

## INTRODUCTION

Coal mine fires pose a constant danger to the safety of miners and to their livelihood. Underground mine fires pose an added hazard because of the confined environment with remote exits. Enactment of safety regulations [30 CFR<sup>2</sup> 75 and 77] for underground coal mines and surface coal operations has greatly improved the safety of miners. However, mine fires and fire injuries remain serious hazards for all coal mining operations.

This report analyzes mine fires and fire injuries for all U.S. coal mining categories (underground coal mines, surface of underground coal mines, surface coal mines, and coal preparation plants) during 1990–1999. Fires involving contractors are also included in the analysis. Similar analyses (for underground coal mines only) by the former U.S. Bureau of Mines (USBM) were reported by McDonald and Pomroy [1980] and Pomroy and Carigiet [1995] for 1950–1977 and 1978–1992, respectively. For comparison purposes, data for 1978–1992 are mentioned in the "Underground Coal Mine Fires" section of this report. Detailed analyses of mobile equipment fires for all underground and surface coal and metal/nonmetal mining categories during 1990–1999 have recently been reported by NIOSH [De Rosa 2004].

Risk rate values (fire and injury risk rates) for the 10-year period (1990–1999) and for five successive 2-year periods within the 10-year period are derived. Risk rate values for individual states for the 10-year period are also derived. Other variables by state and time period include employees' working

hours, lost workdays, and coal production (underground and surface coal mines only). The number of fire fatalities is reported by time period. Variables such as ignition source, method of detection and suppression, equipment involved, location, and burning material are reported by five 2-year periods only. Furthermore, the number of fire injuries per number of fires causing injuries and total fires has been analyzed by year, ignition source, equipment involved, and location. For comparison purposes, the major fire and fire injury findings for all coal mining categories have been reported.

The data in this report were derived from "Injury Experience in Coal Mining" [MSHA 1991a, 1992, 1993, 1994a, 1995a, 1996, 1997, 1998b, 1999c, 2000], "Fire Accident Reports" [MSHA 1991b,c; 1994b; 1995b,c; 1998a,c,d,e,f; 1999a,b,d,e], MSHA "Fire Accident Abstracts" internal publications, and verbal communications with mine personnel. Mining companies are required by 30 CFR 50 to report to MSHA all fires that result in injuries and fires that are not extinguished within 30 min of discovery. A small number of fires lasting <30 min without injuries reported in the "Fire Accident Abstracts" have been included in this report.

The analysis in this report will provide the National Institute for Occupational Safety and Health (NIOSH), the Mine Safety and Health Administration (MSHA), and the mining industry with a better understanding of the causes and hazards of mine fires and fire injuries. It will also form a basis for developing future fire research programs.

## METHODOLOGIES

For all coal mining categories, data on coal mine fires during 1990–1999 have been reported as actual numbers and calculated values.

1. For each mining category, actual numbers include the total number of fires, fire injuries, employees' working hours, lost workdays, and coal production (for underground and surface mines only) for a 10-year period (1990–1999) and for five successive 2-year periods within the 10-year period. These numbers have also been reported by state (10-year period). The actual number of fire fatalities has been reported by time period. Furthermore, actual numbers of fires for the five 2-year periods have been reported by ignition source, method of detection and suppression, equipment involved, location, and burning material. Actual numbers of fire injuries per number of fires causing injuries and total fires have been reported by year, ignition source, equipment involved, and location.

2. For each mining category, the calculated values include the fire and injury risk rates during the 10-year period and the five 2-year periods. The fire risk rate (Frr) values were

calculated according to the USBM formula [Pomroy and Carigiet 1995]. The injury risk rate (Irr) values were calculated according to the MSHA formula [MSHA 1991a, 1992, 1993, 1994a, 1995a, 1996, 1997, 1998b, 1999c, 2000]. Also, risk rate values for individual states (10-year period) were calculated according to the above-mentioned formulas.

Of note is that only the risk rate values for the 10-year and five 2-year periods and risk rate values for individual states with the highest number of fires and fire injuries were considered for comparison purposes. The fatality risk rate values were not calculated because of the extremely small number of fire fatalities during the 10-year period.

3. Calculations of risk rate values are as follows:

- a. Fire risk rate (Frr) value: Number of fires per million tons of coal produced [Pomroy and Carigiet 1995].
- b. Injury risk rate (Irr) value: Number of fire injuries multiplied by 200,000 working hours per total employees' working hours [MSHA 1991a, 1992, 1993, 1994a, 1995a, 1996, 1997, 1998b, 1999c, 2000]. The Irr value is the average risk rate value for the number of fire injuries per 200,000 working hours for a given time period.

<sup>2</sup>Code of Federal Regulations. See CFR in references.