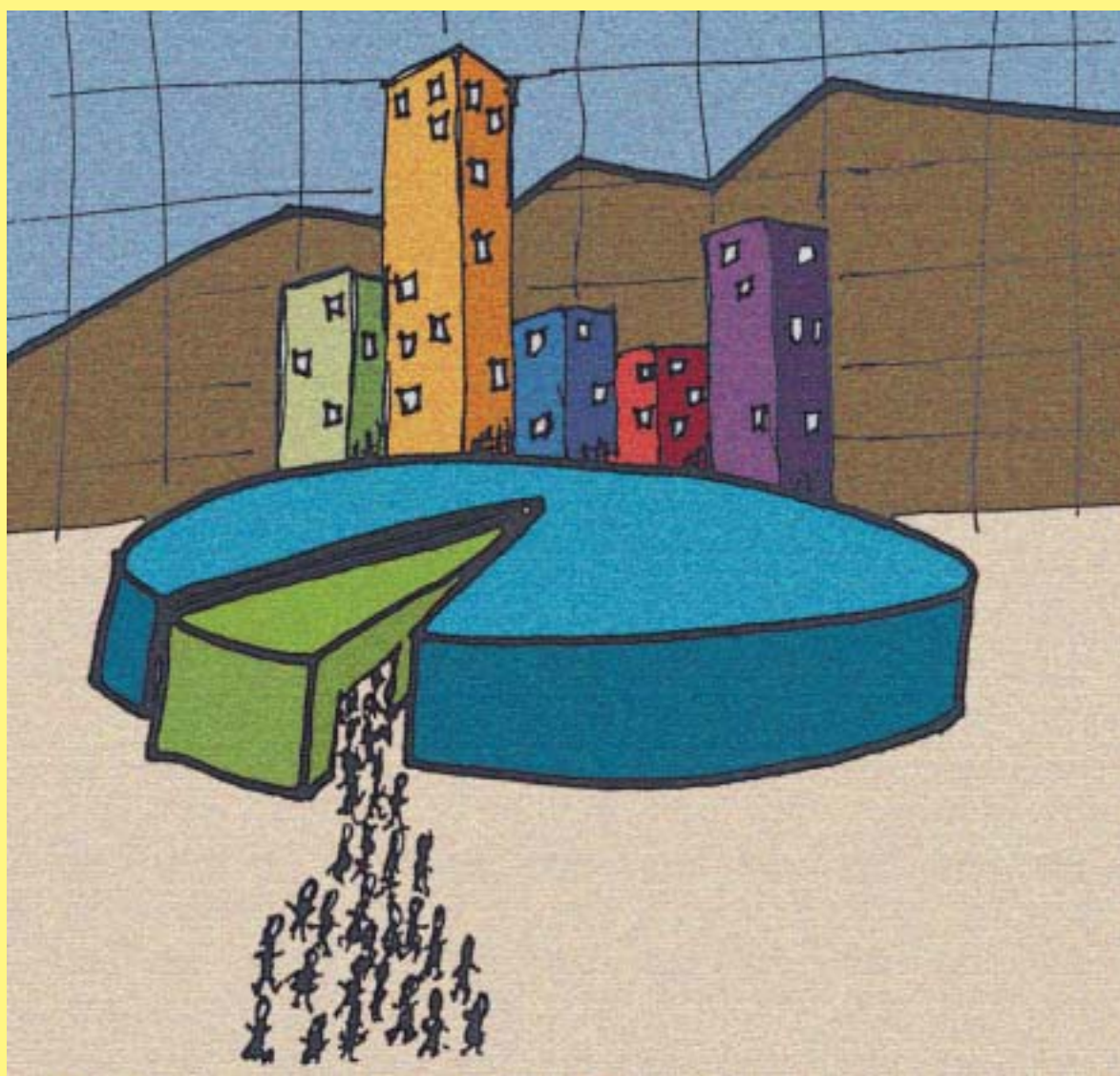




Worker Health Chartbook, 2000

Focus on Mining



DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health





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FOREWORD

The content of this booklet is taken from the *Worker Health Chartbook, 2000* (DHHS NIOSH Publication No. 2000-127), a comprehensive guide to surveillance data for work-related fatal and nonfatal injury and illness. The publication of the chartbook is an important step toward identifying and filling significant gaps in workplace injury and illness information. Several Federal agencies worked with NIOSH to compile data for the chartbook, using a variety of systems that track the nature, prevalence, and incidence of workplace injuries and diseases. These data help us identify new and emerging problems, analyze trends over time, target and evaluate the effectiveness of intervention efforts, and anticipate future needs and concerns. This booklet highlights a focus on mining. It is intended for anyone interested in this topic, including occupational safety and health practitioners, policy makers, health care providers, educators, researchers, workers, and employers. The tracking of injury and illness is a cornerstone of prevention. We hope this booklet contributes to that effort.



Kathleen M. Rest, Ph.D., M.P.A.
Acting Director
National Institute for Occupational
Safety and Health

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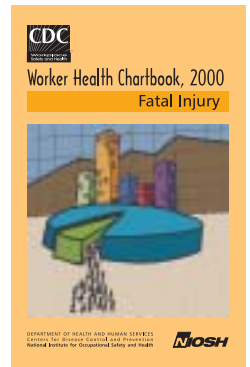
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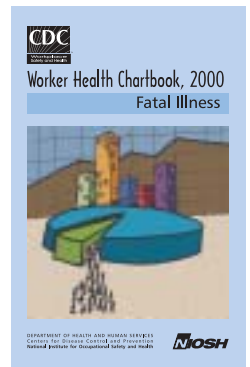
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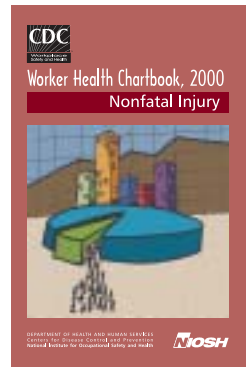
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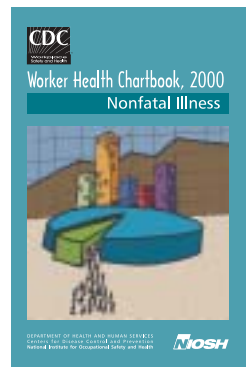
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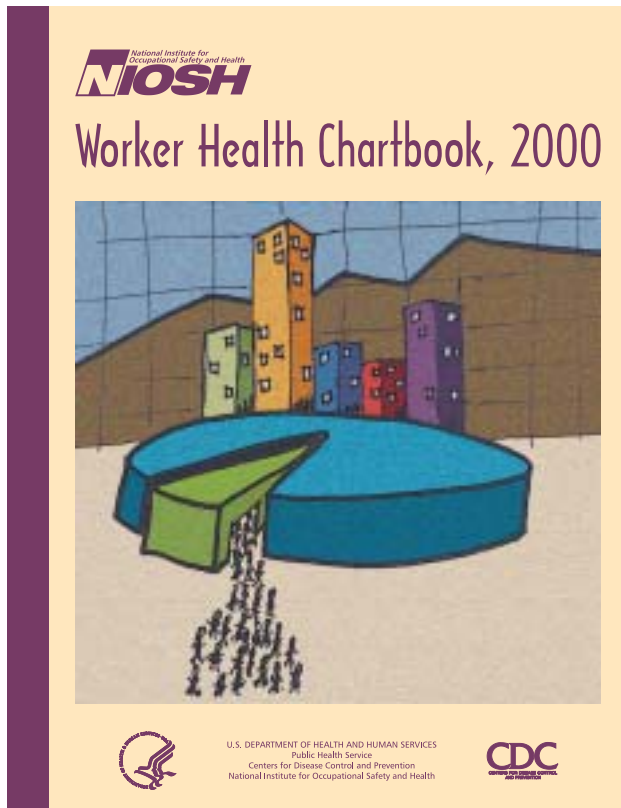
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Nonfatal Injury (2002-119)



Nonfatal Illness (2002-120)



(2000-127)

EXECUTIVE SUMMARY

Historically, the highest rates of fatal and nonfatal injury have occurred in the mining industry. During the 85-year period from 1911 to 1995, more than 103,000 workers were fatally injured in mining. From 1911 through 1915 alone, 16,646 fatalities occurred, and the annual average fatality rate exceeded 300 per 100,000 workers. By the early 1950s, annual fatality rates in coal mining had declined to 150 per 100,000 workers, but rates increased prior to passage of the Coal Mine Health and Safety Act of 1969. Similarly, fatality rates in metal and nonmetal mining fell to 66 per 100,000 workers in the early 1960s, but rose before the Federal Mine Safety and Health Act of 1977 was enacted. After passage of the two Federal mine acts, mining fatality rates decreased substantially. During the 10-year period 1988–1997, 993 mine workers were fatally injured. The average annual mine operator fatality rate was 28.5 per 100,000 miners. Fatality rates in underground mines were higher than those in surface mines. A trend toward decreasing fatality rates with increasing mine size was observed. The types of incidents associated with the highest fatality rates were powered haulage, fall of ground from in place, and machinery.

The mining industry experienced 170,635 lost-workday injury cases and 6,840,987 lost workdays (including restricted workdays) during 1988–1997. The average annual rate was 5.5 cases per 100 full-time workers. The average number of workdays lost per case was 40. Underground mines were associated with the highest injury rates. For example, the underground areas of coal mines accounted for 65,668 cases and an average annual rate of 11.9 cases per 100 full-time workers. The leading types of incidents associated with lost-workday cases were handling materials, slip or fall of person, powered haulage, machinery, and hand tools. Leading types of injuries associated with lost workdays included sprains to the back region, sprains to the lower extremities (primarily the knee), amputations of the arms or hands (primarily the fingers), and fractures to the lower extremities.

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ABBREVIATIONS

- CFOI Census of Fatal Occupational Injuries
- CFR *Code of Federal Regulations*
- DHHS U.S. Department of Health and Human Services
- MSHA Mine Safety and Health Administration
- n.e.c. not elsewhere classified
- NIOSH National Institute for Occupational Safety and Health
- NTOF National Traumatic Occupational Fatalities Surveillance System
- OSHA Occupational Safety and Health Administration
- SIC standard industrial classification

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FOCUS ON MINING

This publication presents a detailed overview of mining and injuries. Historically, mining has been the industry sector with the highest fatal and nonfatal injury rates. Mining still has the highest fatal injury rate—more than five times the national average. Because of the accompanying social toll and public pressures for action, data on fatalities and injuries became available far earlier in the mining industry than in many others. State and Federal agencies began collecting data in the 1870s, and reliable information has been available for an entire century. Examination of the history of coal mining in this century shows important relationships between adverse outcomes (such as fatality rates) and regulatory actions such as enactment of Federal legislation and establishment of enforcement and consultation agencies.

Fatal Injuries

Historical Perspective

More than 103,000 workers died in the mining industry (including all commodities and work locations) during the 85-year period from 1911 to 1995 (Figure 1). From 1911 through 1915 alone, 16,646 fatalities occurred, with an annual average of 2,517 deaths in coal mining and 813 in metal and nonmetal mining. The corresponding annual average fatality rates during this 5-year period were 340 and 300 per 100,000 workers in coal mining and metal and nonmetal mining, respectively. The U.S. Bureau of Mines, established in 1910, focused on coal mine fires and explosions. In the first decade after its creation, disaster-related fatalities* in coal mines decreased substantially, with a 62% reduction in deaths from mine fires and a 45% reduction from explosions. Disaster-related fatalities in metal and nonmetal mining increased during the same period. The number and rate of fatalities decreased again during the Great Depression, a period accompanied by reductions in both the labor force and production, as measured by tonnage mined. Rates increased during the economic mobilization required during World War II. For the years 1941–1945, 694 million tons of coal were mined annually, compared with 520 million tons for the 5 preceding

*Five or more fatalities resulting from a single incident.

FOCUS ON MINING

years—a 33% increase. Coal mining fatality rates increased during the decade preceding the Coal Mine Health and Safety Act of 1969 [Public Law 91–173]. Rates rose similarly for metal and nonmetal mining in the decade before the Federal Mine Safety and Health Act of 1977 [Public Law 95–164]. Fatality rates decreased following the passage of these two Federal mine acts.

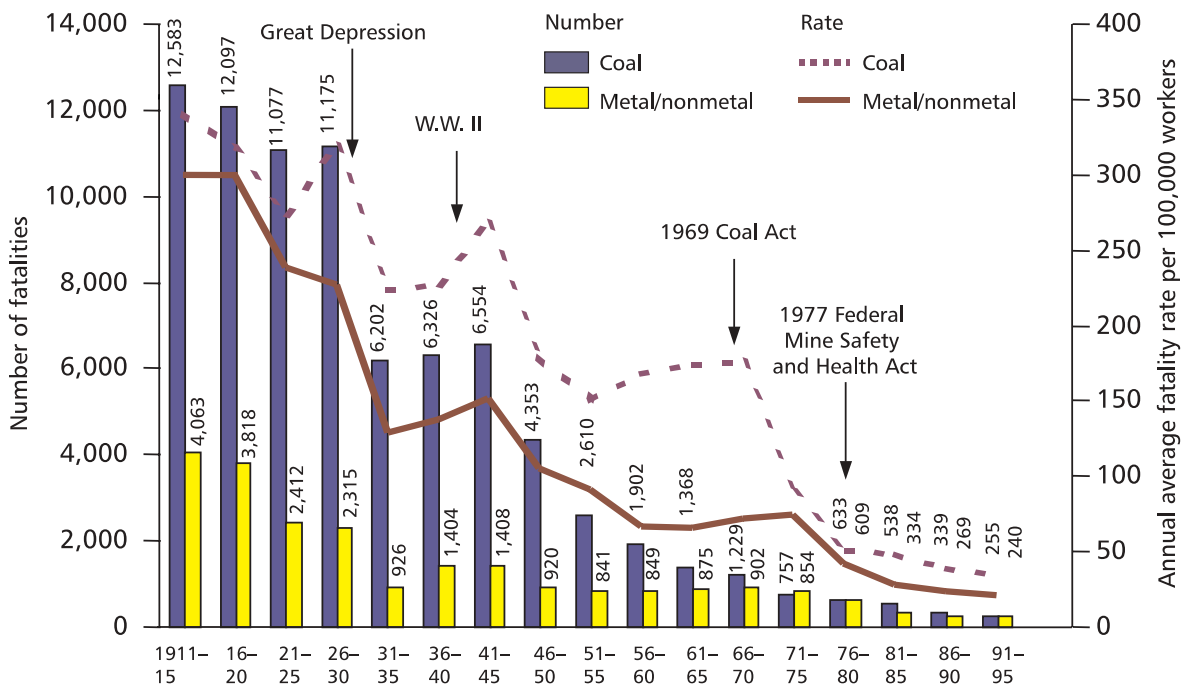


Figure 1. Number of fatalities (5-year aggregates) and annual average fatality rates in the mining industry by commodity, 1911–1995. Annual average fatality rates are calculated per 100,000 workers aggregated over 5-year periods. Metal and nonmetal includes metal, nonmetal, stone, and sand and gravel. (Source: MSHA [1999]; Adams and Wrenn [1941]; Adams and Kolhos [1941]; Reese et al. [1955]; MSHA [1984].)

Fatal Injuries during 1988–1997

Mining operations are located in every State as well as in Puerto Rico and the Virgin Islands. In 1997, 13,682 mining operations reported employment to the Mine Safety and Health Administration (MSHA)—2,609 were coal mining operations (average employment size of 35 full-time workers); 374 were metal mining operations (average employment size of 122 full-time workers); 786 were nonmetal mining operations (average employment size of 32 full-time workers); 3,712 were stone mining operations (average employment size of 19 full-time workers); and 6,201 were sand and gravel mines (average employment size of 5 full-time workers).

At least one mine operator fatality occurred in each State but Delaware, Maine, and Rhode Island during the period 1988–1997 (Figure 2). The national annual average mine operator fatality rate during this period was 28.5 per 100,000 miners, which is more than five times the national annual average occupational fatality rate of 5.3 per 100,000 workers from 1980 through 1995 [NTOF 1999] (Figure 3). Nine states had very high mine operator fatality rates that exceeded the national mining fatality rate by 50% or more. Nine other States and Puerto Rico had rates greater than the national rate.

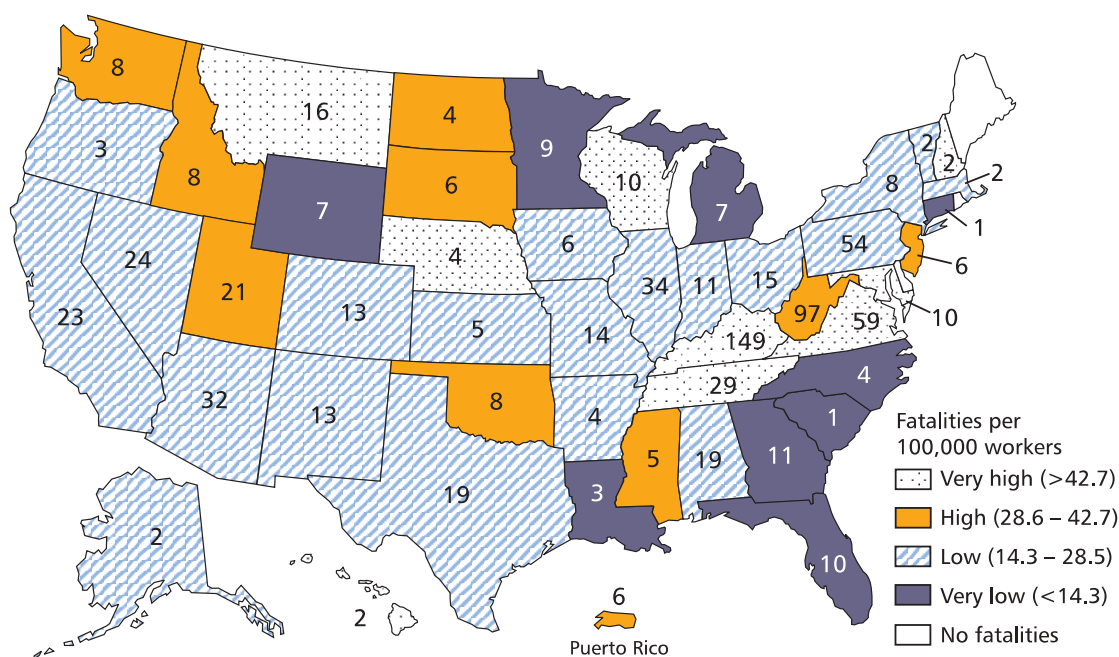


Figure 2. Number of mine operator fatalities (as numbers within State boundaries) and corresponding annual average fatality rates (shading within States) for each State and Puerto Rico, 1988–1997. (Source: MSHA [1999].)

FOCUS ON MINING

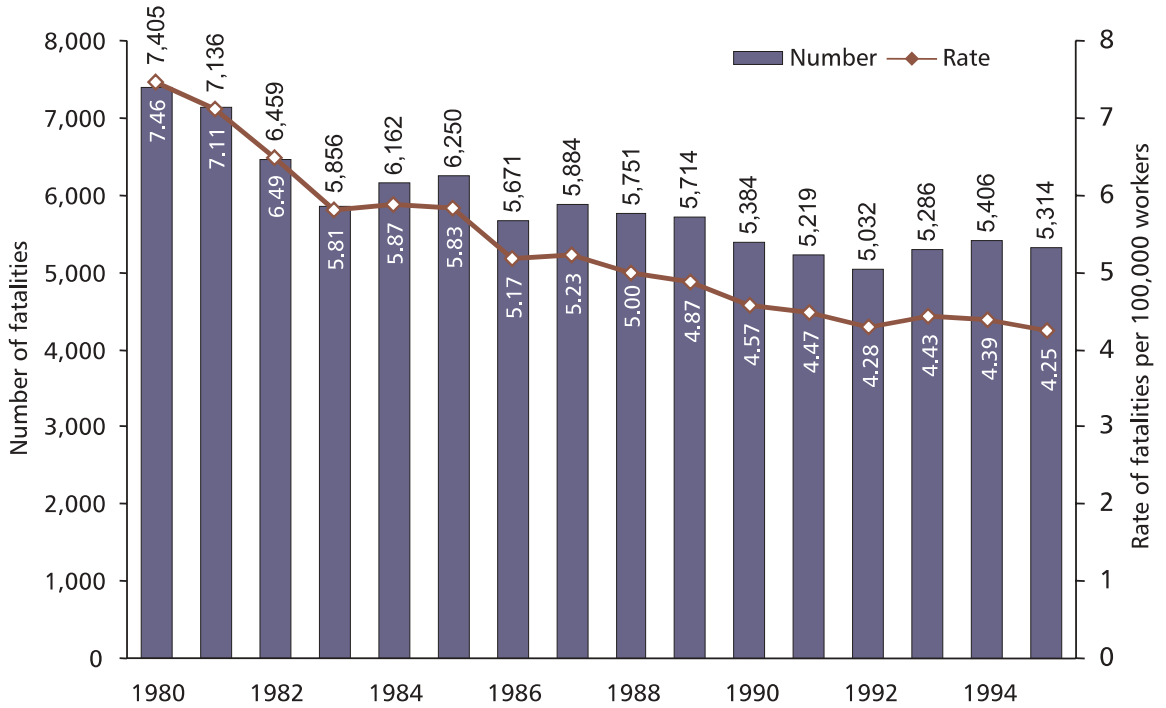


Figure 3. Number and annual rate of fatal occupational injuries, 1980–1995. (Source: NTOF [1999].)

During the 10-year period 1988–1997, the number of fatalities was highest in 1990 (n=122) and lowest in 1994 (n=82) (Figure 4). The overall downward trend since 1990 is attributable primarily to decreases in fatalities of mine operator workers in the coal and metal commodities. During 1988–1997, mine operator workers accounted for 806 (81.2%) of the total number of fatalities (n=993), with the remaining 187 (18.8%) being independent contractor workers. Coal operator workers accounted for 432 (43.5%) of the total, followed by mine operator workers in the commodities of stone (n=157, 15.8%), metal (n=98, 9.9%), sand and gravel (n=83, 8.4%), and nonmetal (n=36, 3.6%). Independent contractor workers in metal and nonmetal mining made up 11.3% (112) of the total, with 7.6% (75) attributed to independent contractors in coal.

Despite annual fluctuations, overall fatality rates have decreased for mine operator workers in the coal and metal commodities (Figure 5). Although fatality rates for independent contractor workers are the highest overall, reduced employment reporting requirements for this sector of workers compromise any direct comparison with rates for mine operator workers.

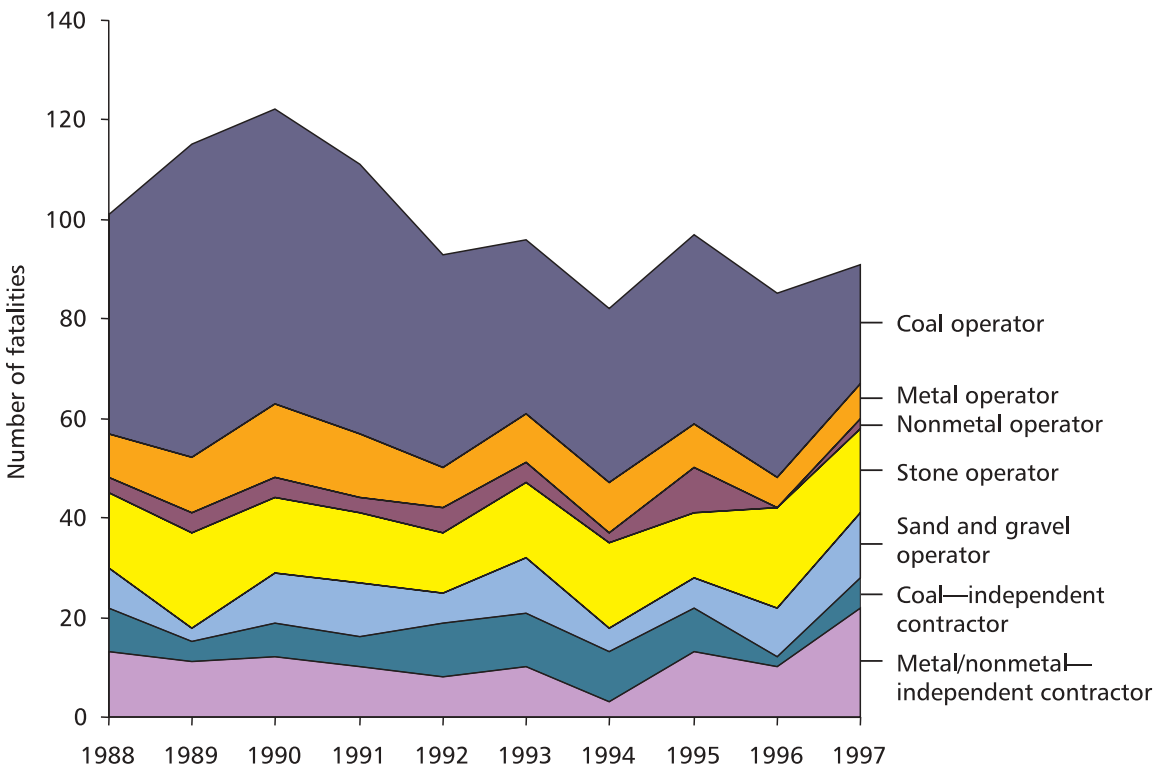


Figure 4. Number of fatalities, by type of employer (mine operator versus independent contractor) and commodity, 1988–1997. Metal and nonmetal includes metal, nonmetal, stone, and sand and gravel. (Source: MSHA [1999].)

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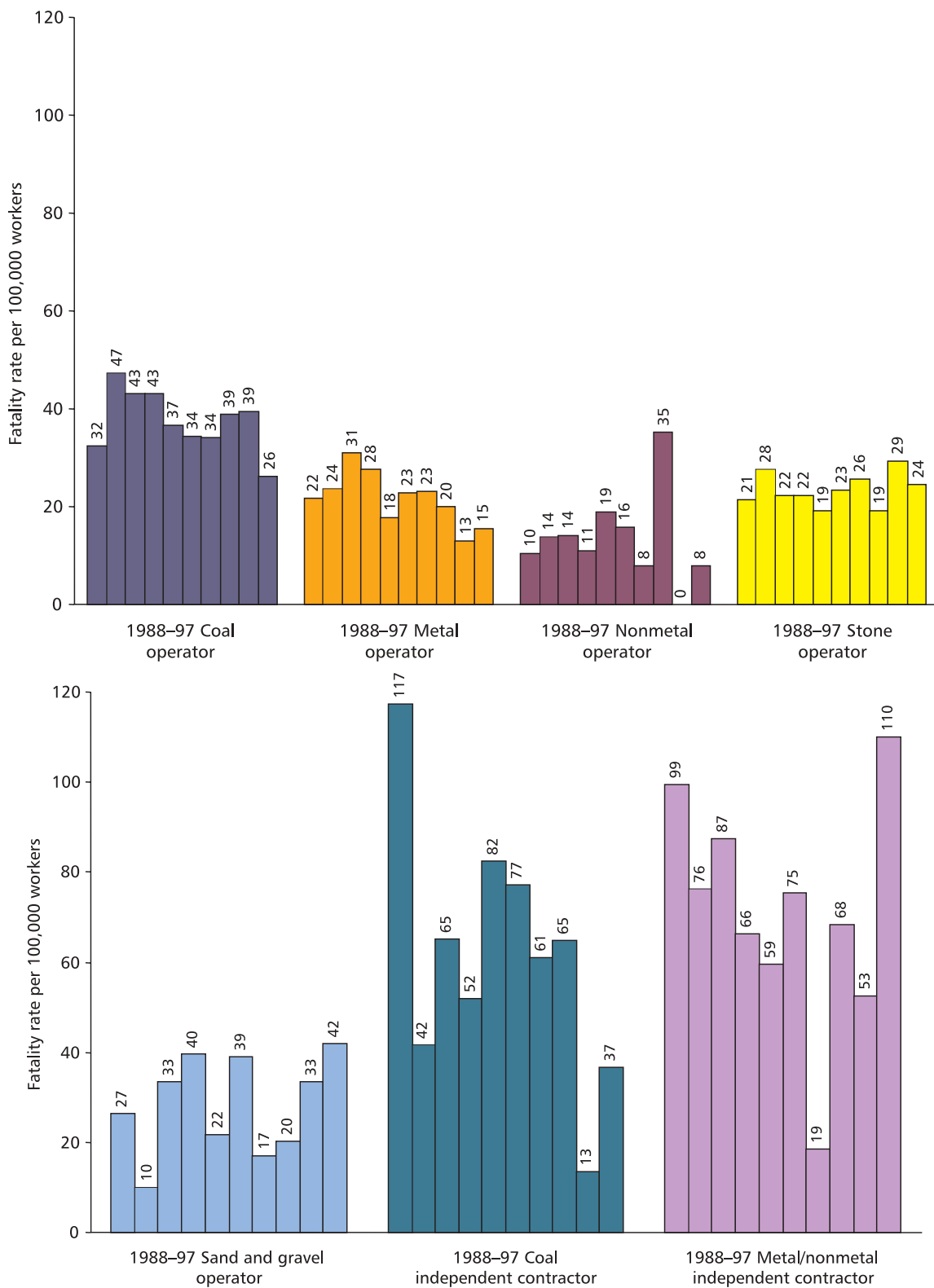


Figure 5. Fatality rates by type of employer (mine operator versus independent contractor) and commodity, 1988–1997. Fatality rates are calculated per 100,000 full-time workers or 200 million employee hours. Metal and nonmetal includes metal, nonmetal, stone, and sand and gravel. (Source: MSHA [1999].)

Both the number and annual average rate of fatalities from 1988 through 1997 varied by work location and by type of employer and commodity (Table 1). Overall, underground work locations exhibited both the highest numbers and rates of fatalities, and preparation plants and mills exhibited the lowest fatality rates. Among mine operator workers, the combination of high numbers and rates of fatalities is most conspicuous for those working in underground coal mines, underground metal mines, stone surface mines (or quarries), and sand and gravel operations. Although independent contractor workers accounted for about one-fifth (19%) of all fatalities during this 10-year period, they accounted for almost one-third (30%) of the fatalities at the surface areas of underground mines, at surface mines, and at mills or preparation plants.

A trend toward decreasing fatality rates with increasing mine size is apparent in underground coal and metal mining operations (Figure 6). This trend is particularly significant for underground coal mining operations, which also accounted for 83% of all underground employee hours and 77% of all underground fatalities reported during the 10-year period 1988–1997. In addition, coal accounted for 90% of the employee hours worked underground in small mines (fewer than 50 workers), followed by stone mines (5.5%), metal mines (3%), and nonmetal mines (less than 1%).

Fatality rates from 1988 through 1997 at surface work locations were highest at the smallest mining operations (fewer than 10 workers) in every commodity (Figure 7). The proportion of employee hours worked at the surface locations of these mines was highest in sand and gravel (43%), followed by stone (8%), coal (6%), nonmetal (5%), and metal (less than 1%). Elevated rates persist for small operations with 10 to 49 workers, although these rates are only slightly elevated in coal. No sand and gravel operations employed more than 250 workers.

The major types of incidents associated with fatal injuries are shown in Table 2 by commodity and type of employer. Overall, powered haulage incidents accounted for the largest percentage of fatalities (30.8%), followed by fall of ground (18.9%) and machinery (16.3%). Some types of incidents, such as falls of ground, are substantially more frequent among mine operators than among independent contractors. The rate differences between type of employer and among commodities suggest that different strategies are needed to reduce fatality rates in various sectors of the mining industry.

Table 1. Number and annual average rate* of fatalities associated with various types of employers and commodities by work location, 1988–1997

Type of employer and commodity	Work location													
	Underground mines						Surface mines							
	All		Underground		Surface areas		Strip/open pit/quarry		Dredge		Other surface operations [†]		Mills/plants	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
All	993	31.9	388	56.9	51	46.3	383	29.4	21	38.3	10	37.2	140	15.0
Mine operator:														
Coal	432	37.9	298	54.2	27	49.5	74	19.1	0	0.0	4	25.7	29	22.0
Metal	98	21.6	53	83.8	6	36.5	28	16.6	0	0.0	0	0.0	11	5.7
Nonmetal	36	13.4	14	40.0	0	0.0	11	18.5	0	0.0	NA [‡]	NA	11	6.6
Stone	157	23.5	15	93.5	3	77.1	95	33.7	0	0.0	0	0.0	44	12.1
Sand and gravel	83	28.2	NA	NA	NA	NA	65	26.3	18	38.3	NA	NA	NR [§]	NR
Independent contractor:														
Coal	75	59.1	2	17.6	12	52.3	40	62.5	0	0.0	5	253.2	16	60.3
Metal and nonmetal**	112	71.3	6	102.0	3	49.0	70	75.0	3	278.1	1	232.7	29	57.7

Source: MSHA [1999].

*Computed per 100,000 full-time workers or 200 million employee hours.

[†]Includes culm banks, auger mining, independent shops and yards, and surface mining n.e.c.

[‡]NA=Not applicable for this commodity.

[§]NR=Not reported separately. Sand and gravel operators report mill employment under strip or dredge operations.

**Includes metal, nonmetal, stone, and sand and gravel.

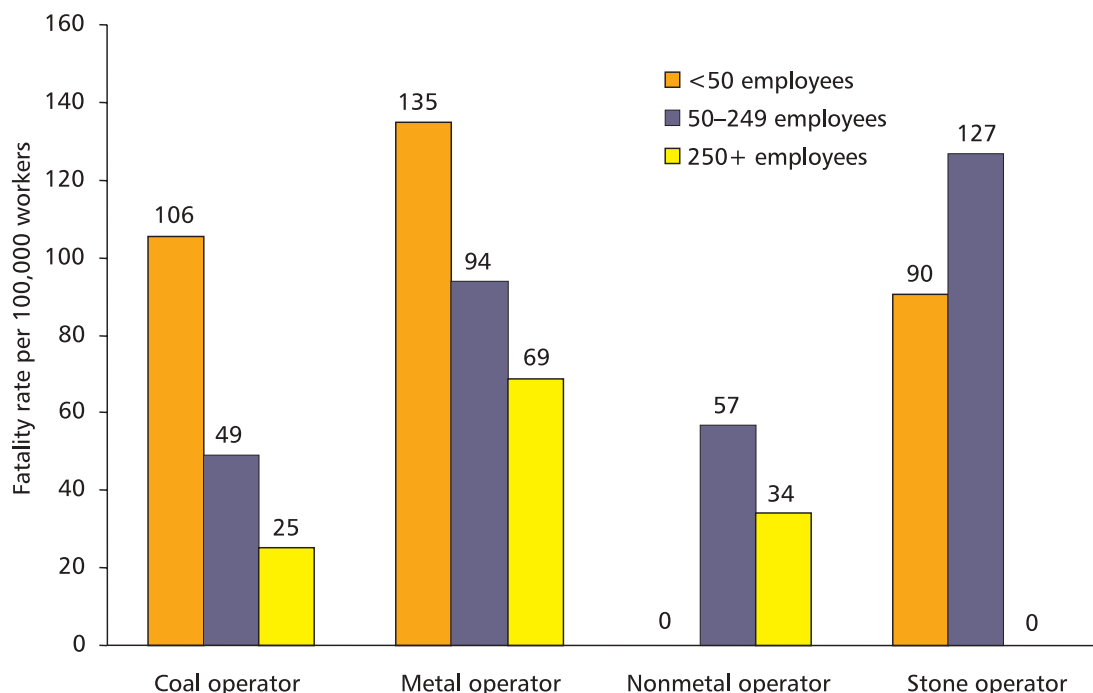


Figure 6. Fatality rates at underground mining operations, by commodity and employment size of operation, 1988–1997. Fatality rates are computed per 100,000 full-time workers or 200 million employee hours. (Note: There are no sand and gravel underground operations.) (Source: MSHA [1999].)

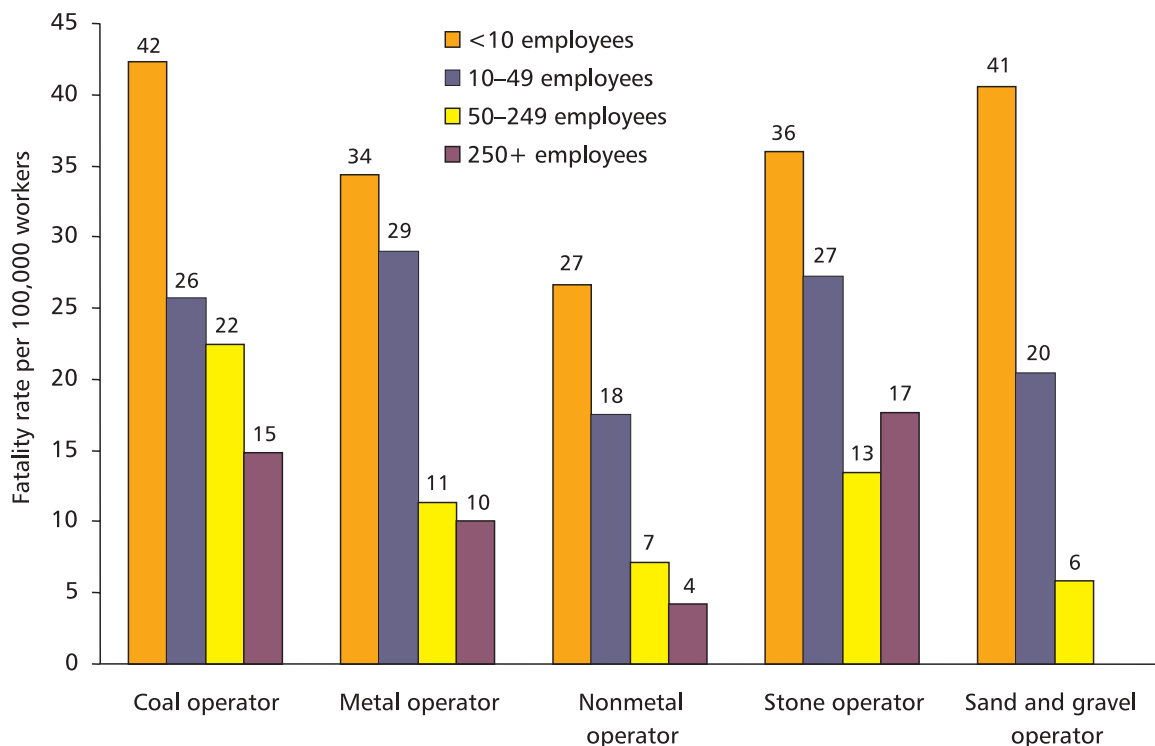


Figure 7. Fatality rates at surface mining operations, by commodity and employment size of operation, 1988–1997. Fatality rates are computed per 100,000 full-time workers or 200 million employee hours. (Source: MSHA [1999].)

Table 2. Number* and annual average rate† of fatalities associated with various types of employers and commodities by type of incident,‡ 1988–1997

Type of employer and commodity	Type of incident											
	All		Powered haulage		Fall of ground (from in place)		Machinery		Electrical		Slip or fall of person	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
All	993	31.9	306	9.8	188	6.0	162	5.2	80	2.6	60	1.9
Mine operator:												
Coal	432	37.9	101	8.9	135	11.8	76	6.7	33	2.9	9	0.8
Metal	98	21.6	30	6.6	18	4.0	6	1.3	11	2.4	8	1.8
Nonmetal	36	13.4	11	4.1	11	4.1	4	1.5	5	1.9	2	0.7
Stone	157	23.5	64	9.6	16	2.4	18	2.7	12	1.8	13	1.9
Sand and gravel	83	28.2	38	12.9	1	0.3	16	5.4	5	1.7	7	2.4
Independent contractor:												
Coal	75	59.1	34	26.8	2	1.6	10	7.9	8	6.3	8	6.3
Metal and nonmetal [§]	112	71.3	28	17.8	5	3.2	32	20.4	6	3.8	13	8.3

See footnotes at end of table.

(Continued)

Table 2 (Continued). Number* and annual average rate[†] of fatalities associated with various types of employers and commodities by type of incident,[‡] 1988–1997

Type of employer and commodity	Type of incident									
	Falling, rolling or sliding rock or material		Ignition/explosion of gas/dust		Explosives and breaking agents		Unknown or n.e.c.		Hand tools	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
All	57	1.8	35	1.1	31	1.0	27	0.9	15	0.5
Mine operator:										
Coal	13	1.1	28	2.5	12	1.1	9	0.8	6	0.5
Metal	13	2.9	1	0.2	4	0.9	1	0.2	0	0.0
Nonmetal	0	0.0	0	0.0	0	0.0	1	0.4	1	0.4
Stone	16	2.4	2	0.3	7	1.0	3	0.4	3	0.4
Sand and gravel	4	1.4	1	0.3	0	0.0	6	2.0	1	0.3
Independent contractor:										
Coal	4	3.2	3	2.4	2	1.6	2	1.6	1	0.8
Metal and nonmetal [§]	7	4.5	0	0.0	6	3.8	5	3.2	3	1.9

See footnotes at end of table.

(Continued)

Table 2 (Continued). Number* and annual average rate[†] of fatalities associated with various types of employers and commodities by type of incident,[‡] 1988–1997

Type of employer and commodity	Type of incident									
	Exploding vessels under pressure		Handling materials		Fire		Hoisting		Inundation	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
All	11	0.4	8	0.3	7	0.2	4	0.1	2	0.1
Mine operator:										
Coal	3	0.3	1	0.1	4	0.4	0	0.0	2	0.2
Metal	3	0.7	0	0.0	2	0.4	1	0.2	0	0.0
Nonmetal	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0
Stone	1	0.1	1	0.1	1	0.1	0	0.0	0	0.0
Sand and gravel	1	0.3	3	1.0	0	0.0	0	0.0	0	0.0
Independent contractor:										
Coal	0	0.0	0	0.0	0	0.0	1	0.8	0	0.0
Metal and nonmetal [§]	2	1.3	3	1.9	0	0.0	2	1.3	0	0.0

Source: MSHA [1999].

*Note: See Appendix for selection of fatalities.

[†]Computed per 100,000 full-time workers or 200 million employee hours.

[‡]MSHA's accident/injury/illness classification. See Appendix for modifications.

[§]Includes metal, nonmetal, stone, and sand and gravel.

Lost-Workday Injuries

Lost-workday injury rates decreased between 1988 and 1997 in all five commodities for mine operator workers and independent contractor workers in metal and non-metal mining (Figure 8). The lost-workday injury rates for independent contractor workers in coal follow a somewhat different trend, with a gradual increase from 1988 through 1992, then a slow decrease for the remainder of the period. Over the 10-year period, the highest lost-workday injury rate was observed in mine operator workers in coal (7.9 cases per 100 full-time workers), followed by mine operator workers in stone (4.7 cases per 100 full-time workers), sand and gravel (4.1 cases per 100 full-time workers), metal (3.9 cases per 100 full-time workers), and nonmetal mining (3.7 cases per 100 full-time workers). Among mine operator workers, the largest percentage of decrease in the lost-workday injury rate occurred in metal mining, dropping from a rate of 5.4 cases per 100 full-time workers in 1988 to 3.1 cases per 100 full-time workers in 1997 (a 43% decrease). Following metal mining, the decreases in lost-workday injury rates were as follows: coal (35%), nonmetal (31%), stone (30%), and

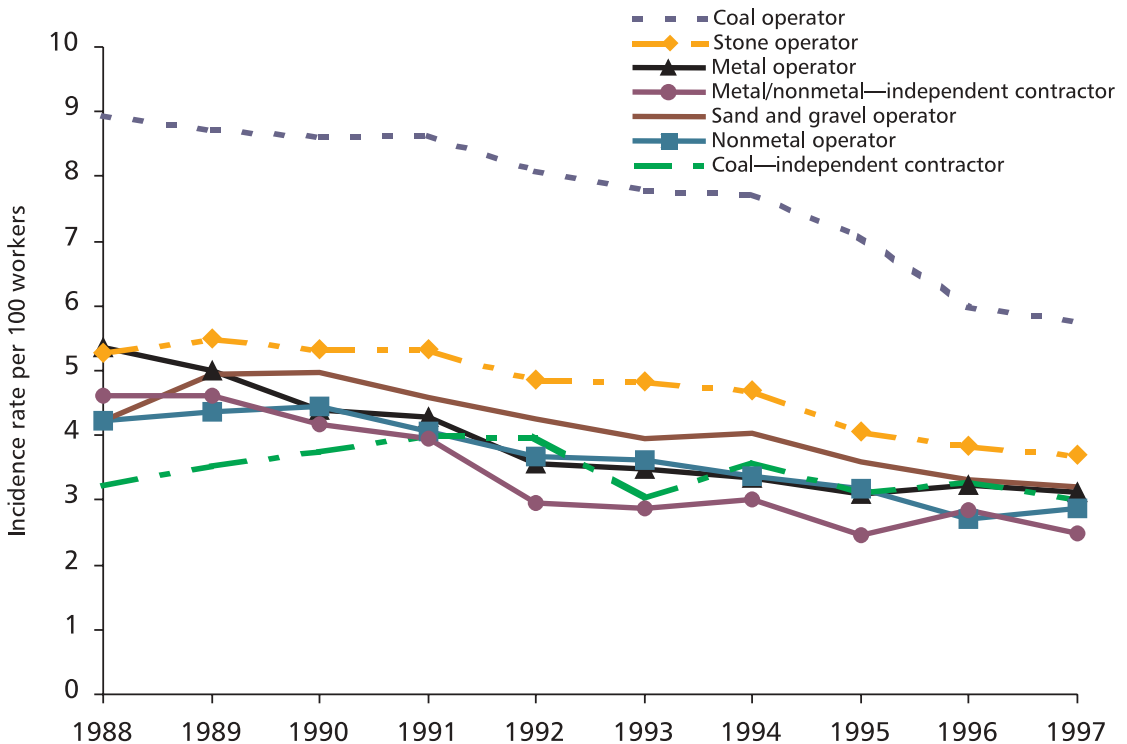


Figure 8. Incidence rates for lost-workday cases, by type of employer and commodity, 1988–1997. Incident rates are calculated per 100 full-time workers or 200,000 employee hours. Metal and nonmetal includes metal, nonmetal, stone, and sand and gravel. (Source: MSHA [1999].)

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sand and gravel mining (24%). A 46% decrease was observed for independent contractor workers in metal and nonmetal mining, and a 6% decrease was observed for independent contractor workers in coal mining.

The number and rate of lost-workday cases from 1988 to 1997 for various work locations are shown by type of employer and commodity in Table 3. Overall, underground work locations exhibited both the highest numbers and rates of lost-workday cases, whereas surface strip/open pit/quarry operations exhibited the lowest rates. Among mine operator workers, a combination of high numbers and rates of lost-workday cases are most conspicuous for workers in underground coal mines, stone surface mines (or quarries) and mills, and sand and gravel operations. Independent contractor workers accounted for less than 6% of all lost-workday cases but 19% of all fatalities (see Table 2).

The leading types of incidents associated with lost-workday cases (Table 4) are handling materials (34.4%), slip or fall of person (20.9%), powered haulage (10.9%), machinery (10.9%), and hand tools (9.5%). These incidents accounted for 86.6% of all cases between 1988 and 1997. Incidents involving handling materials accounted for more than one-third of all lost-workday cases, compared with fewer than 1% of the fatalities. Furthermore, these incidents account for 29.2% of the 6,840,987 lost workdays, followed by slip or fall of person (20.8%) and powered haulage (17.3%).

Sprains to the back region accounted for the largest proportion of lost workdays during the 10-year period (Figure 9). Sprains to the lower extremities (primarily the knee), amputations of the arms or hands (primarily the fingers), and fractures to the lower extremities also accounted for a substantial proportion of lost workdays.

Table 3. Number and annual average rate* of lost-workday cases associated with various types of employers and commodities by work location, 1988–1997

Type of employer and commodity	Work location													
	All		Underground mines				Surface mines							
			Underground		Surface areas		Strip/open pit/quarry		Dredge		Other surface operations [†]		Mills/plants	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
All	170,635	5.5	74,264	10.9	6,272	5.7	46,396	3.6	2,270	4.1	1,250	4.7	40,183	4.3
Mine operator:														
Coal	89,895	7.9	65,668	11.9	4,348	8.0	12,453	3.2	9	1.7	848	5.4	6,569	5.0
Metal	17,622	3.9	4,534	7.2	641	3.9	5,152	3.1	193	4.5	214	3.3	6,888	3.5
Nonmetal	9,855	3.7	1,528	4.4	308	5.0	1,623	2.7	31	5.6	NA [‡]	NA	6,365	3.8
Stone	31,642	4.7	748	4.7	270	6.9	13,426	4.8	66	5.6	82	3.3	17,050	4.7
Sand and gravel	12,059	4.1	NA	NA	NA	NA	10,106	4.1	1,953	4.2	NA	NA	NR [§]	NR
Independent contractor:														
Coal	4,363	3.4	1,367	12.1	499	2.2	1,385	2.2	2	1.0	96	4.9	1,014	3.8
Metal and nonmetal**	5,199	3.3	419	7.1	206	3.4	2,251	2.4	16	1.5	10	2.3	2,297	4.6

Source: MSHA [1999].

*Computed per 100 full-time workers or 200,000 employee hours.

[†]Includes culm banks, auger mining, independent shops and yards, and surface mining n.e.c.

[‡]NA=Not applicable for this commodity.

[§]NR=Not reported separately. Sand and gravel operators report mill employment under strip or dredge operations.

**Includes metal, nonmetal, stone, and sand and gravel.

Table 4. Number and annual average rate* of lost-workday cases and mean days lost associated with various types of employers and commodities by type of incident,[†] 1988–1997

Type of employer and commodity	Type of incident															
	All			Handling materials			Slip or fall of person			Powered haulage			Machinery			
	Number	Rate	MDL [‡]	Number	Rate	MDL	Number	Rate	MDL	Number	Rate	MDL	Number	Rate	MDL	
All	170,635	5.49	40.1	58,661	1.89	34.0	35,679	1.15	39.8	18,676	0.60	63.5	18,647	0.60	43.0	
Mine operator:																
Coal	89,895	7.89	41.7	31,072	2.73	39.0	16,337	1.43	42.5	10,859	0.95	57.7	9,078	0.80	39.2	
Metal	17,622	3.89	39.1	5,975	1.32	32.0	4,067	0.90	40.4	1,591	0.35	59.1	1,950	0.43	41.4	
Nonmetal	9,855	3.67	35.7	3,910	1.46	27.7	2,294	0.85	33.3	912	0.34	77.9	939	0.35	37.9	
Stone	31,642	4.74	33.6	11,108	1.66	26.3	7,588	1.14	33.1	2,825	0.42	63.4	3,752	0.56	36.1	
Sand and gravel	12,059	4.10	39.9	3,760	1.28	23.7	3,077	1.05	34.6	1,512	0.51	90.7	1,334	0.45	60.6	
Independent contractor:																
Coal	4,363	3.44	49.6	1,238	0.98	44.4	1,054	0.83	57.0	515	0.41	51.2	696	0.55	52.3	
Metal and nonmetal [§]	5,199	3.31	55.8	1,598	1.02	30.3	1,262	0.80	54.6	462	0.29	113.2	898	0.57	85.2	

See footnotes at end of table.

(Continued)

Table 4 (Continued). Number and annual average rate* of lost-workday cases and mean days lost associated with various types of employers and commodities by type of incident,[†] 1988–1997

Type of employer and commodity	Type of incident															
	Hand tools			Fall of ground (from in place)			Stepping or kneeling on object			Unknown or n.e.c.			Electrical			
	Number	Rate	MDL [‡]	Number	Rate	MDL	Number	Rate	MDL	Number	Rate	MDL	Number	Rate	MDL	
All	16,134	0.52	28.7	10,522	0.34	45.0	3,446	0.11	25.7	3,203	0.10	38.8	1,571	0.05	53.4	
Mine operator:																
Coal	6,905	0.61	28.9	9,142	0.80	44.5	1,919	0.17	29.8	1,477	0.13	48.3	916	0.08	43.4	
Metal	1,835	0.40	33.6	806	0.18	43.9	404	0.09	21.7	403	0.09	37.5	92	0.02	46.2	
Nonmetal	931	0.35	26.4	166	0.06	45.5	178	0.07	20.7	234	0.09	49.7	74	0.03	23.2	
Stone	4,039	0.60	26.5	123	0.02	79.9	589	0.09	19.7	664	0.10	25.8	251	0.04	46.4	
Sand and gravel	1,554	0.53	26.4	6	0.00	41.5	193	0.07	18.5	256	0.09	22.6	135	0.05	64.2	
Independent contractor:																
Coal	366	0.29	30.0	206	0.16	52.1	66	0.05	23.7	61	0.05	25.3	33	0.03	251.4	
Metal and nonmetal [§]	504	0.32	35.2	73	0.05	45.4	97	0.06	21.1	108	0.07	15.8	70	0.04	136.1	

See footnotes at end of table.

(Continued)

Table 4 (Continued). Number and annual average rate* of lost-workday cases and mean days lost associated with various types of employers and commodities by type of incident,[†] 1988–1997

Type of employer and commodity	Type of incident															
	Striking or bumping			Nonpowered haulage			Exploding vessels under pressure			Fire			Falling, rolling, or sliding rock or material			
	Number	Rate	MDL [‡]	Number	Rate	MDL	Number	Rate	MDL	Number	Rate	MDL	Number	Rate	MDL	
All	1,504	0.05	32.8	722	0.02	44.0	398	0.01	43.6	388	0.01	33.1	363	0.01	86.6	
Mine operator:																
Coal	1,130	0.10	35.3	308	0.03	57.5	181	0.02	27.0	144	0.01	27.0	154	0.01	80.1	
Metal	91	0.02	28.7	126	0.03	38.1	53	0.01	36.0	39	0.01	29.5	46	0.01	32.7	
Nonmetal	55	0.02	14.0	46	0.02	36.2	22	0.01	233.1	24	0.01	28.2	22	0.01	35.8	
Stone	139	0.02	26.6	170	0.03	37.5	81	0.01	27.1	100	0.01	49.6	75	0.01	190.1	
Sand and gravel	57	0.02	30.4	38	0.01	12.7	34	0.01	79.4	42	0.01	18.1	36	0.01	42.2	
Independent contractor:																
Coal	18	0.01	27.4	12	0.01	26.7	14	0.01	10.3	24	0.02	28.2	9	0.01	33.9	
Metal and nonmetal [§]	14	0.01	4.6	22	0.01	20.3	13	0.01	29.4	15	0.01	49.4	21	0.01	34.9	

See footnotes at end of table.

(Continued)

Table 4 (Continued). Number and annual average rate* of lost-workday cases and mean days lost associated with various types of employers and commodities by type of incident,[†] 1988–1997

Type of employer and commodity	Type of incident															
	Ignition/explosion of gas/dust			Explosives and breaking agents			Hoisting			Entrapment			Inundation			
	Number	Rate	MDL [‡]	Number	Rate	MDL	Number	Rate	MDL	Number	Rate	MDL	Number	Rate	MDL	
All	307	0.01	45.3	219	0.01	139.1	160	0.01	99.5	23	0.00	46.9	12	0.00	114.7	
Mine operator:																
Coal	131	0.01	45.3	101	0.01	25.6	33	0.00	64.2	4	0.00	115.0	4	0.00	72.0	
Metal	34	0.01	22.4	48	0.01	349.6	55	0.01	54.6	3	0.00	32.0	4	0.00	228.3	
Nonmetal	21	0.01	36.2	4	0.00	151.5	20	0.01	63.1	1	0.00	15.0	2	0.00	7.0	
Stone	67	0.01	59.5	44	0.01	97.7	17	0.00	436.4	8	0.00	42.9	2	0.00	80.5	
Sand and gravel	18	0.01	23.6	2	0.00	1.5	3	0.00	35.3	2	0.00	5.5	0	0.00	0.0	
Independent contractor:																
Coal	22	0.02	53.5	12	0.01	102.9	16	0.01	55.7	1	0.00	58.0	0	0.00	0.0	
Metal and nonmetal [§]	14	0.01	60.8	8	0.01	620.8	16	0.01	70.1	4	0.00	23.8	0	0.00	0.0	

Source: MSHA [1999].

*Computed per 100 full-time workers or 200,000 employee hours.

[†]MSHA's accident/injury/illness classification. See Appendix for modifications.

[‡]MDL=mean days lost. MDL is average number of days lost (including restricted workdays) per lost-workday case.

[§]Includes metal, nonmetal, stone, and sand and gravel.

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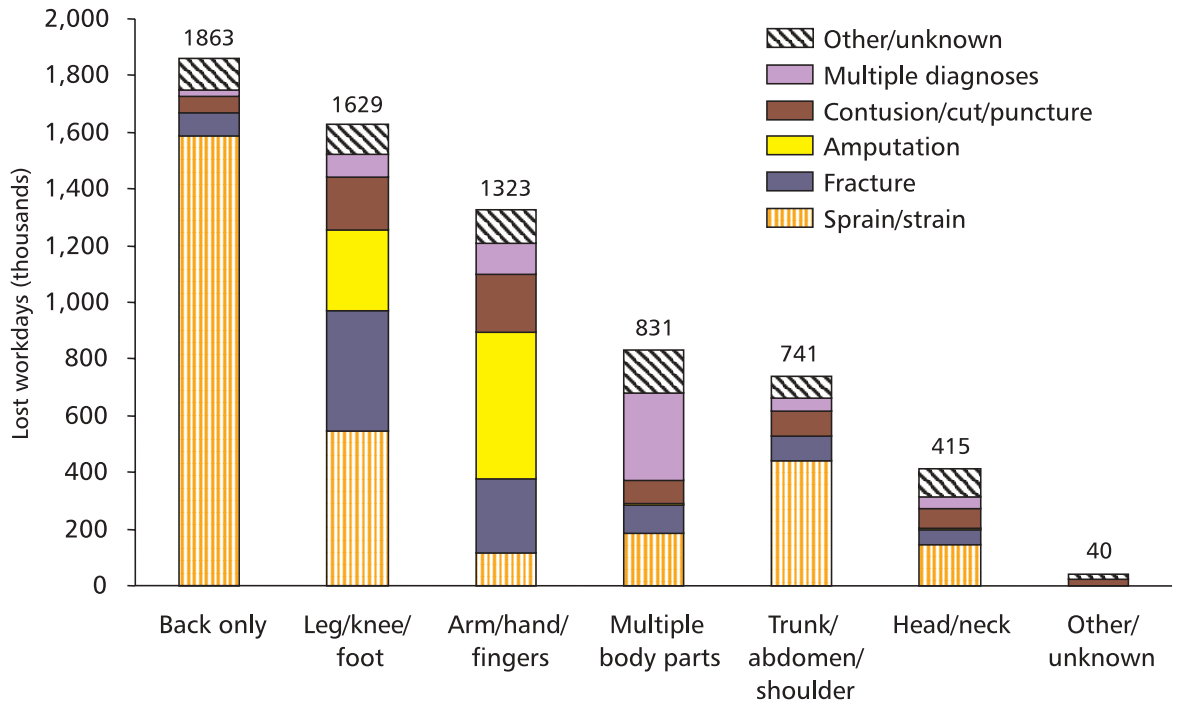


Figure 9. Lost workdays in mining, by part of body affected and nature of injury, 1988–1997. (Source: MSHA [1999].)

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APPENDIX

MINING INJURY AND EMPLOYMENT STATISTICS

Data were obtained from the Mine Safety and Health Administration (MSHA) databases of reported employment and reported cases of accident/injury/illness for mine operators as well as independent contractors working on mine property as required under 30 CFR[†] Part 50 [MSHA 1999]. The historical data (presented in Figure 1 for the period 1911–1995) were derived from several different sources [MSHA 1999; Adams and Wrenn 1941; Adams and Kolhos 1941; Reese et al. 1955; MSHA 1984].

According to 30 CFR Part 50, mine operators and independent contractors whose employees perform certain types of work on mine property are required to file a *Mine Accident, Injury, and Illness Report (Form 7000-1)* [30 CFR 50.20; MSHA 2000a] for reportable incidents within 10 working days after the accident or injury, or 10 working days following the illness diagnosis. The term “reportable injury” as defined by MSHA includes all incidents that require medical treatment or result in death, loss of consciousness, inability to perform all job duties, or temporary assignment or transfer to another job. Injuries involving “first-aid only” are not reportable. (First-aid only is defined as one-time treatment and subsequent observation of minor scratches, cuts, burns, splinters, etc. that do not ordinarily require medical care, even if it was provided by a physician or a registered health care professional.) Information reported on MSHA Form 7000-1 includes demographics of the injured or ill worker such as age, sex, years of total mining experience, years of experience at current mine, where the incident occurred (i.e., underground, surface, plant/mill), days away from work, days of restricted work activity, source of the injury, body part(s) injured, and a narrative description of the incident.

Also, under 30 CFR Part 50, mine operators and independent contractors whose employees perform certain types of work on mine property are required to file a *Quarterly Mine Employment and Coal Production Report (MSHA Form 7000-2)*

[†]Code of Federal Regulations. See CFR in references.

[30 CFR 50.30; MSHA 2000b] within 15 days after the end of each calendar quarter. This information is reported in the address and employment files and includes the address and other contact information, production of clean coal tonnage, average number of persons employed during the reporting period, and the corresponding number of hours worked for each type of operation (designated by MSHA as operational subunits that include underground operations, strip operations, plants or mills, etc.).

Commodity Differences for Type of Employer (Mining Operators versus Independent Contractors)

The five commodity groups of coal (anthracite and bituminous), metal, nonmetallic minerals (nonmetal[‡]), stone, and sand and gravel are based on a modification of the six ‘canvass classes’ designated by MSHA for mine operators. The only modification combines anthracite coal and bituminous coal into coal. Because independent contractors may work at multiple mining operations associated with a diversity of commodities, a ‘canvass class’ is not designated for independent contractors. Rather, independent contractors report employment under two aggregates: (1) all coal locations, and (2) all metal, nonmetal, stone, and sand and gravel locations. As a result of these reporting differences, fatality and injury rates for independent contractors can only be computed for coal and metal/nonmetal locations. However, within these two aggregates, independent contractors report employment separately for each type of operation (designated by MSHA as operational subunits that include underground operations, strip operations, plants or mills, etc.). Consequently, fatality and injury rates can be computed for both mine operators and independent contractors by type of operation.

Injury Data Inclusion Criteria

For the period 1988 to 1997, only cases that were coded as a degree injury 1–6 were included. This excludes reportable incidents not associated with an injury (degree injury 0), illnesses (degree injury 7), and nonoccupational injuries and illnesses that are maintained in the MSHA files because they occurred on mine property. Of those cases coded degree injury 1–6, office workers were excluded from analyses by excluding both employee hours and injuries reported for office locations (MSHA subunit code = 99).

[‡]Depending on the context, the term ‘nonmetal’ may refer to either (1) the class of nonmetallic mineral that includes clays, salt, phosphates, etc. or (2) nonmetallic minerals, stone, and sand and gravel. In the current context, the first definition applies.

Selection Criteria for Fatalities

The number of fatalities used for the analyses varies from the number of fatalities reported in the MSHA accident/injury/illness databases as follows:

1. Seventeen fatalities attributed to and associated with a contractor code of “ZZZ” were excluded from all analyses. Although these fatalities occurred on mine property, the victims were not employees of either an independent contractor or mine operator. Rather, these victims were on mine property for other reasons (e.g., visitors, customers) when they were fatally injured.
2. Three fatalities attributed to mine operators were excluded from all analyses. Although fatally injured on mine property, the victims were nonemployees and minors (aged 5, 15, and 16).
3. Four additional fatalities were included in all analyses, two for independent contractors and two for mine operators per subsequent MSHA errata file. Two of these fatalities were originally reported in the database as nonfatal injuries.
4. One independent contractor fatality was excluded as not having occurred on mine property per subsequent MSHA errata file.

Selection Criteria for Lost-Workday Cases

Lost-workday cases include only those cases that resulted in total or partial permanent disabilities, days away from work, or days of restricted work activity (MSHA degree of injury codes 2 through 5). The number of lost workdays were computed by summing the days away from work and days of restricted work activity, with one exception. For injuries resulting in total or partial permanent disabilities, lost workdays were the statutory days charged to the incident [MSHA 1998] whenever the statutory days exceeded the lost workdays reported or when lost workdays were unreported.

Calculation of Injury Rates

Injury rates for the period 1988–1997 were computed using employment estimates derived from total hours worked. Full-time workers were calculated by dividing total hours by 2,000 hours/worker. Nonfatal injury rates were constructed per 100 full-time workers, and fatal injury rates per 100,000 full-time workers. Of note, MSHA publishes both fatal and nonfatal injury rates on the basis of 200,000 hours worked, which is equivalent to 100 full-time workers. Fatality rates for the historical data (Figure 1) were computed using average numbers of workers, because of the lack of exposure hours during the first few decades of this century.

Determining the Type of Incident Associated with the Injury

MSHA's accident/injury/illness classification scheme was used to establish the type of incident associated with a fatality or nonfatal injury [MSHA 1998]. The type of incident is identical to MSHA's accident/injury/illness with two exceptions:

1. Both fatal and nonfatal cases classified as a *fall of highwall or rib* (accident/injury/illness code = 06) or as a *fall of roof or back* (accident/injury/illness code = 07) are reported under the type of incident *fall of ground*.
2. Nonfatal injury cases occurring underground and classified under *machinery* (accident/injury/illness = 17) were reclassified as a *fall of ground* if the source of the injury was *caving rock, ore, etc.* (MSHA source of injury code = 90). This reclassification is consistent with the way in which MSHA classifies similar incidents that resulted in a fatal injury. Typically, the victim is operating a roof bolter or continuous miner and is struck by caving rock from the mine roof or rib.

MSHA Data Compared with Other Surveillance Systems

The mining data presented in this report may differ from mining industry data for the same period using the National Traumatic Occupational Fatalities Surveillance System (NTOF) and the Census of Fatal Occupational Injuries (CFOI) surveillance system. Both NTOF and CFOI use the 1987 Standard Industrial Classification (SIC) Manual [OMB 1987] to categorize fatal injuries by industry. The SIC scheme includes oil and gas extraction in the mining industry. MSHA excludes oil and gas extraction, as regulatory authority is delegated to OSHA. In addition, MSHA data include only incidents that occur on mine property. Therefore, an injury occurring during the course of work, but off mine property, is excluded from the MSHA file. NTOF and CFOI systems would capture this type of injury.

For more information please see *Injuries, Illnesses, and Hazardous Exposures in the Mining Industry, 1986–1995: A Surveillance Report* [NIOSH 2000]. The report summarizes available data on work-related fatal and nonfatal injuries in the mining industry for the 10-year period 1986–1995.

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