TABLE. Association between reported exposures and diarrheal illness among 130 respondents who attended a community fair — Kansas, October 2007

	Exposed			Not exposed				
Exposure	**Ill**	**Total**	**Ill (%)**	**Ill**	**Total**	**Ill (%)**	**RR***	**(95% CI†)**
Drank well water	61	101	(60)	2	7	(29)	2.1	(0.6–6.9)
Made butter	24	38	(63)	41	79	(52)	1.2	(0.9–1.7)
Made cheese	21	31	(68)	42	83	(51)	1.3	(0.9–1.6)
Ate butter	37	55	(67)	29	61	(48)	1.4	(1.0–1.9)
Ate cheese	67	101	(66)	1	21	(5)	13.9	(2.0–94.8)
Ate chili	60	106	(57)	6	14	(43)	1.3	(0.7–2.4)
Ate biscuits	42	62	(68)	25	56	(45)	1.5	(1.0–2.1)
Shoed horses	26	42	(62)	39	74	(53)	1.2	(0.9–1.6)

* Relative risk.
† Confidence interval.

illness after consuming raw milk or products made with raw milk purchased from another local dairy. Seven (28%) patients had *C. jejuni* isolated from stool specimens; three of the isolates had indistinguishable PFGE patterns. *Campylobacter* was not isolated from any of the milk or cheese samples. Unpasteurized milk legally can be sold or donated at dairies in Kansas. Dairy farms in Kansas that sell unpasteurized milk on-site are not required to display notices regarding the potential hazards of consuming unpasteurized milk.†

When Scotland banned the sale of unpasteurized milk in 1983, milkborne infection decreased markedly in that country. Before the ban, an average of 14 outbreaks annually affected an average of 1,090 persons per year; after the ban, an average of eight outbreaks annually affected an average of 46 persons per year in dairy farming communities. None of the outbreaks in the postban period occurred in the general community (*4*).

Required permits and point-of-sale signage warning of the potential dangers of unpasteurized milk and unpasteurized milk products have not demonstrably decreased outbreaks of gastrointestinal illness in other states (*5*–*7*). Stricter laws prohibiting the sale or donation of unpasteurized milk might better protect the public, especially members of certain groups that are at increased risk for infection-related complications (e.g., young and elderly persons and pregnant women) (*8*). To prevent milkborne infections, unpasteurized milk and unpasteurized milk products should not be consumed.

Acknowledgments

This report is based, in part, on contributions by ME Vajnar, Kansas Department of Health and Environment; L Johnson and C Brehman, Minnesota Dept of Agriculture Laboratories; the Kansas Dept of Agriculture; local health department staff members, and K Bisgard, Office of Workforce and Career Development, CDC.

† The Kansas Dairy Law. Kansas Statute K.S.A. 65-789 Ch. 65 Art. 7(d). Available at http://www.ksda.gov/includes/statute_regulations/dairy/06dairylaw.pdf.

References

1. Gillespie IA, Adak GK, O'Brien SJ, Bolton FJ. Milkborne general outbreaks of infectious intestinal disease, England and Wales, 1992–2000. Epidemiol Infect 2003;103:461–8.
2. Warner DP, Bryner JH, Beran GW. Epidemiologic study of campylobacteriosis and the possible role of unpasteurized milk as a vehicle of infection. Am J Vet Res 1986;47:254–8.
3. Hutchinson DN, Bolton FJ, Hinchliffe PM, et al. Evidence of udder excretion of *Campylobacter jejuni* as the cause of milk-borne *Campylobacter* outbreak. J Hyg 1985;94:205–15.
4. Sharp JC, Patterson GM, Barrett NJ. Pasteurization and the control of milkborne infection in Britain. Br Med J 1985;291:463–4.
5. CDC. *Salmonella* Typhimurium infection associated with raw milk and cheese consumption—Pennsylvania, 2007. MMWR 2007;56:1161–4.
6. Potter ME, Blaser MJ, Sikes RK. Human *Campylobacter* infection associated with certified raw milk. Am J Epidemiol 1983;117:475–83.
7. CDC. Multistate outbreak of *Salmonella* serotype Typhimurium infections associated with drinking unpasteurized milk—Illinois, Indiana, Ohio, and Tennessee, 2002–2003. MMWR 2003;52:613–5.
8. Allos BM. *Campylobacter jejuni* infections: update on emerging issues and trends. Clin Inf Dis 2001;32:1201–6.

Underground Coal Mining Disasters and Fatalities — United States, 1900–2006

During a 5-month period in 2006, three underground coal mining incidents in the United States resulted in the deaths of 19 miners. All three incidents received nationwide attention, particularly the Sago Mine disaster, which occurred on January 2 and resulted in the deaths of 12 miners. The other two incidents, which occurred at the Alma No. 1 Mine on January 19 and the Darby No. 1 Mine on May 20, resulted in the deaths of two miners and five miners, respectively. The occurrence of three fatal incidents in 5 months was a departure from recent trends in underground coal mining safety. Before 2006, the number of mining disasters had decreased from a high of 20 in 1909 to an average of one every 4 years during 1985–2005. Deaths resulting from the three incidents were the stimulus for

the Mine Improvement and New Emergency Response Act of 2006 (MINER Act) (*1*), which amended the Mine Safety and Health Act of 1977 to improve safety, health, preparedness, and emergency response in U.S. mining. This report briefly describes the three 2006 mining incidents, reviews mining disasters in the United States during 1900–2006, and traces the effect of the disasters and the 2006 incidents on mining health and safety regulations.

Federal law mandates reporting of mining-related incidents that can result in loss of life, such as an explosion or fire in an underground coal mine. The Mine Safety and Health Administration (MSHA) determines whether investigation of such incidents is required and, if so, initiates the investigation within 24 hours. MSHA teams evaluate the scene, interview witnesses and experts, and with the aid of researchers from CDC's National Institute for Occupational Safety and Health (NIOSH) and other technical specialists, recreate specific conditions to measure and evaluate outcomes. The three 2006 incidents were investigated at both the state and federal level. Of the three incidents, two were classified by MSHA as disasters, which are defined as incidents with five or more fatalities (*2–4*).

To better understand the context of these events, NIOSH researchers reviewed mining fatality surveillance data from the period 1900–2006 published by MSHA (*5–6*) and the U.S. Bureau of Mines (*7*). Underground mine disasters are classified by cause as follows: 1) explosion, 2) fire, 3) haulage (i.e., transportation of personnel, material, or equipment), 4) ground fall/bump (i.e., fall of roof rock or outward bursting of walls in an underground work area), 5) inundation (i.e., usually an inrush of toxic gases or water from old mine workings), and 6) other (*8*). Using MSHA reports, NIOSH researchers collected additional data on the deaths and circumstances associated with the Sago, Alma, and Darby incidents. Researchers reviewed published materials and traced how events during these 2006 incidents led to the MINER Act.

2006 Mining Incidents

In 2006, a total of 14,885 mines were operating in the United States, representing every state and multiple mining commodities (e.g., coal, metal, nonmetal, stone, and sand and gravel). These mines included 2,113 active coal mines (1,438 surface mines and 675 underground mines). Most underground coal mines were concentrated in Kentucky, West Virginia, and Pennsylvania. In 2006, the two incidents in West Virginia and one in Kentucky resulted in the deaths of 19 workers, accounting for 26% of the 73 U.S. mine worker fatalities in that year.

Sago Mine. The first 2006 incident occurred on January 2 at the Sago Mine near Tallmansville, West Virginia. At approximately 6:30 a.m., 30 minutes after the 13 members of the No. 1 production crew entered the mine (*2*), a methane gas explosion occurred underground near a worked-out area approximately 2 miles from the mine entrance. MSHA investigators determined that lightning was the most likely ignition source for the explosion (*2*). The force of the explosion broke foam concrete block walls and propelled dust, dirt, and debris toward the mine entrance, killing one miner instantly and cutting communication wires. The other 12 miners in the No. 1 production crew, who had arrived at their work area approximately 1,000 feet beyond the site of the explosion, donned their 1-hour self-contained breathing apparatus and attempted to escape. After encountering smoke, dust, and debris, and with no information regarding the condition of the mine, the miners returned to their work area, erected a barricade, and awaited rescue. Eleven of the 12 died of carbon monoxide poisoning before rescuers reached them 41 hours later; the twelfth trapped miner survived. Because communications were cut off by the explosion, rescuers were unsure where the miners were located and whether any had survived. As a result, the trapped miners could not be told they were 700 feet from fresh air and could walk out of the mine. The deceased miners ranged in age from 28 to 61 years; average age was 49.4 years. They ranged in experience from 1.6 to 37 years and averaged 23.6 years of experience.

Alma No. 1 Mine. The second 2006 incident occurred on January 19 at the Alma No. 1 Mine near Stollings, West Virginia. A conveyor belt that removed coal from the mine caught on fire. A total of 29 miners were in the mine at the time, and two miners became separated when the others escaped in heavy smoke. Several unsuccessful attempts were made to locate the missing workers. After the fire had been extinguished, the two bodies were found by mine rescue teams 46 hours later (*4*).

Darby No. 1 Mine. The third 2006 incident occurred on May 20 at the Darby No. 1 Mine in Holmes Mill, Kentucky (*3*). At the end of the afternoon shift, the crew foreman and another miner had remained to finish some construction work when the four-member night shift crew entered the mine. An underground explosion destroyed several mine seals, which MSHA later attributed to improper construction of the seals and inappropriate use of cutting and welding equipment in an attempt to correct the deficient mine seal construction (*3*). The two miners who were finishing construction work died of blunt force trauma near one of the destroyed mine seals. Three other miners died of carbon monoxide poisoning while trying to escape from the mine through smoke and toxic gases.

The sixth miner was able to navigate part way out of the mine through smoke, rock, and debris by wearing his 1-hour breathing apparatus; he was found by mine rescue teams within 2 hours. The bodies of the five victims were removed from the mine 10 hours later.

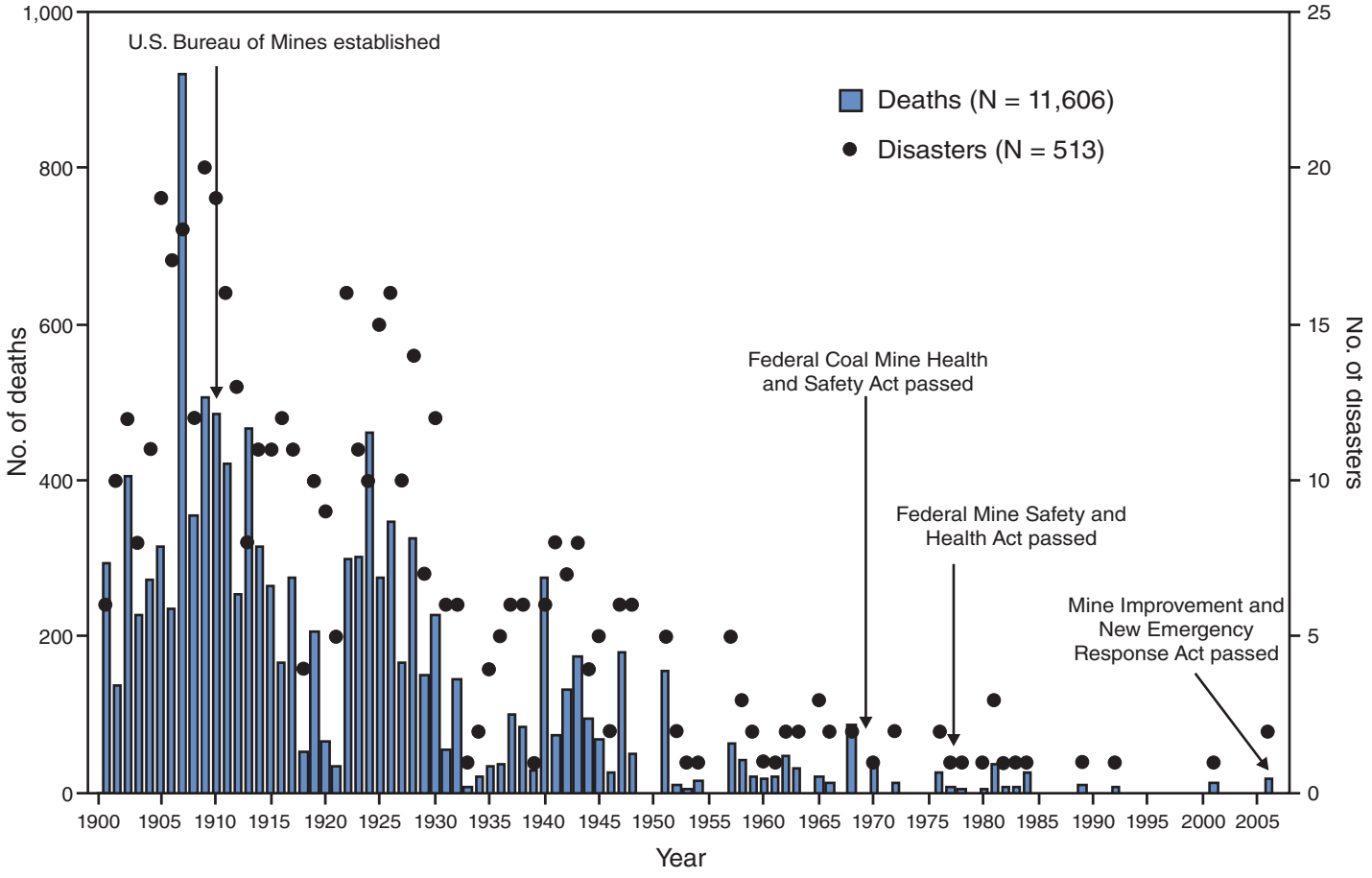
Coal Mining Disasters, 1900–2006

During 1900–2006, a total of 11,606 underground coal mine workers died in 513 U.S. underground coal mining disasters* (Figure), with most disasters resulting from explosion or fire (Table). In 1907 alone, 692 miners died in four mine explosions in West Virginia, Pennsylvania, and Alabama (*6*). However, the frequency and severity of underground coal mining disasters and the number of deaths of miners decreased substantially during 1970–2005. Until the 2006 incidents, underground coal mine disasters with multiple fatalities were thought to be permanently on the decline.

* Reliable data on fatalities in coal mining nondisasters (i.e., incidents with four or fewer deaths) are not available for the early 1900s.

Many of the disasters during 1900–2006 led to new legislation (Figure) (*5,6*). The 1907 explosions led to establishment in 1910 of the U.S. Bureau of Mines, an agency specifically authorized to conduct mine safety and health research. A 1968 explosion at the Farmington No. 9 Mine in West Virginia resulted in the deaths of 78 miners and led to 1) passage of the Federal Coal Mine Health and Safety Act of 1969 (1969 Act), the most sweeping mine safety and health legislation ever adopted in the United States, and 2) creation of the Mining Enforcement and Safety Administration (MESA), a separate agency from the Bureau of Mines, to enforce mine safety and health requirements. The 1969 Act strengthened numerous mine safety and health regulations, including those relating to explosion prevention, fire prevention and protection, and ventilation. In 1976, two explosions at the Scotia Mine in Kentucky resulted in the deaths of 26 miners and rescuers and led to passage of the Federal Mine Safety and Health Act of 1977 (1977 Act). This legislation strengthened provisions of the 1969 Act and also incorporated new mandates for all

FIGURE. Number of worker deaths in underground coal mining disasters* and key mining safety milestones — United States, 1900–2006



* Disasters are defined by the Mine Safety and Health Administration as incidents resulting in five or more deaths.

TABLE. Number of worker deaths in underground coal mining disasters,* by causal classification — United States, 1900–2006

Causal classification	No. of diasters	No. of deaths
Explosion	420	10,390
Fire	35	727
Haulage†	21	145
Ground fall/Bump§	13	83
Inundation¶	7	62
Other	17	199
Total	**513**	**11,606**

* Disasters are defined by the Mine Safety and Health Administration as incidents resulting in five or more deaths.
† Transportation of personnel, material, or equipment.
§ Fall of roof rock or outward bursting of walls in an underground work area.
¶ Usually an inrush of toxic gases or water from old mine workings.

noncoal mines. The 1977 Act also renamed MESA as MSHA and moved the agency from the U.S. Department of the Interior to the U.S. Department of Labor.

The MINER Act of 2006

The 2006 coal mine disasters were the stimulus for the MINER Act (*1*). This legislation contains provisions to improve safety, health, preparedness, and emergency response in U.S. mines. After the explosion at the Sago Mine, delays occurred in incident reporting and emergency response. The MINER Act requires mine operators to develop and maintain a preparedness and response plan to reduce the delays and improve the quality of the response.

Under the MINER Act, mine operators must provide caches of self-contained breathing apparatus along escapeways; the breathing apparatus must supply at least 2 hours of oxygen per miner and must be spaced no more than 30 minutes travel time apart to enable miners to make their way through the entire escapeway. Before the Sago disaster, mines were only required to provide miners with a single self-contained breathing apparatus, providing 1 hour of oxygen. The sole survivor of the group of Sago miners told rescuers that some miners thought their self-contained breathing apparatus was not working properly. Regulators felt miners needed to be provided with sufficient quantities of breathing apparatus to give them at least 2 hours of protection in the event of a prolonged escape. The MINER Act also calls for installation and maintenance of directional lifelines† in escapeways, a direct response to NIOSH research findings (*9*). In addition, the inability of trapped miners to communicate with rescuers during the Sago disaster led to another feature in the MINER Act. By July 2009, mine operators must install wireless two-way communications and tracking systems that will link surface rescuers with underground workers. Congress subsequently passed an emergency supplemental appropriation to accelerate implementation of 1) emergency oxygen supplies, 2) refuge chambers, and 3) communications and tracking systems.

As a result of the three 2006 incidents, the National Mining Association created an independent commission of mining and safety experts, which concluded that more research was needed in rescue and escape training and communications, realistic training, professional emergency response and rescue capability, and development of a safety culture in mining organizations. These safety improvements will require more attention to human behavior and comprehensive risk management (*10*).

Coal mining disasters have decreased substantially in frequency and number of fatalities since 1900. The 2006 underground coal mine incidents and their 19 fatalities marked a reversal of that trend. However, the incidents also drew critical attention to mine safety in the United States, engaging the public, industry, and government and resulting in legislative and regulatory action.

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Acknowledgment

This report is based, in part, on contributions by A Podlesny and PJ Lenart, National Institute for Occupational Safety and Health, CDC.

References

1. Mine Improvement and New Emergency Response Act of 2006 (MINER Act), Pub. L. No. 109-236 (S 2803). Available at http://www.msha.gov/mineract/mineractsinglesource.asp.
2. Gates RA, Phillips RL, Urosek JE, et al. Report of investigation: fatal underground coal mine explosion, January 2, 2006. Sago Mine, Wolf Run Mining Company, Tallmansville, Upshur County, West Virginia, ID No. 46-08791. Arlington, VA: US Department of Labor, Mine Safety and Health Administration; 2007. Available at http://www.msha.gov/sagomine/sagomine.asp.
3. Light TE, Herndon RC, Guley AR, et al. Report of investigation: fatal underground coal mine explosion, May 20, 2006. Darby No. 1 Mine, Kentucky Darby LLC, Holmes Mill, Harlan County, Kentucky. ID No. 15-18185. Arlington, VA: US Department of Labor, Mine Safety and Health Administration; 2007. Available at http://www.msha.gov/fatals/2006/darby/ftl06c2731.pdf.
4. Murray KA, Pogue CW, Stahlhut RW, et al. Report of investigation: fatal underground coal mine fire, January 19, 2006. Aracoma Alma Mine No. 1, Aracoma Coal Company, Inc., Stollings, Logan County, West Virginia. ID No. 46-08801. Arlington, VA: US Department of Labor, Mine Safety and Health Administration; 2007. Available at http://www.msha.gov/fatals/2006/aracoma/ftl06c1415.pdf.
5. DeMarchi J. Historical mining disasters. Beckley, WV: US Department of Labor, Mine Safety and Health Administration, National Mine Health and Safety Academy; 1997:34–44.

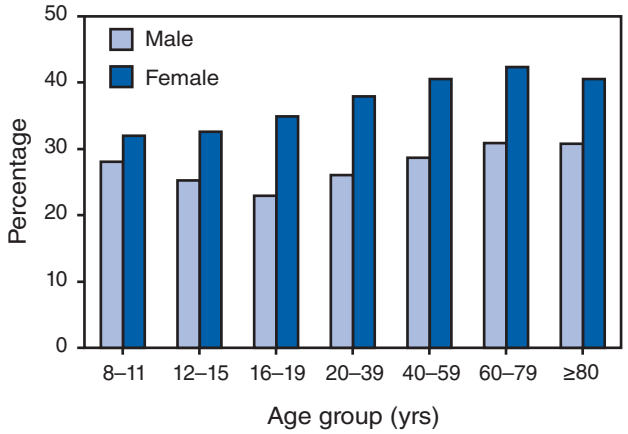
† A rope with cones spaced at regular intervals along its length. If a miner's hand slides over the cone, the miner is going in the correct direction. If the hand is blocked by the cone, the miner is headed in the wrong direction.

6. Mine Safety and Health Administration. Historical summary of mine disasters in the United States. Volume II: coal mines, 1959–1998. Beckley, West Virginia: US Department of Labor, Mine Safety and Health Administration, National Mine Health and Safety Academy; 1998.
7. Humphrey HB. Historical summary of coal-mine explosions in the United States, 1810–1958. Bulletin 586. Washington, DC: US Department of the Interior, Bureau of Mines; 1960.
8. Mine Safety and Health Administration. Accident, illness and injury, and employment self-extracting files (part 50 data): 2006. Denver, CO: US Department of Labor, Mine Safety and Health Administration, Office of Injury and Employment Information. Available at http://www.msha.gov/stats/part50/p50y2k/p50y2k.htm.
9. Conti R, Chasko L, Wiehagen W, Lazzara C. Fire response preparedness for underground mines. DHHS IC 9481. Washington, DC: US Department of Health and Human Services; 2005. Available at http://www.cdc.gov/niosh/mining/pubs/pdfs/2006-105.pdf.
10. Mine Safety Technology and Training Commission. Improving mine safety technology and training: establishing U.S. global leadership. Available at http://www.coalminingsafety.org/documents/msttc_report.pdf.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Mean Percentage Body Fat,* by Age Group and Sex — National Health and Nutrition Examination Survey, United States, 1999–2004†



* Based on whole body, dual energy, x-ray absorptiometry (DXA) scans.
† Estimates are based on DXA scans acquired from a sample (N = 22,010) of the civilian, noninstitutionalized U.S. population.

During 1999–2004, females had higher mean percentage body fat than males at all ages. Male/female differences were smallest at age 8–11 years (3.9 percentage points) but increased to 12.0 percentage points at age 16–19 years. In males, mean percentage body fat ranged from 22.9% at age 16–19 years to 30.9% at age 60–79 years. In females, mean percentage body fat ranged from 32.0% at age 8–11 years to 42.4% at age 60–79 years.

SOURCE: National Health and Nutrition Examination Survey, 1999–2004. Available at http://www.cdc.gov/nchs/nhanes.htm.