Safety improvements in the Alaska commercial fishing industry during the 1990s did not occur because of a single intervention. Several interventions were implemented, including requirements for emergency gear, development of hands-on safety training, and tailored safety interventions addressing specific hazards for particular fishing fleets. The findings in this report suggest that safety interventions should be tailored to specific groups of vessels and emphasis should be placed on the Northwest Dungeness crab fleet, with targeted preseason safety inspections and safety and stability training. Other areas of emphasis should include improved weather reporting, training in the deployment and use of life rafts, and increased training in the use of immersion suits and personal flotation devices.

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Fatalities Among Oil and Gas Extraction Workers — United States, 2003–2006

Oil and gas extraction (i.e., removing oil and natural gas from the ground) is a growing industry in the United States, employing approximately 380,000 workers in 2006 (*1*). In recent years, activity in this industry has increased substantially, from an average of 800 actively drilling rigs in the United States during the 1990s to approximately 1,300 during 2003–2006 (*2*). In August 2005, the U.S. Department of Labor's Bureau of Labor Statistics (BLS) asked CDC to investigate a 15% increase in fatalities among oil and gas extraction workers (from 85 fatalities in 2003 to 98 in 2004) (*3*). CDC analyzed data from the BLS Census of Fatal Occupational Injuries (CFOI) for the period 2003–2006. This report describes the results of that analysis, which indicated that increases in oil and gas extraction activity were correlated with an increase in the rate of fatal occupational injuries in this industry, with an annual fatality rate of 30.5 per 100,000 workers (404 fatalities) during 2003–2006, approximately seven times the rate for all workers (4.0 per 100,000 workers) (*4*). Nearly half of all fatal injuries among these workers were attributed to highway motor-vehicle crashes and workers being struck by machinery or equipment. Employers should work with existing industry groups and federal, state, and local government agencies to promote seatbelt use. In addition, researchers and public health officials should collaborate with industry groups to establish engineering and process controls that remove workers from potentially dangerous machinery while drilling and servicing oil and gas wells.

A fatal injury was considered occupational and was included in CFOI if the event leading to the injury occurred while the employee was working, either on or off the employer's premises (*5*). CFOI cases are identified, verified, and profiled using multiple source documents; these data sources include death certificates, workers' compensation records, and reports to federal and state agencies. The industry of the worker was based on the North American Industrial Classification System.* Oil and gas extraction workers are coded in the mining sector: 211 (oil and gas extraction), 213111 (drilling oil and gas wells), and 213112 (support activities for oil and gas operations). These include employees of operators that own or lease oil and gas wells, drilling contractors, and service companies that provide additional support. In addition to analyzing the variables collected by CFOI, CDC coded seatbelt use on the basis of information available in the injury narratives. Annual fatality rates were calculated using the BLS Quarterly Census of Employment and Wages estimate of workers.

During 2003–2006, a total of 404 occupational fatalities among oil and gas extraction workers occurred in the United States, resulting in an average annual fatality rate of 30.5 per 100,000 workers (Table 1). A statistically significant correlation was observed between the number of drill-

*A standardized system developed jointly by the United States, Canada, and Mexico to provide comparability in statistics on business activity throughout North America.

TABLE 1. Number and rate* of fatal injuries among oil and gas extraction workers and average number of drilling and workover rigs,† by year — United States, 1993–2006§

Year	No. of fatalities¶	No. of workers**	Rate	No. of rigs
2006	123	385,803	31.9	3,221
2005	98	338,234	29.0	2,735
2004	98	306,863	31.9	2,427
2003	85	292,846	29.0	2,161
2002	71	308,000	23.1	1,840
2001	98	353,000	27.8	2,367
2000	83	313,000	26.5	1,974
1999	50	329,000	15.2	1,460
1998	76	373,000	20.4	1,915
1997	85	369,000	23.0	2,365
1996	82	302,000	27.2	2,113
1995	77	336,000	22.9	2,000
1994	99	387,000	25.6	2,072
1993	94	371,000	25.3	2,146

SOURCES: US Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries (2003–2006). US Department of Labor, Bureau of Labor Statistics, Current Population Survey (1993–2002). US Department of Labor, Bureau of Labor Statistics, Quarterly Census of Employment and Wages (2003–2006). Baker Hughes, Inc., Rig Counts (1993–2006).

* Per 100,000 workers.

† Workover rigs restore or increase production of an existing well, whereas drilling rigs drill new wells.

§ Data for 2006 are preliminary.

¶ The industry definition used by the U.S. Department of Labor changed in 2003.

** Numbers of workers for 1993–2002 are from the Current Population Survey and are reported in thousands. Numbers of workers for 2003–2006 are from the Quarterly Census of Employment and Wages. Data sources differ because the industry definition used by the U.S. Department of Labor changed in 2003.

ing and workover rigs† and the annual occupational fatality rate during 1993–2006 (Pearson correlation coefficient r = 0.80; p<0.01). Two types of events accounted for nearly half of all fatal injuries among oil and gas extraction workers in the United States during 2003–2006: highway motor-vehicle crashes (27%) and workers being struck by tools or equipment (22%). Other events included explosions (9%), falls to lower levels (7%), and fires (7%) (Table 2). The highest numbers of oil and gas extraction occupational fatalities occurred in Texas (153 [38%]), Louisiana (49 [12%]), Oklahoma (43 [11%]), Wyoming (32 [8%]), and New Mexico (22 [5%]). Among the states where most of the fatalities occurred, New Mexico (45.2 per 100,000) and Wyoming (58.5 per 100,000) had the highest average annual fatality rates, compared with Oklahoma (33.3 per 100,000), Louisiana (29.2 per 100,000), and Texas (25.3 per 100,000).

† Workover rigs restore or increase production of an existing well, whereas drilling rigs drill new wells.

TABLE 2. Number of fatal injuries among oil and gas extraction workers, by type of injury event — United States, 2003–2006*

Injury event	No. of fatal injuries
Highway crash	110
Struck by object	88
Explosion	36
Fall to lower level	30
Fire	27
Caught or compressed in moving machinery or tools	26
Electric current	20
Aircraft crash	18
Other	49
Total	**404**

SOURCE: US Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries (2003–2006).

* Data for 2006 are preliminary.

The 110 fatal highway motor-vehicle incidents in this industry were divided among noncollision (42 [38%]), collision between vehicles (40 [36%]), and other events (28 [26%]) (Table 3). Three out of four highway fatalities (82 [75%]) involved light trucks (e.g., pickups and delivery trucks) (55 [50%]) or semi-tractor trailers (27 [25%]). A total of 39 (35%) workers in highway fatalities were not wearing seatbelts; another 13 (12%) workers were ejected upon impact and likely were not wearing seatbelts.

A total of 88 (22%) workers died after being struck by tools and equipment (most of which were dropped from a height), and another 26 (6%) were caught or compressed in moving machinery or tools. Approximately one fourth of all fatalities (116 [29%]) in this industry occurred among employees of companies with fewer than 10 employees, and approximately one fourth of all workers who had fatal injuries had worked for their employer for less than 1 year (112 [28%]).

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Editorial Note: Since 1993, when CFOI data became available, both the number and rate of occupational fatalities among oil and gas extraction workers have varied with increases and decreases in drilling activity (*6,7*). This correlation might be a result of several factors, including an increase in the proportion of inexperienced workers, longer working hours, and the use of all available rigs (including older equipment with fewer safeguards). Current petroleum prices suggest that increased oil and gas extraction activity will continue. Therefore, unless changes are made to increase worker safety, the high fatality rates described in this report are likely to continue.

Although highway crashes are the most common fatal event in U.S. industries overall (*8*), certain aspects of highway crashes in oil and gas extraction create the need for

TABLE 3. Number of fatalities in highway crashes among oil and gas extraction workers, by type of event — United States, 2003–2006*

Type of event	No. of fatalities
Noncollision (e.g., rollover or jackknife)	42
Collision between vehicles	40
Vehicle struck stationary object or equipment on side of road	23
Other	5
Total	**110**

SOURCE: US Department of Labor, Bureau of Labor Statistics, Census of Fatal Occupational Injuries (2003–2006).
* Data for 2006 are preliminary.

further study and targeted interventions. Vehicles used in oil and gas extraction are exempt from certain U.S. Department of Transportation hours-of-service regulations.[§] Truck drivers and workers in pickup trucks often travel between oil and gas wells located on rural highways, which often lack firm road shoulders, rumble strips, and, occasionally, pavement. Workers often are on 8- or 12-hour shifts, working 7–14 days in a row. Fatigue has been identified as an important risk factor in motor-vehicle crashes (*9*); therefore, a targeted program that addresses fatigue among workers in this 24-hour industry might reduce motor-vehicle crashes and fatalities. Persons also can reduce driving fatalities by always wearing seatbelts while operating or riding in motor vehicles.

Many of the hazards associated with using heavy tools and equipment in this industry were documented in the 1970s (*10*), and being struck by these items remains the second most common event leading to an occupational fatality. The use of mechanized tools to move and manipulate heavy pipe can remove workers from potentially injurious environments. These types of controls are becoming more common on land-based drilling rigs and are consistent with good safety practices because they control a work-related hazard at the source.

The findings in this report are subject to at least three limitations. First, fatality rates were calculated using an employment estimate that is different from the standard employment estimates used by CFOI to calculate occupational fatality rates. Comparisons of the fatality rates in this report to other CFOI occupational fatality rates should be interpreted with caution. Second, the data do not provide detailed information on the worker population at risk (e.g., the proportion of new workers), which would allow more detailed analyses of risk factors. Finally, because classification of worker fatalities into industry subsectors is limited by the information available, misclassification might have occurred.

Although each company has the ultimate responsibility for the safety of its employees, drilling operations involve many companies working together in an environment with complex machinery and complex levels of supervision. Well operators have significant influence over how work is conducted and authority to establish a culture and process of safety at a site. Improved safety for oil and gas extraction workers requires a dedicated and collaborative effort from all parts of the industry. CDC is supporting this type of effort through 1) development of new worksite self-assessment, training, and communication products that emphasize seatbelt use and fall protection and 2) the activities of the National Occupational Research Agenda Oil and Gas Extraction Sub Council.[¶]

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[§] According to part 395 of the Code of Federal Regulations title 49 (Transportation Regulations), drivers of vehicles that are used exclusively to service oil and gas wells are not required to count waiting time at the well site toward their on-duty hours.

[¶] Additional information available at http://www.cdc.gov/niosh/nora/councils/mining/oilgas.