

A deeper look at contractor injuries in underground coal mines

by D. Pappas and C. Mark

Abstract Over the past decade, the number of contractors working in underground coal mines has nearly doubled; however, the effect this has had on the industry's injury rates has been the subject of much speculation. The confusion exists because the U.S. Mine Safety and Health Administration (MSHA) database does not assign contractor hours to the individual mining operations where they worked. To better understand the safety record of the contractor segment of the industry, the National Institute for Occupational Safety and Health (NIOSH) undertook a comprehensive analysis of the data contained in the MSHA database. The first part of the study compared overall contractor and operator trends from 1983 to 2009 related to employment, hours worked and injury rate. One unexpected finding was that the larger contractors tended to have higher injury rates than the smaller ones. The second part of the study directly addressed the role of contractors on the safety record of 10 large underground coal mines. A detailed analysis provided both injuries and estimated contractor hours worked at these mines for the period 1992–2007. Comparison between the estimated contractor injury rates and the reported operator injury rates at these mines indicated that the contractor injury rates were significantly higher at most of the operations studied. However, the industry-wide data indicates that contractor and operator injury rates have converged since 2005 and are now equivalent.

Introduction

Over the past 27 years, the number of contractor workers in underground coal mines has increased nearly six-fold. In 1983, there were 763 underground contractor workers, compared to 5,347 in 2009. This dramatic increase in the contractor workforce has magnified the problem of interpreting contrac-

tor injury rates and trends and has also magnified problems with recording procedures. In 1983, the U.S. Mine Safety and Health Administration (MSHA) started to compile records of contractor injuries, hours worked and production data separately from mine operator data. While the contractor data can provide a valuable insight into this large, growing sector of the mining industry, they are seldom subjected to the same level of scrutiny as the mine operator data. Moreover, while MSHA does collect contractor hours worked, it does not apportion those hours to individual mine sites, which makes it difficult to directly determine contractor injury rates at individual mines. As a result, the published incident rates and productivity statistics for individual operator mines may be misleading, because they do not include contractor hours worked.

The safety record of the contractor segment of the industry has been

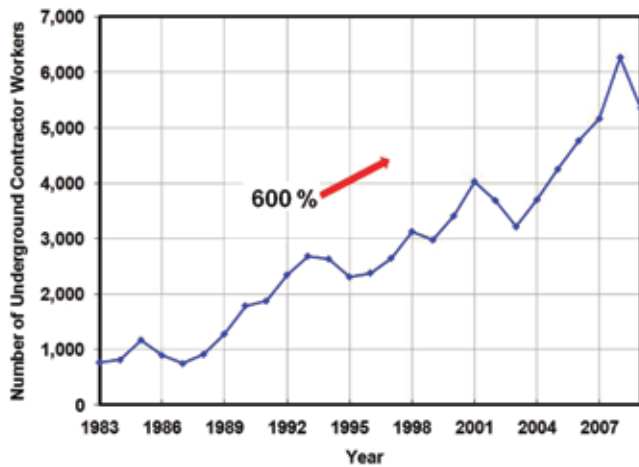
a concern for some time. In 2001, after 13 coal miners died in separate West Virginia mine incidents, Gov. Bob Wise asked David McAteer, the Assistant Secretary for Mine Safety and Health at the U.S. Department of Labor during the Clinton administration, to prepare a report on mine safety and health in West Virginia. McAteer's report found that 30% of the state's fatalities in 2001 were contractor employees. According to McAteer, "because neither mine operators nor independent contractors keep records of the amount of coal the contract employees produce, the accident rates per tons produced at companies where a substantial number of contractors are employed is hopelessly skewed," and "since 30% of the accidents in southern West Virginia are contractor employees, new methods of addressing this problem need to be devised."

At about this same time (Sept. 18, 2001), a methane explosion occurred

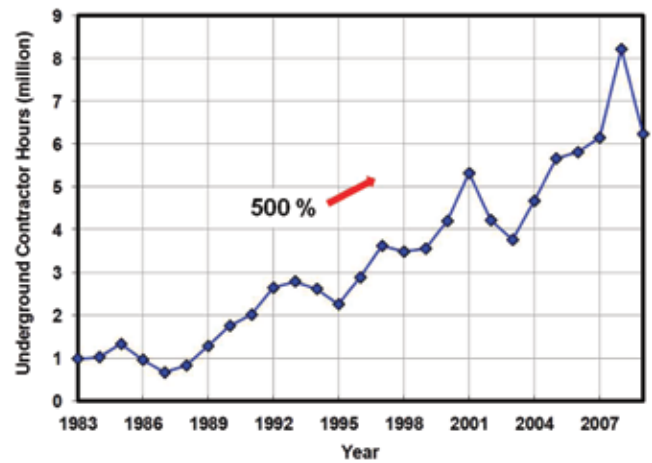
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Figure 1

Trend in underground contractor employment (MSHA, 1983-2009).

**Figure 2**

Trend in underground contractor hours (MSHA, 1983-2009).



at an Alabama mine, resulting in the deaths of 13 miners. Although the media's attention to this tragic incident was diverted by the catastrophic Sept. 11 terrorist attacks, the *Chicago Tribune* did provide an in-depth exposé on coal mine safety. This article recognized that "growing numbers of coal companies hire contractors to supply and supervise miners, insulating themselves from the cost of worker accidents and deaths. The rate of contractor injuries underground rose 20% over the decade since 1992 and comprised a growing share of all underground injuries. But MSHA does not collect key injury data about contractors, the *Tribune* found. The agency does not gather records showing the number of hours contract miners work at each mine, making it impossible to identify "dangerous operations" (Jackson and Dougherty, 2002). However, this issue may be addressed with the proposed Robert Byrd Mine and Workplace Safety and Health Act of 2011, which states, "operators shall be responsible for reporting on all miners working at such mines regardless of their employer, except that independent contractors shall only be responsible for reporting on miners in their employ or under their direction or authority" (Rockefeller, 2010).

Both of the pivotal reports cited above asked questions concerning the effects of contractor injury rates on the coal mining industry, and both have yet to be methodically answered. This paper addresses these questions with a two-pronged approach. First, it presents a thorough, updated analysis of the descriptive data associated with operator and contractor production and injury rate trends using the MSHA database. Second, a method has been developed that allows for reasonably accurate estimates of the contractor hours worked at individual large mines. Hopefully, this study will provide some clarity to the past and current effects contractor injuries have on the U.S. underground coal industry.

Who are the contractors?

Workers in underground coal mines can be categorized into two groupings, those that work for mine operators and those that work for contractors. Operators currently employ 89% of the nation's underground coal workforce and perform most of the tasks needed in coal removal. Contractors compose most of the remaining portion of the workforce. According to MSHA 30CFR 45.2 (1996), contractors are defined as any person, partnership, corporation, subsidiary

of a corporation, firm association or other organization that contracts to perform services or construction at a mine. Typically, this includes specialty tasks such as performing complex equipment repairs, injecting roof sealant materials, sinking shafts, rehabilitating high roof fall areas, drilling and installing overcasts, conveyor belts, etc. Mining companies often evaluate workers while they are employed by contractors prior to offering them permanent employment. In a few circumstances, the whole mining operation is contracted to an outside company who manages all facets of the underground mining operation. These comprehensive contractor-managed mines have coal tonnage assigned to them in the MSHA database. For definition purposes, these operations will be referred to as contractor-operated mines. Because contract work is growing in mining and contractors often do not report individual mine production statistics to MSHA, tracking contractor workers' injuries is becoming more difficult. Now that contractors make up over 11% of the underground coal workforce, excluding these injuries dilutes the accuracy of the operator injury statistics.

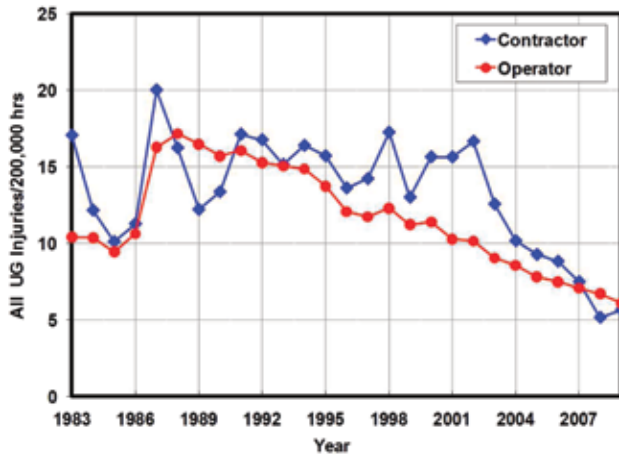
Trends in contractor statistics

The descriptive data for the contractor segment of the industry were obtained from the MSHA accident injury and employment databases (MSHA, 2010). This study examined the closeout data for 1983-2009 for all underground bituminous coal mine injuries resulting in death, a permanent disability, days away from work only, days away from work with restricted work activity, days of restricted activity only or injuries with no lost workdays or restricted activity (degree of injury: 1-6). Injury rates were computed by calculating the number of injuries for every 200,000 hours worked underground; this number was selected because 100 full-time miners work approximately 200,000 hours per year. Since contractor records were first compiled, the number of underground coal contractor workers has increased six-fold (Fig. 1), and a very similar trend was found with the number of hours worked (Fig. 2). It is important to note that while contractors represent 11% of all underground coal workers, contractor hours were only 6% of all underground hours worked in 2009.

A 27-year overview of contractor injury rates shows that the contractor injury rate initially fluctuated, but stabilized

Figure 3

Injury rate comparison (MSHA, 1983-2009).



around the operator injury rate. From about 1997 to 2003, the contractor injury rate was significantly higher than the operator rate (Fig. 3). In some of these years, the contractor injury rate exceeded the operator injury rate by more than 35%. Several factors may have contributed to their high injury rates. During this period, an older generation of miners was retiring, resulting in a new workforce of young and inexperienced miners. Many of these new workers first entered as contract workers.

Management practices may also have been changing due to the coal boom of 2001. After 20 lean years, the spot market for coal surged to \$50 per ton, and suddenly there was a big demand for coal and coal miners (Abramson, 2001). Along with the generational change, the size of the workforce was increasing due to the greater demand for coal. Mining companies may have used more contractors to fill in the gaps in their workforce to keep up with production demands.¹ Finally, contractor-operated mine injuries peaked during this time period.

Since about 2004, however, the contractor injury rates have converged with the operator injury rates and, by 2008, they were actually lower than the operator rates. Figures 4-6 provide insight into the age and experience of the injury victims. While the demographics (age and experience) of the entire contractor and operator workforce are not known, the data present some interesting comparative trends. The mean age of the victims has been fairly constant for the past 20 years: around 40 years of age for the operators and 35 years for the contractors (Fig. 4). However, the mean total mining experience of the operator victims peaked in 2000 at 17 years of experience and has been dropping every year to 11 years of experience in 2009 (Fig. 5). The mean total mining experience of the contractor victims peaked in 1997 at 11 years of experience and dropped to four years of experience in 2008 (Fig. 5). Perhaps this is an indication of the changing workforce in underground mines, as the older generation of miners retires and is replaced by a younger one. This seems to be especially the case for contractor miners, who seem to be hired at younger ages than the operator miners and

¹These injury rate differences could also be associated with the possibility that contractors and operators may be performing diverse tasks with different intrinsic levels of hazard exposure.

Figure 4

Comparison of mean victims' age (MSHA, 1983-2009).

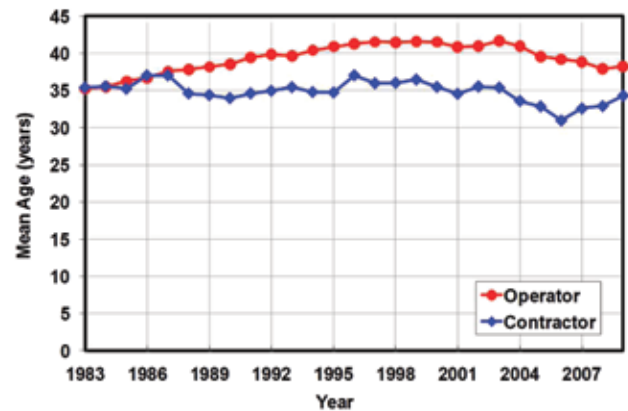


Figure 5

Comparison of mean total mining experience of victim (MSHA, 1983-2009).

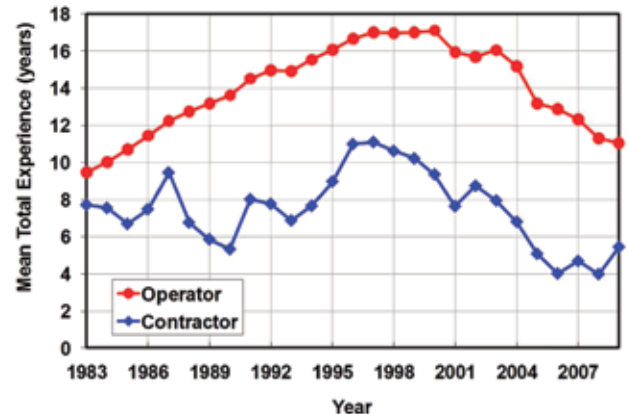


Figure 6

Comparison of mean mining experience of victim at the mine where the incident occurred (MSHA, 1983-2009).

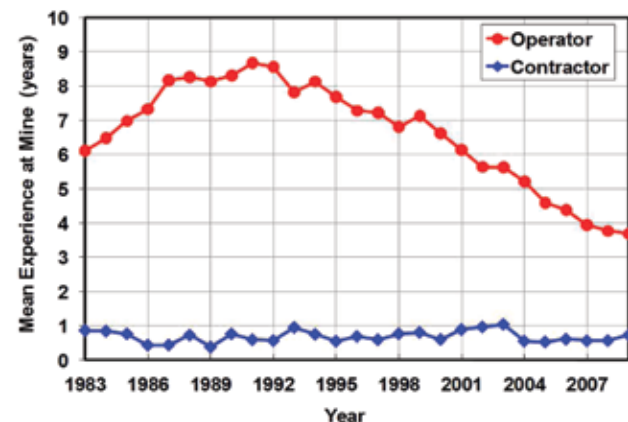


Figure 7

Injury rate by contractor size (MSHA, NIOSH, 1992-2009).
 Note: The “very small contractors” and “contractor-operated mines” groupings are not shown due to the large annual fluctuations in their injury rates.

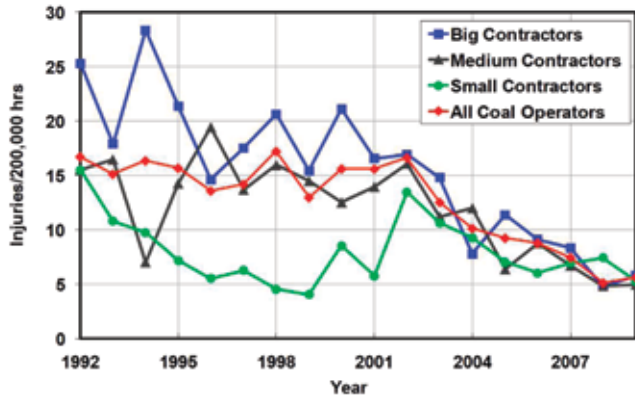


Figure 8

Comparison of contractor injuries and hours worked based on contractor’s size (MSHA, NIOSH, 1992-2009).

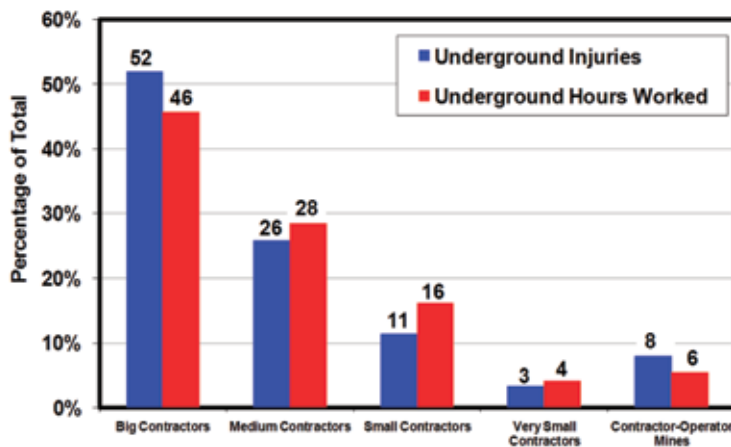
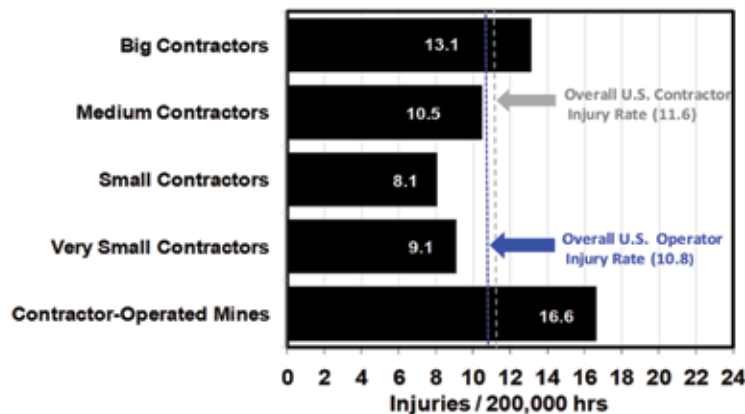


Figure 9

Comparison of contractor injury rates based on contractor size (MSHA, NIOSH, 1992-2009).



hired with less mining experience. Figure 6 shows the mean mining experience of the victims at the mine where the incident occurred. For the operator workforce, the mean experience at the mine peaked at 8.5 years in 1991, dropping to four years by 2007. For contractor miners, the consistent average for the past 27 years has been less than one year of experience at the mines where the incident occurred.

The MSHA data can also be used to evaluate different subgroups within the contractor segment of the industry. For this analysis, the contractors were grouped into four sizes based on cumulative hours worked (1992-2009):²

- big contractors, with more than 1 million hours worked,
- medium-sized contractors, with 200,000 to 1 million hours worked,
- small contractors, with 20,000 to 200,000 hours worked and
- very small contractors, with less than 20,000 hours worked.

An overall grouping of all operator coal mines is listed for comparison purposes.

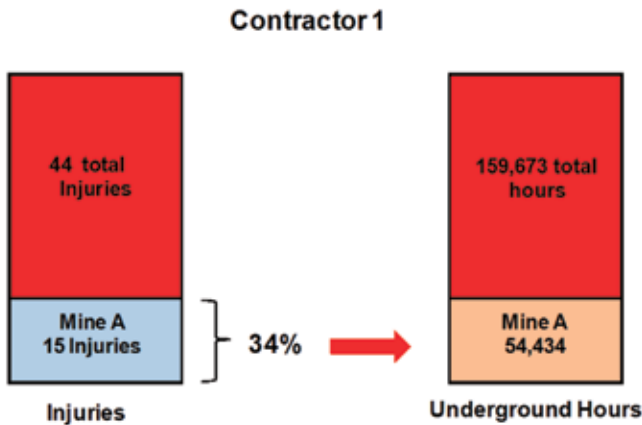
For these five groupings, the number of injuries and hours were compiled and actual injury rates were calculated. Figure 7 shows that the large contractor grouping, which includes almost half of all contractor hours, has had consistently — often significantly — higher injury rates than traditional coal operators. However, within the past five years, all four contractor rate groupings have converged with operator injury rates (which was the case for the overall contractor injury rates shown in Fig. 3).

A comparison of the percentage of injuries and hours worked among the four groupings for the period 1992-2009 reveals that big contractors had 52% of the injuries but account for only 46% of the hours worked (Fig. 8). The injury rate for the big contractor group exceeded the overall contractor injury rate by 13% and the operator injury rate by 21% (Fig. 9). Most importantly, contractor-operated mines had at least 40% higher injury rates than the overall injury rates for the U.S. These contractor-operated mines represent only

²The period 1992-2009 was chosen in order to focus on the years that contractor injuries became more commonplace and the injury rates were not so volatile (due to the low numbers in the 1980s).

Figure 10

Estimating contractor underground hours for Contractor 1 at Mine A. Each full bar represents Contractor 1 injuries or hours at all mines worked.



6% of all contractor hours, so the small number of workers involved may explain the volatility of the injury rate from year to year. The number of contractor-operator mines appears to be on the decline. All other contractor groupings had injury rates below the overall contractor injury rate.

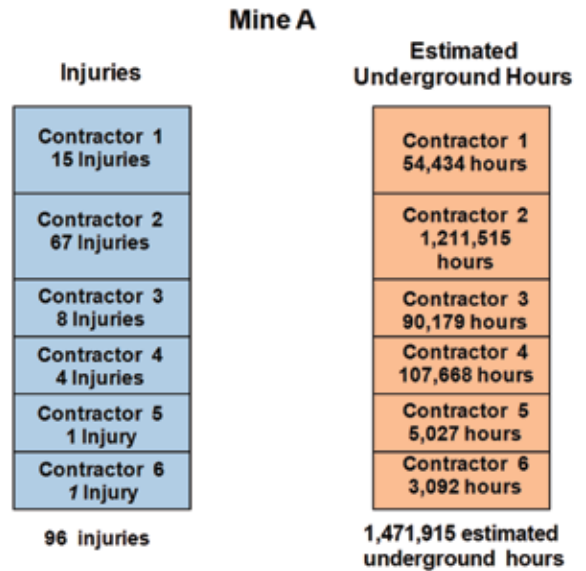
Estimated contractor statistics

The next phase of the study focused on the largest contractors and the mines where they worked. As discussed previously, contractor injury rates for individual mines cannot be determined directly, because contractor hours are not apportioned to the individual mines. To obtain indirect estimates of contractor hours worked at individual mines, a method was developed that uses the mine-specific injury data. The key assumption is that for an individual contractor, the percentage of their total reported injuries at a particular mine is proportional to the percentage of their total reported hours spent at that same mine. Figures 10 and 11 illustrate the method using real data. Figure 10 shows that during the period 1992-2007, Contractor 1 had 44 total injuries, 15 of which occurred at Mine A. Therefore, the ratio of injuries occurring at Mine A for Contractor 1 is 15 out of 44, or 34%. Contractor 1 also reported a total of 159,673 hours worked during the period. Therefore, we assume that 34% of these hours, or 54,434 hours, were worked by Contractor 1 at Mine A. This process is repeated for each of the other five large contractors that worked at Mine A, and the total hours are summed to provide the estimated total contractor hours worked (Fig. 11) at Mine A. Dividing the total contractor injuries at Mine A by the estimated total contractor hours worked provides an estimated contractor injury rate for Mine A (Fig. 11). This process was duplicated for the other nine largest mines that had at least 40 contractor injuries and more than 1,000,000 total hours worked per contractor for the years 1992-2007.³

Table 1 shows that at five of the 10 mines with a large contractor presence, the estimated contractor injury rates

Figure 11

Estimating contractor injury rate for Mine A.



$$\text{Injury Rate} = \frac{96 \text{ injuries} \times 200,000 \text{ hrs}}{1,471,915 \text{ hrs}} = 13.0$$

exceeded the operator injury rate by a factor of two or more. At three of the 10 mines, when the estimated contractor rate is combined with the operator rate (Table 1, last column), the combined overall injury rates increase by more than 15%. However, this analysis used 16 years of data and included the period when contractor injury rates were significantly higher than operator rates industry-wide. Since industry-wide contractor injury rates are now very similar to operator rates, it is likely that the current discrepancies at individual mines are also much smaller.

Conclusions

When contractor injuries were first included in the MSHA database in 1983, their impact on industry statistics might have been overlooked as negligible due to their small numbers. As the number of contractors working in underground coal mines has increased, their safety record has become a significant part of the overall industry statistics. To investigate contractor injuries, a full review of contractor and operator production data, injuries, rates and injury demographics were compiled and compared. A brief summary of this evaluation shows the following for underground bituminous coal mining in the United States:

³ It should be noted that with this method, if a contractor works at a given mine for a period of time but does not report any injuries, the presence of that contractor at that mine is not known and the contractor hours worked at that mine will be underestimated. In general, however, the larger the mine, the larger the contractor and, the larger the time period being studied, the more accurate the estimate should be.

Table 1

Estimated contractor injury rates for 10 largest mines (MSHA, NIOSH, 1992-2007).

Mine name	No. contractors	No. operator injuries	No. contractor injuries	All injuries associated with contractor	Pct contractor injuries at this mine	Estimated contractor hours worked	Operator hours
Mine A	6	370	96	543	17.7	1,471,915	16,201,205
Mine B	8	215	70	612	11.4	1,384,242	12,337,135
Mine C	8	252	57	908	6.3	598,890	5,616,096
Mine D	13	184	88	438	20.1	1,792,754	7,909,681
Mine E	4	1,242	56	323	17.3	383,300	17,359,392
Mine F	2	1,189	47	493	9.5	333,630	13,326,313
Mine G	10	474	104	731	14.2	2,331,752	15,888,633
Mine H	8	250	82	1,162	7.1	949,785	3,373,598
Mine I	13	220	54	932	5.8	846,741	3,868,079
Mine J	6	1,423	44	270	16.3	2,637,419	18,988,067
All UG coal mines	1,703	76,808	4,122	4,122	100.0	63,599,990	1,351,471,594

Mine name	Contractor injury rate (injuries/200 khrs)	Operator injury rate (injuries/200 khrs)	Ratio contractor rate/operator rate	Estimated total injury rate (injuries/200 khrs)	Ratio-estimated total injury rate/operator injury rate ¹
Mine A	13.0	4.6	2.86	5.3	1.15
Mine B	10.1	3.5	2.90	4.2	1.19
Mine C	19.0	9.0	2.12	9.9	1.11
Mine D	9.8	4.7	2.11	5.6	1.21
Mine E	29.2	14.3	2.04	14.6	1.02
Mine F	28.2	17.8	1.58	18.1	1.01
Mine G	8.9	6.0	1.50	6.3	1.06
Mine H	17.3	14.8	1.17	15.4	1.04
Mine I	12.8	11.4	1.12	11.6	1.02
Mine J	3.3	15.0	0.22	13.6	0.91
All UG coal mines	13.0	11.37	1.14	11.4	1.01

¹ This ratio indicates the proportion that the overall total injury rate (includes operator and estimated contractor rate) is underreported when compared to the operator injury rate.

- In 2009, contractors represented about 11% of the underground workforce, 6% of the hours and 6% of the injuries.
- The current average age of contractor injury victims is about four years younger than that of the operator injury victims.
- The current average total mining experience of contractor injury victims is about six years less than that of the operator injury victims.
- The current average mining experience at the mine where the incident occurred is less than one year for contractors and four years for operator victims.
- Contractor injury rates peaked in 2000-2003, when they were more than 35% higher than operator injury rates.
- Big contractors had higher injury rates than small

contractors, though in the past six years these rates have also converged.

- Peak contractor injury rates seem to coincide with the years when the contractor-operated mines had high injury rates.
- A unique approach to estimate contractor hours worked at 10 mine sites with a large contractor presence was developed for the years 1992-2007. Five of these 10 mines had estimated contractor injury rates that exceeded the operator injury rate by a factor of two. Three of these 10 mines had a combined estimated contractor and operator injury rates that exceeded the actual operator injury rate by more than 15%.

Based on the five most recent years of data, it appears that contractor injury rates are now very similar to operator injury rates, and the alarmingly high rates of the 2000-2003 period have significantly improved. The causes of the poor safety record compiled by contractors in the early years of the last decade may have been related to the drastic employment changes that were occurring in the underground coal mines at that time and the reduction of contractor-operated mines. These recent lower injury rates appear to indicate that contractor worker safety has significantly improved. However, other factors may be partially responsible for the improvement, such as overall progress in safety intervention techniques (i.e., screening, bolting equipment, etc.), reduction in contractor exposure to hazardous activities and more

experienced contractor miners.

Without records of contractor hours spent at individual mine sites, it is not possible to accurately calculate the effects of contractor injuries on the mine's overall injury rate. Until such data becomes available, it is hoped that studies like this may shed some light on independent contractor injury trends in the underground coal mine industry.

Disclosure

The findings and conclusions in this paper have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.

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