

The Wisconsin Fatality Assessment and Control Evaluation (WI FACE)

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List of Abbreviations:

WI	Wisconsin
FACE	Fatality Assessment and Control Evaluation
NIOSH	National Institute for Occupational Safety and Health
DHFS	Department of Health and Family Services
DPH	Division of Public Health
OSHA	Occupational Safety and Health Administration
CFOI	Census of Fatal Occupational Injuries
DWD	Department of Workforce Development
BHIP	Bureau of Health Information and Policy
HIPAA	Health Insurance Portability and Accountability Act
ROPS	Rollover protective structure
UW	University of Wisconsin

Abstract:

The Wisconsin Fatality Assessment and Control Evaluation (WI FACE) program was dynamic and innovative having met its program objectives for surveillance, investigations and outreach. The program investigated 39 fatalities to obtain more detailed information and these cases were published as investigation reports or alerts. Twenty-two alerts were also disseminated during last five years. Wisconsin targeted high risk groups (deaths of youths under age 18, Hispanic workers), specific worksites (highway work zone deaths) and machine-related deaths for investigations.

In Wisconsin, the age adjusted death rate ranged from 1.7 to 2.0 per 100,000 people during the last five year cooperative period. Without variance, deaths were more frequent in the categories of male gender, non-Hispanic ethnicity, and White race. The one anomaly is the disproportionately higher fatalities of males compared to females. This could be due to the fact that traditionally, males make up significantly more of the employees in high risk jobs such as agriculture, transportation and construction. The greatest number of fatalities occurred in the age groups spanning 25-64 years of age. During the last five years, the four most fatal occupations in Wisconsin were motor/truck driver (23%), farming (21%), laborer (16%) and construction (11%). In Wisconsin, from 2000-2005, we had 616 occupational fatalities. Of these fatalities, one hundred sixty one (26%) work-related fatalities occurred in the agricultural sector. During this period other fatality percentages were 16% construction, 12% transportation, 21% service industries, and 7% government service industry.

The WI FACE database has underlying cause of death for 68% of the cases. Of these, traumatic injuries were the most prevalent (59%), followed by motor vehicle crash including passengers, pedestrian and plane crashes (25%), and farm accidents (6%). Overall, our patterns of occupational fatalities did not change over the last five years. The state's occupational fatality

rate remained at half that of the U.S. (4.0/100,000; 2002). Wisconsin fatality data, like national fatality data, demonstrates that motor/truck driver (23%) and agriculture (21%) continue to be the most hazardous occupations.

In summary, the WI FACE program successfully identified and tracked cases of occupational fatalities. The data were used to guide the selection of investigation priorities and intervention strategies. Outreach included making information and recommendations available via the internet, publications and other written materials, as well as actively presenting information to target groups. The work has effectively raised awareness of occupational safety in general, as well as specific risk factors for occupational fatalities. The impact is the lowest fatality rate in the state since the inception of the program 25 years ago.

Highlights/Significant Findings:

The Wisconsin Fatality Assessment and Control Evaluation (WI FACE) program was dynamic and innovative having met its program objectives for surveillance, investigations and outreach. A complex system of partners was used to capture all cases and corresponding information for surveillance. Some cases were investigated further to obtain more details and were published as investigation reports or alerts. Specifically, the program completed 39 in-depth fatality investigations in Wisconsin targeted high risk groups (deaths of youths under age 18, Hispanic workers), worksites (highway work zone deaths) and machine-related deaths. Twenty-two alerts were also disseminated during this period.

Implementation of a robust communication strategy has resulted in significant improvements in the visibility and impact of WI FACE. In 2002, Wisconsin established a state FACE website where all reports written since 1991 are now posted. Thirteen “FACE FACTS,” also known as “alerts,” were prepared and 77 FACE FACTS created since the beginning of the WI FACE Program, were published on the WI FACE web site. In 2005, two journal articles were published regarding youth fatalities and youth employment. Twenty-one presentations were made to various groups and materials were distributed at five display booths, one of them at the WI Farm Tech Days with 40,000-60,000 attendees. We presented “Preventing Young Worker Fatalities” at the annual National Occupational Injury Research Symposium in Pittsburgh.

Timely data analysis and prompt evaluation processes helped focus and target specific intervention e.g. alerts as well as to identify cases for in-depth investigations. For example, in

2003, Youth worker materials and the NIOSH (The National Institute for Occupational Safety and Health) Youth Worker Alert were mailed to 700 Wisconsin Work Permit officers. Feedback from this mailing was positive, stating the information was new and valuable to their programs. In 2004, the NIOSH Youth Worker Alert and WI FACE materials about youth workers were mailed to 650 school nurses, and 100 youth Alerts were sent upon request to a job center for inclusion in their employer packets. In 2005, an evaluation to determine the effectiveness of one of the published journal articles was sent to 530 school nurses.

WI FACE efforts have resulted in policy changes. One such change was the use of marker posts at the ends of culverts for the safety of maintenance and survey personnel in highway work zones. Additionally, the program partnered with the WI Department of Transportation to address seatbelt use among workers who drive as part of their work duties. WI FACE focused on addressing a seat belt requirement for employed youth. This work resulted in a 2003 Wisconsin law that required all drivers to use a seat belt, and a 2005 ruling that allowed law enforcement to stop a driver that was not wearing a seat belt. The successes of WI FACE were a direct result of continued, comprehensive surveillance of work-related fatalities linked to the development of effective intervention strategies.

Overall, the WI FACE program successfully identified and tracked cases of occupational fatalities. The data were used to guide selection of investigation priorities and intervention strategies. Outreach included making information and recommendations available via the internet, publications and other written materials, as well as actively presenting information to target groups. The work has effectively raised awareness of occupational safety in general, as

well as specific risk factors for occupational fatalities. The impact is the lowest fatality rate in the state since the inception of the program 25 years ago.

Introduction:

The Wisconsin FACE program has been working to reduce the risks and number of work-related fatalities since 1991. The current cooperative agreement with NIOSH was from 2000 to 2005.

The program's goals and priorities are consistent with those of the Wisconsin Department of Health and Family Services (DHFS) and played an integral role in the Department's Division of Public Health (DPH), Bureau of Environmental and Occupational Health's mission to protect and improve the health of the state's citizens.

The WI FACE project was designed to provide information to support the hypothesis that occupational fatalities can be prevented through surveillance, investigation and dissemination of prevention techniques for common risk factors. The long-term goal of this project was to prevent serious and fatal occupational injuries. The specific objectives for the program are:

1. Continue to improve the timely, comprehensive, multiple source (e.g. death certificate, coroner, police, OSHA, worker's compensation reports) state level surveillance system for identifying and recording basic epidemiologic data on all work- related fatalities occurring in Wisconsin.
2. Continue conducting on-site investigations of specific traumatic occupational fatalities (e.g., machine-related injury, deaths of youths under 18 years of age, street/highway construction work zone fatalities and Hispanic work-related fatalities) using the NIOSH FACE model.
3. Through case investigations, continue to identify factors common to selected types of traumatic occupational fatalities, leading to development and evaluation of prevention strategies.

4. The Wisconsin FACE Program will continue to participate in the NIOSH/ State-FACE Coordinating Committee meetings. We will collaborate with other states in common interest areas.

The program's activities met national and state level health plan objectives related to increased worker safety and reduction in workplace fatalities. Specifically, the WI FACE program systematically collected data related to occupational fatalities and identified risk factors for these incidents. The information was used to guide the development and implementation of effective prevention strategies. The program's activities were supported by a Division and Bureau infrastructure with multiple objectives that were also consistent with those of the FACE program.

The infrastructure of the public health system in Wisconsin was a valuable resource in the surveillance, investigation, dissemination and evaluation activities of WI FACE. Regional Office Director Meetings, statewide meetings of local public health agency representatives, and organizations such as the Wisconsin Association of Local Health Departments and Boards have provided a venue to describe the goals and activities of the WI FACE program. Information exchanged with the public health community was also facilitated by a secure, electronic network, the state's Public Health Information Network. It is accessible for all Wisconsin local health departments and was devised for quick and efficient methods of communication of public health issues.

WI FACE joined with other state agencies and community organizations to include a broad range of key stakeholders and promote the program's agenda. A number of partners were integral to

the successful comprehensive surveillance and outreach efforts. These groups included the Wisconsin Occupational Injury and Disease Prevention Center, OSHA (Occupational Safety and Health Administration) Consultation program, OSHA Area Offices, Department of Transportation, Department of Workforce Development, Census of Fatal Occupational Injuries (CFOI), Bureau of Health Information and Policy, University of Wisconsin Department of Biological Systems Engineering, National Farm Medicine Center, Department of Public Instruction, and Public Health Agencies. Each of these groups served an important purpose for the FACE program and helped ensure comprehensive surveillance, effective interventions, and collegial interactions with key stakeholders. Their individual contributions were critical to Wisconsin's strong FACE program.

WI FACE collected information on all of the state's work-related deaths from a variety of sources and entered select information into a standard FACE database. A multi-source network was vital for thorough case ascertainment of work-related fatalities. Each individual source was developed for purposes other than the surveillance of work-related fatalities and none individually provides for the identification of all cases. The network that was established by the WI FACE program was broad and complex, and critical for the program's success.

Utilizing these varied resources, a comprehensive surveillance system was established. All surveillance data were entered into the standard WI FACE database for ease of analysis and sharing with NIOSH. Some data were also collected and not entered in the database, but rather were maintained in confidential individual case files. Traditionally, NIOSH and the states have used the surveillance data to identify targeted categories of fatalities that warranted in-depth

investigations for identification of more specific risk factors. Results of the investigations were also used to develop recommendations for prevention strategies. Within the state, materials were disseminated to the appropriate sources depending upon the type of incident or industry in which the victim worked. WI FACE also sent reports to any of the following agencies as appropriate: Wisconsin area OSHA offices, the Wisconsin Safety Council, UW Department of Biological Systems Engineering, University of Wisconsin-Extension-Madison, labor unions and/or trade organizations, local health departments, individual employers, the victim's immediate family, the Wisconsin Association of County Coroners and Medical Examiners, and law enforcement agencies. The reports were also published on the NIOSH and the WI FACE web sites.

Program Objectives:

The WI FACE program successfully met all proposed objectives with continued surveillance and outreach activities. The program's work for each objective is detailed here.

Objective 1: Continue to improve the timely, comprehensive, multiple source (e.g. death certificate, coroner, police, OSHA, worker's compensation reports) state level surveillance system for identifying and recording basic epidemiologic data on all work- related fatalities occurring in Wisconsin.

The WI FACE database is a comprehensive collection of work-related deaths in the state and requires a review of multiple information sources to ensure its completeness and accuracy. A multi-source network was vital for thorough case ascertainment of work-related fatalities. Each individual source was developed for purposes other than the surveillance of work-related

fatalities and none individually provides for the identification of all cases. The sources reviewed include: death certificates, CFOI, OSHA area offices, private citizens and news media. In some cases, data access required the establishment of formal data sharing agreements. For example, the WI FACE program had a partnership with the vital statistics section of the Bureau of Health Information and Policy (BHIP), and annually signed a Data Release Agreement. Occasionally when a death certificate was not marked as a work-related injury, but appeared to be a probable work-related fatality, follow-up was done to determine the contributing cause of death. Recently, the Bureau created a data release agreement that allowed WI FACE access to the Wisconsin death certificate data; however, a list of all death certificates where the death was not from a natural cause was compiled by partners in BHIP and provided to the WI FACE and CFOI programs for further review and selection of all those certificates where the cause of death was specifically recorded as “work-related injury.” CFOI and WI FACE shared the cost of access to these death certificates, and collaborated closely in the review of the documents to increase the probability of capturing all applicable cases.

The WI FACE program further benefited from its partnership with CFOI with the receipt of notices for pertinent fatalities as they were identified via the CFOI news clipping service. The completeness of the surveillance database was enhanced by claim information that was collected by CFOI and shared with the WI FACE program. The claim information included the occupation of the deceased, the employer, place of employment and a brief description of the injury that occurred.

Other partners also provided pieces of information that helped identify cases that may have been missed via the other methods and/or listed additional details related to the event. For instance, area OSHA offices provided faxed information about work-related fatalities including the type of fatality, where it occurred and the name of the company. That information was matched with the death certificate. Also, in the last few years, WI FACE contacted the county coroner /medical examiner and the local law enforcement agencies when additional information about a specific incident was needed. The WI DPH and the County Coroners jointly developed a system called Casepoint, which is a web-based data collection tool shared by multiple agencies to capture and analyze data submitted by the state's coroners and medical examiners. Casepoint completed its pilot testing phase in 2005 with 16 counties. Now the program includes 20 of 72 county coroners/medical examiners, and efforts are ongoing to expand its use to all other counties. Finally, private citizens provided information to the program that was subsequently matched with death certificate data.

Integration of information from these multiple sources provides for the WI FACE database that includes fields for: incident information (incident number, date notified, date and time of the incident, county of the incident, the number of occupational fatalities that occurred in this incident, the initial reporting agency, the type of incident and a brief narrative about the incident) and victim information (date of death, date of birth, age, sex, race, ethnicity, state of residence, state of death, death certificate number, cause of death, the occupation of the victim and the type of industry where the victim was employed). While the WI FACE Program collected the victim's name, employer's name, and names of potential witnesses, such information remained in confidential case files and was not entered into the database. Statistical analyses of the data were

used to track patterns in work-related fatalities and guide the selection of groups where interventions would likely have significant impact.

During 2000-2005 cooperative periods, 616 work-related deaths were identified and incorporated into the database and analyzed. The demographic distributions of work-related deaths are described in the following tables. Data were also analyzed for high risk industries and occupations in Wisconsin.

Table 1: Wisconsin Deaths Due to Occupational Injuries by Gender

Year	Total Deaths	Death Rate/100,000 population*	Males n (%)	Females n (%)
2000	102	1.9	90 (88.2)	12 (11.8)
2001	112	2.0	108 (96.4)	4 (3.6)
2002	92	1.7	84 (91.3)	8 (8.7)
2003	99	1.8	96 (96.9)	3 (3.1)
2004	99	1.7	91 (91.9)	8 (8.1)
2005	112	2.0	104 (92.9)	8 (7.1)

* Death rate per 100,000 populations has been age-adjusted to the 2000 U.S. standard population.

Table 2: Wisconsin Deaths Due to Occupational Injuries by Ethnicity

Year	Total Deaths	Hispanic n (%)	Non-Hispanic n (%)	Unknown Ethnicity n (%)
2000	102	1 (1.0)	95 (93.1)	6 (5.9)
2001	112	6 (5.4)	97 (86.6)	9 (8.0)
2002	92	3 (3.3)	84 (91.3)	5 (5.4)
2003	99	3 (3.1)	96 (96.9)	0 (0.0)
2004	99	4 (4.0)	91 (91.9)	4 (4.1)
2005	112	7 (6.2)	105 (93.8)	0 (0.0)

Table 3: Wisconsin Deaths Due to Occupational Injuries by Age (years)

Year	Total Deaths	<16 n (%)	16-17 n (%)	18-19 n (%)	20-24 n (%)	25-44 n (%)	45-64 n (%)	65 + n (%)
2000	102	4 (3.9)	1 (1.0)	1 (1.0)	5 (4.9)	34 (33.3)	42 (41.2)	15 (14.7)
2001	112	0 (0.0)	1 (0.9)	3 (2.7)	7 (6.3)	43 (38.4)	45 (40.2)	13 (11.6)
2002	92	2 (2.2)	0 (0.0)	0 (0.0)	11 (11.9)	34 (36.9)	33 (35.9)	12 (13.0)
2003	99	3 (3.0)	0 (0.0)	3 (3.0)	4 (4.0)	40 (40.4)	35 (35.4)	14 (14.1)
2004	99	1 (1.0)	1 (1.0)	4 (4.0)	6 (6.1)	30 (30.3)	38 (38.4)	18 (18.2)
2005	112	0 (0.0)	0 (0.0)	2 (1.8)	6 (5.4)	40 (35.7)	43 (38.4)	21 (18.8)

Table 4: Wisconsin Deaths Due to Occupational Injuries by Race*

Year	Total Deaths	White n (%)	African American n (%)	American Indian n (%)	Asian n (%)	Other n (%)	Unknown n (%)
2000	102	90 (88.2)	4 (3.9)	0 (0.0)	2 (2.0)	0 (0.0)	6 (5.9)
2001	112	98 (87.5)	2 (1.8)	1 (0.9)	1 (0.9)	1 (0.9)	9 (8.0)
2002	92	85 (92.4)	1 (1.1)	0 (0.0)	1 (1.1)	0 (0.0)	5 (5.4)
2003	99	91 (91.9)	3 (3.0)	2 (2.1)	0 (0.0)	3 (3.0)	0 (0.0)
2004	99	93 (93.9)	0 (0.0)	0 (0.0)	1 (1.0)	1 (1.0)	4 (4.1)
2005	112	104 (92.9)	4 (3.5)	2 (1.8)	0 (0.0)	1 (0.9)	1 (0.9)

* Race groups in this table include Hispanics.

The age adjusted death rate ranged from 1.7 to 2.0 per 100,000 people. Without variance, deaths were more frequent in the categories of male gender, non-Hispanic ethnicity, and White race. This is not unexpected as it is consistent with the demographics of the state's workforce population. The Wisconsin workforce is about 53% males versus 47% females. More than 90% of the Wisconsin work force is white non-hispanic. The one anomaly is the disproportionately higher fatalities in males compared to females. This could be due to the fact that traditionally, males make up significantly more of the employees in high risk jobs such as agriculture, transportation and construction. In Wisconsin, these occupations have the greatest fatality risk.

Also as expected, the greatest number of fatalities occurred in the age groups spanning 25-64 years of age.

Overall, there were no clear trends for change in the pattern of fatalities in the state. However, there is some indication of an increase in the number of deaths occurring in workers over 65 years of age which is likely a result of increasing numbers of older people joining the workforce.

The data were also analyzed by occupation and by industry, and for underlying cause of death. During the last five years, the four most fatal occupations in Wisconsin were motor/truck driver (23%), farming (21%), laborer (16%) and construction (11%). CDC reported in the Worker Health Chartbook (2004), that agriculture production remains one of the most hazardous industrial sectors. Fatal occupational injury rates in the agricultural sector, though decreasing, averaged more than four times the rate for the private sector during 1992-2002. In Wisconsin, from 2000-2005, 161 (26%) fatal work-related injuries occurred in the agricultural sector. Farm tractors were the leading source of fatal occupational injuries in agriculture, while trucks and fishing boats were also major sources. During this period, we have 16% construction, 12% transportation, 21% service industries, and 7% government service industry fatalities. Wisconsin recorded some of the highest numbers of on-farm deaths among youths under age 20 during this same time period.

The WI FACE database has underlying cause of death for 68% of the cases. Of these, traumatic injuries were the most prevalent (59%), followed by motor vehicle crush including passengers, pedestrian and plane crush (25%), farm accidents (6%). Overall, our patterns in occupational

fatalities did not change over the last five years. The state's occupational fatality rate remained at half that of the U.S. (4.0/100,000; 2002). Wisconsin fatality data, like national fatality data, demonstrated that motor/truck driver (23%) and agriculture (21%) continue to be the most hazardous occupations.

Objective 2: Continue conducting on-site investigations of specific traumatic occupational fatalities (e.g., machine-related injury, deaths of youths under 18 years of age, highway work zone and construction fatalities and Hispanic work-related fatalities) using the NIOSH FACE model.

In-depth investigations of selected fatalities were conducted in order to obtain and record details about the events leading to the death. The information was used to identify risk factors and to make appropriate recommendations for avoiding such accidents. Formal reports were written and made accessible via the internet at both the NIOSH and WI FACE websites. Hard copies were additionally distributed to a wide range of partners in an effort to provide occupational safety recommendations that, while specific to the reported event, could be implemented more widely for overall worker safety and injury prevention. These recipients included, but were not limited to; local health departments, Wisconsin area OSHA offices, the Wisconsin Safety Council, UW Department of Biological Systems Engineering, University of Wisconsin-Extension, unions or trade organizations, the employer associated with a specific incident and/or the immediate family, and the Wisconsin Association of County Coroners and Medical Examiners.

The reports provided specific recommendations ranging from specific actions that might have prevented the fatality from occurring (ex: guarding or the use of personal protective equipment) to more general actions that might have lessened the risk factors associated with the incident. Recommendations addressed specific hazards or risk factors, clearly described the action necessary to eliminate or control the hazard or risk factor, and provided documentation, if applicable, of noncompliance with applicable OSHA or other regulatory standards. Additionally, all references such as OSHA standards, NIOSH Alerts and Hazard Identifications, prior FACE reports, and journals and periodicals that are used in researching or writing an incident report were cited in a reference section.

A full WI FACE investigation includes an onsite visit; interviews with employers, employees, witnesses and the victim's family members; and consultations with other investigators and investigative reports. Copies of official incident reports are requested from law enforcement agencies and medical examiners' offices. Copies of photographs, sketches, drawings, and witness statements are also requested from law enforcement agencies such as police and sheriffs' departments. In addition WI FACE investigators would request to speak directly to the officer(s) who responded to an incident to obtain information that might not be contained in written reports. Before beginning the investigation of an incident that falls under a Wisconsin area OSHA jurisdiction (employer has 11 or more workers), the corresponding Area OSHA Office and the assigned OSHA investigator were contacted. Because of regulatory concerns, fatalities covered by Wisconsin area OSHA offices would not be finalized by WI FACE prior to the completion of an investigation by that particular area OSHA office without their approval.

Given the substantial resources required for these in-depth investigations, only a small subset of work-related fatalities were selected and pursued. Priority populations were identified based on previous years' data and experience at both the state and national levels. In Wisconsin the following areas were given priority for investigation over the five year reporting period: youth, highway work zone, machine-related, Hispanic, farmers with disabilities, and cultural and faith minorities such as the Amish. A total of 39 investigations were completed, with NIOSH approving 35. Full investigation reports are at http://www.dhfs.state.wi.us/dph_boh/FACE/ or <http://www.cdc.gov/niosh/face/WIFACE.html>, and have been included in Appendix A.

The targets were identified by NIOSH based on the national surveillance priority to gather incidence specific information for epidemiological data for education and prevention purposes. Among the investigated cases, 13 were farm related, 9 involved youths, 4 involved Hispanics, 3 involved highway construction workers, 1 was a fall and 5 others were machine-related fatalities. Among the farm related fatalities, 5 were skid steer loader related, 4 were tractor-related fatalities with 2 of those being roll overs. Among the youth cases, 3 were vehicle related fatalities during newspaper deliveries, 2 were tractor roll-overs, 1 was a carbon monoxide poisoning and 1 a gun shot. Each investigated incident was unique and the recommendations were specific to the case. However, a few general recommendations were indicated. First, in the case of skid steer loader fatalities, it was recommended that operators always operate the loader while seated, with the restraint bar in place and seat belt fastened; and work should never be performed beneath raised loader arms without a safety support in place to prevent the arms from descending. Second, with regards to tractor roll overs it was recommended that; the tractor

should have a rollover protective structure (ROPS) and a seatbelt should always be used unless in a low-clearance area.

Objective 3: Through case investigations, continue to identify factors common to selected types of traumatic occupational fatalities, leading to development and evaluation of prevention strategies.

Program visibility was significantly increased with the deployment of the WI FACE website in 2002 (http://www.dhfs.state.wi.us/dph_boh/FACE/). All in-depth investigation reports written since 1991 are posted here. These reports provide thorough descriptions of work-place incidents that ended in death, and list recommendations for preventing such accidents in the future. The website also houses the program's alerts, otherwise known as FACE FACTS. Currently, a total of 77 FACE FACTS are available, with 22 of those completed during the current grant reporting period. These most recent alerts are found in Appendix B.

The alerts were prepared in conjunction with NIOSH. Each alert contains the detailed incidence information including photographs, drawings, and specific recommendations. During the current reporting period, thirteen alerts addressed farm machine related (8) and youth (5) fatalities. Alerts were developed for incidents that were consistent with targeted categories and/or were unusual and had not occurred before in Wisconsin. Dissemination of these alerts was an effective way to communicate work related fatality information to the employee, employers and occupational health community through out Wisconsin.

The WI FACE database surveillance data and in-depth investigation findings were utilized to develop and implement targeted interventions. While all types of occupational fatalities were addressed, particular attention has been given to youth worker fatalities. In 2004-2005 two journal articles were published regarding youth fatalities and youth employment. One of the articles was distributed, along with the NIOSH Youth Worker Alert to schools and in 2005, a survey to evaluate the impact was sent to 530 school nurses in the state. More than 75% of the respondents stated the article increased their understanding about child labor laws, improved their knowledge of safety training and helped them identify areas in their school or community where they can promote safety with youth. Over 60% stated they shared the information from the article with their colleagues further demonstrating the effectiveness of this approach to reach a large number of adults that have important roles in the safety and welfare of young people.

Furthermore, in 2003, youth worker materials and the NIOSH Youth Worker Alert were mailed to 700 Wisconsin Work Permit officers. Feedback from this mailing was positive, indicating the officers considered the information to be new and valuable to their programs. Similarly, in 2004, the NIOSH Youth Worker Alert was sent upon request to a job center for inclusion in their employer packets. Finally, WI FACE program personnel regularly attend the annual Wisconsin Farm Technology Days involving 40,000-60,000 attendees. Materials are distributed from display booths at this event.

In addition to the dissemination of documents, program personnel made twenty-one presentations to various groups in order to promote worker safety and bring attention to the WI FACE program. Sample presentations are found in Appendix-C. In addition to the several in-

state presentations, “Preventing Young Worker Fatalities” was presented at the annual National Occupational Injury Research Symposium in Pittsburgh, PA.

As another measure of the program’s impact, WI FACE efforts have directly influenced important policy changes. One such change was the use of marker posts at the ends of culverts for the safety of maintenance and survey personnel in highway work zones. Additionally, the program partnered with the WI Department of Transportation to address seatbelt use among workers who drive as part of their work duties. WI FACE focused on addressing a seat belt requirement for employed youth. This work resulted in a 2003 Wisconsin law that requires all drivers to use a seat belt, and a 2005 ruling that allowed law enforcement to stop a driver that was not wearing a seat belt. The successes of WI FACE were a direct result of ongoing, comprehensive surveillance of work-related fatalities linked to the development of effective intervention strategies.

The true effect of these many and varied interventions will only become apparent over time, most likely indicated as decreases in the number of associated fatalities. With the discontinuation of WI FACE program funding, personnel dedicated to surveillance and interventions have assumed different responsibilities. Thus, the surveillance system will not continue at its current capacity, interventions are minimal, and it will be difficult to fully evaluate the impact of the program’s earlier efforts as they are realized in the future.

Objective 4: The Wisconsin FACE Program will continue to participate in the NIOSH/ State-FACE Coordinating Committee meetings. We will collaborate with other states in common interest areas.

Effective outreach and collaboration with multiple partners have been important components of the WI FACE Program. These types of activities helped the program to keep current with existing and emerging issues, promoted the program and broadened the range for disseminating safety information to groups that might not otherwise be targeted. The WI FACE program also worked with a number of groups and programs to facilitate surveillance and outreach efforts. These groups included the Wisconsin Occupational Injury and Disease Prevention Center, OSHA Consultation program, OSHA Area Offices, Department of Transportation, Department of Workforce Development, Census of Fatal Occupational Injuries (CFOI), Bureau of Health Information and Policy, University of Wisconsin Department of Biological Systems Engineering, National Farm Medicine Center, Department of Public Instruction, and Public Health Agencies. Each of these groups served an important purpose for the FACE program and helped ensure comprehensive surveillance, effective interventions, and collegial interactions with key stakeholders. Their individual contributions are described here to provide an explanation of the system that has been established and was important to the maintenance of Wisconsin's strong FACE program.

- The Wisconsin Occupational Injury and Disease Prevention Center was a particularly important partnering committee. It consisted of representatives from a wide range of agencies that share worker injury and health responsibilities and interests. OSHA Consultation at the State Laboratory of Hygiene and the DHFS FACE program scheduled

and facilitated regular meetings, and established the agenda in response to requests of members and new issues in the state.

- While the OSHA Consultation Program was transferred to the State Laboratory of Hygiene in 2004 due to a departmental reorganization, WI FACE continued to maintain a close working relationship with the program to ensure quality surveillance and effective outreach activities, and utilized OSHA Consultation as a technical resource for the Program. OSHA staff provided training and resources related to new and revised standards, while FACE contributed case summary data and supporting documents in the form of Alerts, monographs, and other research and prevention materials. Additionally, WI FACE routinely exchanged information with the OSHA Area offices regarding fatalities that were within OSHA jurisdiction.
- The Department of Transportation contributed to a workgroup that strived to promote methods for preventing worker injuries in highway construction work zones, and established a relationship for continued interactions with the WI FACE program as activities dictated.
- The Department of Workforce Development served as an information and technical resource with regards to youth labor laws, and WI FACE provided them with youth worker fatality investigation reports.
- Staff from the Census of Fatal Occupational Injuries met regularly with WI FACE staff to ensure early notification to each program of workplace fatalities, and coordinated surveillance and information dissemination efforts of both programs.
- The Bureau of Health Information and Policy provided an avenue for the WI FACE program to obtain work-related fatalities death certificate information and coordinated the

annual meeting with the Wisconsin Coroner Association. The WI FACE Program Director and the CFOI Program Manager had several joint presentations of occupational fatality surveillance and determination of injury at work to the coroners and medical examiners at their annual statewide meetings in order to promote more accurate and consistent reporting on death certificates.

- Agricultural engineering specialists from the UW Biological Systems Engineering Department provided technical assistance for realistic, effective recommendations on prevention of farm injuries for WI FACE investigation reports. Agricultural Extension staff provided resources for WI FACE presentations on preventing injuries to youth farm workers.
- The National Farm Medicine Center served as a resource to WI FACE and provided information about specific farm-related fatalities.
- The Department of Public Instruction served as a liaison between WI FACE and their school personnel such as school nurses.
- A final example of the collaborative network for the WI FACE program was work with the Public Health Agencies throughout the state. The infrastructure of the public health system in Wisconsin had proven to be a valuable resource in surveillance, investigation, dissemination and evaluation activities of WI FACE. Regional Office Director Meetings, statewide meetings of local public health agency representatives, and organizations such as the Wisconsin Association of Local Health Departments and Boards have provided a venue to describe the goals and activities of the WI FACE program. Information exchanged with the public health community was also facilitated by a secure, electronic network, the state's Public Health Information Network. It is accessible to all Wisconsin

local health departments and was devised for quick and efficient methods of communication of public health issues.

In addition to the numerous partnerships, the program actively engaged a variety of audiences with in-person appearances. Presentations were made as needed to describe the program or raise awareness of specific types of fatalities and their associated risk factors. Over the past five years, WI FACE personnel made 21 presentations to various groups such as the National Occupational Injury Research Symposium (NOIRS) Conference on youth fatalities, the Annual NIOSH FACE Coordinating Council meeting about our electronic reporting system, at local monthly meetings and the American Association of Occupational Health Nurses annual meetings, and others. Presentations were usually a result of an invitation from a specific group and WI FACE accepted these invitations when it was feasible for the program schedule.

WI FACE personnel also conducted various training sessions. Approximately every other year training was provided for the County Coroners /Medical Examiners regarding the definition of a work-related injury. This assisted the county coroners/ medical examiners in completing the death certificates correctly and accurately recognizing the victim's work status. This ultimately improved the accuracy of the surveillance system as a whole. Second, the WI Safety Council invited WI FACE to provide instruction for OSHA courses. Incidents based on actual investigations were shared, including the recommendations, and discussions for preventing the risk of fatal injuries made up the bulk of the curriculum. Finally, program personnel attended various meetings to identify appropriate opportunities for collaboration and community involvement. For example, in the past five years WI FACE actively participated in the state-

based NIOSH FACE Coordinating Council. The meetings were very useful and group efforts included identifying training opportunities in targeted fatality areas.

In summary, the primary objectives of WI FACE were well integrated through our occupational fatality surveillance activities, targeted in-depth investigations to better identify environmental and human risk factors of these accidents, and appropriate intervention and outreach activities. This coordination resulted in successful completion of the program's objectives during this reporting period.

Discussion:

The objective of the WI FACE cooperative project was consistent with the goals and priorities at the national and state levels. At least two of the National Occupational Research Agenda (NORA) priority research areas were included in the scope of FACE proposal: traumatic injuries and special populations at risk. Additionally, the program addressed the state's Healthiest Wisconsin 2010 state health plan, particularly the priority areas of "environmental and occupational health hazards" and "intentional and non-intentional injury and violence."

The WI FACE program addressed the health department's goals by utilizing the strategies of enhancing prevention and early intervention efforts that improved individual, family and community health and functioning, protecting the public from environmental hazards and other risks to safety and health, and implementing systems improvements that strengthen the capacity to improve the health of the public; by improving Wisconsin's capacity to protect Wisconsin's working population from serious and fatal injuries; finally by utilizing the strategy to develop

and strengthen professional partnerships with federal, state, and local governments, tribal nations, other organizations, communities, and providers of service.

During the last five years, the WI FACE program established a broad network of partners to support a comprehensive surveillance and outreach system for occupational fatalities. The data were collected and maintained in a comprehensive database. This information guided the selection of events to record in formal investigative reports and alerts that were disseminated to critical partners, and also made available to the general public via the web. Other appropriate interventions and outreach activities were conducted as required by the cooperative agreement.

The impact of all these activities over the full 25 year life of the program likely translated to lower fatality rates compared to the national average and also compared to previous years in Wisconsin. Specifically, the age adjusted work-related fatality rate for Wisconsin was less than 2.0 per 100,000 (2000-2005), which is lower compared to previous periods (1980-1995 and 1991-1999; 4.5 & 2.8 per 100,000 respectively). Wisconsin had almost half the national work-related fatalities rate (4/100,000) during the last five years of WI FACE program. Also Wisconsin had much lower fatalities rate compared to several other states including Alaska, Wyoming, and Montana (NIOSH, 2004).

In addition to the impact at the state level, the WI FACE program contributed to the objectives specified in the DHFS 2000-2005 Strategic Business Plan, Healthy People 2010: National Health Promotion and Disease Prevention Objectives, and the NORA priority research areas. The FACE targeted surveillance data were part of the national fatalities surveillance conducted by NIOSH.

In-depth investigations provided valuable detailed event information for national fatality research. This information was part of the national data collection for the epidemiological research of occupational fatalities and preparation of educational materials & guidelines for prevention of similar incidents in future. The impact of funding discontinuation for the WI FACE program will not only affect the health and safety of the state's work force but also the national epidemiological research, education and prevention activities for occupational fatalities.

Publications:

- 1) Doloris N. Higgins, RN, MS, COHN-S, Jeanette Tierney, RN, BSN, COHN-S, and Lawrence Hanrahan, PhD. Preventing Young Worker Fatalities. *AAOHN Journal*. 2002; 50 (11):508-514.
- 2) Doloris N. Higgins, RN, MS, COHN-S, Jeanette Tierney, RN, BSN, COHN-S, Meredith Lins, RN, BSN and Lawrence Hanrahan, PhD. School Nurses: A Resource for Young Worker Safety. *The Journal of School Nursing*. 2000; 20:317-323.
- 3) Lawrence Hanrahan, PhD, Dee Higgins, RN, Linda Haskin and Henry Anderson, MD. Project FACE: Wisconsin surveillance of fatal occupational injuries. *Wisconsin Medical Journal*. 1992; Jan; 91(1):43-46.

Appendices:

Appendix-A: Summary report of 35 investigations with key recommendations.

1) Youth Restaurant Cashier Shot to Death during Attempted Robbery: A 16-year-old female restaurant cashier (the victim) died when she was shot in the head during an armed robbery attempt. The victim was the daughter of the co-owners of the small Asian food restaurant where the incident occurred. She worked there when not attending high school, and assisted with most of the business activities including food preparation, receiving customers' food orders, and tending the cash register. At the time of the incident, she was standing behind the service counter, near the cash register. Her father was in the back of the restaurant, out of view of the customer area, and her mother was standing next to her. A man entered the restaurant, went directly to the counter, then pointed a handgun at the victim's head and demanded money. Almost immediately after the demand, the gun fired in the victim's face. She collapsed to the floor, and the assailant ran from the building. When he heard the gunfire, the victim's father pushed the button to notify the security company while the victim's mother called for emergency services. The EMS and police responded. The victim was transported by ambulance to the hospital, where she was pronounced dead.

Key Recommendation(s): To prevent similar occurrences, employers should develop and implement violence prevention programs in each workplace and arrange appropriate treatment for victimized employees.

2) Youth Farm Worker Pinned Under Overturned Horse-Drawn Manure Sled: A 16-year-old male farm worker (the victim) died when a horse-drawn sled loaded with manure overturned on him. The victim had driven the horses with the sled to a snow-covered hillside about a half-mile from the farmstead to spread the load of cow and horse manure. He was in the wooden box that was piled high with manure, using a pitchfork to throw it out the back of the box. The long rectangular box sat on the cross braces attached to the sled runners. (Figure 1) Wooden dowels projected up from the cross braces and through the bottom of the box to prevent the box from shifting side-to-side. Apparently, the box tipped sideways off the runners, trapping the victim under the load and the box. When the horses returned to the farmstead pulling the sled runners, the victim's family went to the field and found him under the box. They removed the box and went to a neighbor's house to contact authorities. The coroner, EMS and sheriff responded. The coroner pronounced the victim dead at the scene.

Key Recommendation(s): Farmers who use box sleds should design and build the sled box with secure attachments to the runners ensure the loaded sled box maintains a low center of gravity

3) Farmer Dies When he is Pinned between Bucket and Frame of a Skid-Steer Loader: An 87 year-old dairy farmer (the victim) was pinned between the bucket and frame of a skid-steer loader after the bucket lowered while he was entering the machine with the bucket raised. The victim had been working with his son and grandson (co-workers) on the family farm, using a skid-steer loader to haul rocks from a cornfield to the rock pile in a wooded area at the edge of the field. After the last load of rocks was loaded into the bucket of the loader, the co-workers left the field to deliver a truck to another field. They planned to meet the victim at the farmyard after he dumped the load of rocks. The victim drove the loader to the rock pile, and exited the loader for an unknown reason with the bucket raised. It was his habit to exit and enter the loader this

way, because knee and hip pain made it difficult for him to climb over the bucket. While returning from the second field, the co-workers noticed the loader was still at the rock pile, with blue smoke rising in the area. They went to the loader and saw the victim on the ground in front of the loader, pinned between the bucket and frame. The loader engine was still running, so they turned it off and checked the victim for signs of life. Although he appeared lifeless, they left the bucket in place to avoid causing additional injuries. Then they drove to the farmyard to call for emergency services. They immediately returned to the scene and directed EMS responders and sheriffs to the victim's location. An EMS responder started the loader engine and raised the bucket so the victim could be removed. EMS workers called for air ambulance services, which arrived within twenty minutes. The victim was pronounced dead at the scene by a physician from the air ambulance.

Recommendation(s): The FACE investigator concluded that, to prevent similar occurrences, farmers should enter or exit a skid-steer loader only when the bucket or other attachment is on the ground, or when lift-arm supports are in place. Seek and use the services of organizations and agencies that provide technical assistance and/or adaptive equipment to agricultural workers with physical impairments. Carry personal communication devices when working in remote worksites. In addition, farm family members should develop an action plan for first response to emergencies.

4) Beef Farmer Pinned Under Overturned All-Terrain Vehicle: A 50-year-old male farmer (the victim) died when he was trapped under a six-wheel all-terrain vehicle (ATV) that overturned on a hillside where he was repairing fences. The vehicle was equipped with a raised cargo box where he carried his tools and supplies (Figure 1). The vehicle apparently struck a small hay bale that was partially hidden in the grass on the uphill side, and rolled over sideways down the hill. The victim either jumped or was tossed from the vehicle as it overturned, and was pinned underneath. ATV's, including this model, are not equipped with ROPS or a seatbelt. When the victim did not return to the farmhouse for dinner as expected, his family searched the farm area but did not locate him. He frequently helped neighbor farmers with their work, so the family assumed he might be involved in a task off the farm and stopped searching for him. When he didn't return the next morning, they resumed their search and found him beneath the vehicle. Emergency services were summoned, and were onsite within six minutes. The coroner pronounced the victim dead at the scene. DNR conservation wardens were also summoned to determine if state all-terrain-vehicle (ATV) requirements applied to the incident.

Recommendation(s): To prevent similar occurrences, farmers and other employers who use off-road utility vehicles should select a non-ATV utility vehicle with ROPS and designed to maintain a low center of gravity. Conduct a thorough evaluation of the terrain to identify hazards in the pathway prior to beginning an operation with an off-road vehicle.

5) Youth Newspaper Delivery Person Killed When he Fell out of the Open Door of a Minivan and was Run Over: A 9-year-old male newspaper delivery person (the victim) died after he fell out of an open door of a moving minivan and was run over by the vehicle. The victim was seated in the rear seat on the passenger side of the vehicle that was being driven by his stepfather (the driver). At each paper box stop, the victim would step out of the minivan to place an advertising newspaper in the paper boxes mounted on posts on the edge of the road. He usually did not use a seat restraint or lock the door after returning to the vehicle and riding to the next stop. On the afternoon of the incident, the victim had placed newspapers in the paper boxes

of an unknown number of residences in a suburban community. He was in the vehicle and had the next paper in hand after placing a paper in a box, when the driver told him to close the door. The vehicle began to move forward, when the door swung open and the victim fell out. The rear wheel of the van ran over him before the driver could stop. Emergency services were summoned and were at the scene within four minutes. The victim was transported to a hospital, where he died the following day.

Recommendation(s): Employers should develop and enforce safety policies that require workers who are in motor vehicles to keep all doors closed and locked whenever the vehicle is in motion. Know and comply with child labor laws which exclude employment of youths in occupations which are deemed detrimental to their health or well-being by the Secretary of Labor or state legislatures. Additionally, agencies responsible for setting standards for highway safety should develop and enforce requirements for all occupants of moving vehicles to use occupant restraint systems whenever the vehicle is in motion.

6) Construction Laborer Killed When Run Over by Dump Truck in Highway Work Zone: A 20-year-old construction laborer (the victim) died of injuries he received from being run over by a dump truck in the activity area of a highway work zone. This was a large project, where the main contractor was a bridge-building company and the employer, a road construction company, was a sub-contractor. Road traffic was diverted with a lane shift, so the activity area was free of non-construction related vehicular traffic. The employer was laying a new road at the site of a new freeway overpass. The dump truck driver was self-employed, and was subcontracted by the road construction company to transport and dump loads of gravel on the road construction site. Just prior to the incident, the truck had dumped a load of gravel in the area being prepared for paving. A grader operator was in a grader in line with the path of the gravel truck, waiting for the gravel to be dumped in front of him so he could spread the load. After dumping the load, the truck operator drove forward, lowered the dump box, and began to back up. As the truck began to back up, the truck driver steered the vehicle to the left to avoid backing into the grader behind him. The truck's back-up lights and alarms were working, and the driver was watching the mirrors on both sides of the truck. At the time of the incident, the victim was pounding stakes into the ground adjacent to where the truck had been laying the gravel. The changing path of the dump truck brought the victim into the truck's path. The victim, wearing a traffic safety vest, was crouching down with his back to the easterly direction from which the truck was backing, moving west as he pounded stakes. He stepped into the lane where the truck was backing, apparently unaware of the truck's presence. The grader operator glanced to the side, saw the truck as it struck and began to pass over the victim, and tried to alert the truck driver by radio. The signal didn't go through to the driver's radio. At about the same time, the truck driver turned to look forward through windshield and saw the victim's body lying in the gravel in front of the truck. He jumped out of the truck and yelled to other workers in the area to call for emergency services. Although the incident occurred in a metropolitan area, it took extra time for the emergency vehicles to locate the scene and the victim due to traffic changes caused by the construction. The medical examiner pronounced the victim dead at the scene.

Recommendation(s): To help prevent similar occurrences, road builders should develop an internal traffic control plan (ITCP) that project managers can use to coordinate the flow of construction vehicles, equipment, and workers operating in close proximity within the activity area, especially on large and multi-contractor jobs. Design the workflow to minimize backing

heavy equipment. Ensure that a person is designated as a spotter to direct trucks that must back up within highway construction sites. Consider equipping vehicles with devices to detect the presence of individuals or objects behind backing vehicles. In addition, EMS providers should conduct practice runs to road construction sites that have altered the normal traffic patterns.

7) Youth Camp Counselor Dies of Carbon Monoxide Poisoning: A 15-year-old male camp counselor (the victim) died of carbon monoxide poisoning when the furnace malfunctioned in the cabin where he was sleeping. The victim had worked as a counselor at the camp for nine weeks, and then planned to stay an extra week after the camp closed in late summer to assist with clean-up. On the night of the incident, he was the only person assigned to sleep in the building that housed the health services. The wood frame building had a furnace room which housed an LP gas fueled furnace and LP gas fueled water heater the water heater was used continuously throughout the summer, while the furnace was only used infrequently and for brief time periods. There were no records to indicate when the furnace and water heater had been inspected or repaired. Smoke detectors were located on two opposite ends of the building, which held sleeping quarters for four people. There were no carbon monoxide detectors in the building. The victim went to the building about 8:30 p.m. the eve of the incident, and turned on the furnace before he went to bed. He kept the windows and doors closed. When the victim didn't show up for breakfast the next morning, a supervisor went to the building and found him motionless in bed. Emergency services were summoned, and EMS arrived at the scene within 25 minutes. The first responders found no signs of life in the victim, and then exited the building until the sheriff arrived. The sheriff viewed the scene and determined there were no signs of foul play. The coroner was called to the scene, and pronounced the victim dead.

Recommendation(s): Employers should ensure that gas fueled appliances are installed and maintained to prevent production and buildup of carbon monoxide. Ensure gas fueled appliances are inspected on a schedule recommended by the manufacturers by knowledgeable technicians with authority to make changes. Install carbon monoxide detectors in buildings with gas fueled appliances. Additionally, emergency workers who respond to the scene of an unexplained death should be trained in the hazards of an asphyxiating environment and methods to protect themselves during rescue and recovery efforts.

8) Youth Newspaper Delivery Assistant Dies in Motor Vehicle Collision: A 17-year-old male newspaper delivery assistant (the victim) was a passenger in an automobile that burst into fire after it was struck from behind by another vehicle. The victim was seated in the front passenger seat of the auto driven by a newspaper carrier (co-worker) who employed the youth as a casual worker to assist with the driver's daily newspaper delivery route. The incident occurred shortly after sunrise while the co-worker was pulling the vehicle off a two-lane county road. She was traveling at about 5 miles per hour, and steered the auto partially onto the shoulder of the southbound lane. Neither the victim nor the co-worker was wearing seatbelts at the time of the collision. An automobile was traveling at about 55 miles per hour in the southbound lane and struck the back of the newspaper delivery workers' auto. The impact pushed the workers' auto into the ditch and caused it to overturn onto the driver's side and burst into flames. The victim was tossed into the back seat by the collision, and the co-worker was ejected from the passenger side window. A resident of a house situated near the collision site ran outside when she heard the crash. She saw the co-worker lying in the road in front of the burning car, and pulled her away from the flames. A driver in another vehicle saw the burning vehicles from his rear-view mirror

and summoned emergency services with his cell phone. The sheriff arrived at the scene within four minutes, followed by the fire department and EMS. After the flames were extinguished, the victim was extricated from the vehicle. He was pronounced dead at the scene. The drivers of both vehicles survived the collision, and were taken to the hospital.

Key Recommendation(s): Employers should equip vehicles that must travel slowly and/or stop frequently with high-visibility flashing lights that can be seen from all directions. Confirm if such equipment is allowed under state law in the jurisdiction where the employer is operating. Ensure all travelers are trained in the proper use of vehicle safety features and drivers are trained in safe driving practices. Additionally, agencies responsible for setting standards for highway safety should develop and enforce requirements for all occupants of moving vehicles to use occupant restraint systems whenever the vehicle is in motion.

9) Farmer Dies When He is Pinned under Drawbar While Fueling Tractor: A 91 year-old beef farmer (the victim) was pinned under the drawbar of a farm tractor after fueling the tractor while standing on a stepladder. The fuel cap was located on top of the tractor, about 65 inches high, midway from the front to the operator's seat. The farmer's habit was to place a 4-foot ladder on the tractor body in front of the left rear tire, climb two or three steps with the fuel pump in hand, remove the cap, fill the tank, replace the cap, and climb down the ladder. On the day of the incident, he apparently replaced the cap after adding the fuel, and fell toward the tractor wheel, striking the shift lever and throwing the tractor into a forward gear. As the tractor began to roll forward, the victim and the ladder rolled up and over the left fender and fell upside down. The victim was caught between the left rear wheel and under a drawbar attachment, while the tractor rolled forward about 6 feet until it was stopped when it struck a block wall (figure 1). The victim was found by his sister-in-law, who went to the farm to investigate when the victim did not answer phone calls for several days. She immediately called for emergency services and notified the victim's neighbor and brother. EMS responders and the sheriff arrived within 15 minutes. The coroner was called, and pronounced the victim dead at the scene.

Recommendation(s): Farmers should shift the tractor into park, set the brakes and turn off the engine before dismounting from the tractor. For tractors without a park position, farmers should shift into neutral, set the brakes and turn off the engine before dismounting. Seek and follow medical advice and take precautions to prevent falls if they have medical conditions that could cause loss of balance.

10) Youth Reserve Recruit Killed in Automobile Collision While Traveling on Duty: A 17-year-old Marine reserve recruit was killed when the car in which he was riding slid out of control on an icy rural highway into an oncoming vehicle. The victim and three other recruits, including the 17-year-old driver, were driving 90 miles to a training center for their one-weekend-a-month training. All occupants were wearing lap and shoulder restraints and the car had front airbags for the driver and passenger.

Recommendation(s): Although this might not apply to the military, employers generally should establish policies and procedures to determine the necessity of having workers travel during inclement weather or poor driving conditions. Employers should also check state and federal laws governing the operation of motor vehicles by workers under age 18 and the conditions in which such operation is permitted.

11) Snowmobile Mechanic Dies When He is ejected from Snowmobile Operator's Seat and Strikes a Tree: A snowmobile mechanic employed by a sales and service shop was killed while testing a snowmobile on a public trail. He apparently hit a snow bank at high speed, flew off the seat and skidded down the trail, and eventually hit a tree along the edge of the trail. He was wearing a helmet and was a snowmobile safety instructor.

Key Recommendation(s): Outdoor testing should be done at speeds appropriate for the trail, or else moved to an area without obstacles. A complete slower-speed lap (down the trail and back) should be made to identify hazards prior to higher speed testing.

12) Farmer Dies When Skid Steer Loader Overturns: A farmer operating a skid-steer loader on an uphill slope with the bucket raised was killed when the loader overturned to the rear and he was thrown against back of the rollover protective structure (ROPS), dying of positional asphyxia.

Key Recommendation(s): Operators should always have the restraint bar in place and the seatbelt fastened during operation. The bucket should be kept low during travel to keep the center of gravity low.

13) Hispanic Laborers Drowned In Pond on Golf Course: Two Hispanic laborers employed at a golf course died when their canoe capsized while trying to sink a tire in a course pond. The course had a fishery license, had stocked the pond with fish, and had constructed an underwater fish crib using old tires, but a tire had floated to the surface and was to be cut and resunk.

Key Recommendation(s): Workers on or above water should always wear personal flotation devices. Stable boats, not canoes, should be used for work on water.

14) Farmer Dies When Pinned Between Arm and Frame of a Skid Steer Loader: A farmer changing the attachment on a skid-steer loader died when the loader arms descended and pinned him against the loader. He was operating the loader while standing on the ground in front of it, beneath the raised arms.

Key Recommendation(s): Operators should always operate the loader while seated, with the restraint bar in place and seat belt fastened. Work should never be performed beneath raised loader arms without a safety support in place to prevent the arms from descending.

15) Youth Killed in Tractor Roll-Over While Moving Large Hay Bales: An 11-year-old boy was killed when his tractor overturned while moving large round hay bales scattered around a field to one location in that field for later loading onto a truck.

Key Recommendation(s): A tractor with a rollover protective structure (ROPS) and seatbelt should always be used unless in a low-clearance area. The seatbelt should be worn, to keep the operator within the zone of protection during an overturn.

16) Farmer Killed When Kicked By Horse: A farmer died after being kicked in the head and chest by a horse while currying it inside a dimly-lit barn. Apparently the horse had suffered a leg injury unnoticed by the farmer, and kicked when the curry brush contacted the sensitive area.

Key Recommendation(s): Adequate lighting should be used in all work areas to enable workers to spot hazards, such as an injury to an animal.

17) Farmer Fell Into Auger of Manure Spreader While Scraping the Tank: A farmer died after falling into a V-tank manure spreader while scraping down the inner walls with the auger running. Apparently he was standing on a tire while scraping and slipped or fell into the spreader.

Key Recommendation(s): The power take-off (PTO) and engine should always be turned off while working on machinery. Because scraping down a spreader is common, a stable place should be provided from which to scrape the inner walls of a tall spreader.

18) Laborer Dies After Being Struck by Detached Excavator Bucket: A construction laborer died in a trench when he was struck by an excavator bucket that became detached from the excavator and fell on him in the trench. The excavator operator had just changed buckets, and when the excavator boom was raised to begin work, the bucket detached and rolled into the trench.

Key Recommendation(s): Locks on quick-disconnect equipment should be maintained and/or retrofitted according to manufacturers' specifications and recommendations. Excavator operators should conduct visual and operational checks following attachment changes, away from workers, prior to resuming work. Workers should not enter the swing area of an excavator without acknowledgement from the operator that it is safe to enter.

19) Youth Newspaper Carrier Dies after Being Struck by an Automobile While Delivering Newspapers on a Bicycle: A 12-year-old boy was killed while delivering newspapers on a bicycle. He came out of a driveway onto a busy street in front of a car and was struck. He was apparently somewhat behind schedule, although the employer did not think he was rushing.

Key Recommendation(s): All bicycle carriers should wear bicycle helmets, to prevent or mitigate injury when possible. Carriers should be regularly reminded through employer meetings and by parents or guardians of hazards, safety rules, and safe procedures, including not rushing.

20) Youth Dies in Tractor Rollover Attempting to Pull Trailer Out of Mud: A 15-year-old boy was killed when the tractor he was driving overturned as he attempted to pull a stuck trailer out of the mud. He had attached a chain between the rear of the tractor and the trailer when the tractor overturned to the rear.

Key Recommendation(s): A tractor with a rollover protective structure (ROPS) and seatbelt should always be used unless in a low-clearance area. The seatbelt should be worn, to keep the

operator within the zone of protection during an overturn. Operators should be trained on proper and safe procedures for hitching and pulling stuck machines.

21) Hispanic Painter Dies after Falling From a New House Roof: A Hispanic painter died from falling 20 feet from the edge of a roof to the ground. He had been assigned to ground-level work but had climbed a ladder placed for coworkers to paint at higher levels. He was wearing worn, smooth-soled shoes.

Key Recommendation(s): A fall protection program, including training and proper equipment, should be implemented. Supervisors should be sure workers not only know their assignments but also know assignments they are not authorized to undertake or places they are not allowed to be.

22) Hispanic Laborer Dies after Falling Through Roof of Old Building: A Hispanic worker for an asbestos-abatement company fell through a weak spot in the roof of a building undergoing renovation. The company crew had planned to work on windows and not the roof, but its supervisor (not the owner) was told to work on the roof by the general contractor. The asbestos-abatement company had a comprehensive, well-implemented safety program, but the appropriate safety equipment for known weak areas of the roof was not yet present due to the change in plans. Fall protection equipment was not worn at the time of the incident due to a misunderstanding of where the workers would be.

Key Recommendation(s): Supervisors should be given clear authority to refuse to work in unsafe areas or in areas for which their crews are not prepared at that time. Supervisors and employers should communicate clearly on hazardous areas to be avoided or for which safety equipment must be worn.

23) Farmer Dies When Pinned Between Frame and Bucket of a Skid Steer Loader: A farmer died while working beneath the raised bucket of a skid-steer loader, possibly performing repairs. The arms descended and pinned him against the front of the loader.

Key Recommendation(s): Operators should never enter or exit the loader with the bucket raised. Work should never be performed beneath raised loader arms without a safety support in place to prevent the arms from descending.

24) Dairy Farmer Dies 15 Days After All-Terrain Vehicle Rolled Over Him: A farmer died from injuries sustained when the four-wheel ATV he was operating to check fences overturned and rolled down a 20-foot embankment. He had chosen to drive over a small tree that was growing from a stump in the old loggers' path he was following, and instead of being crushed; the tree started the ATV overturning.

Key Recommendation(s): ATV operators should not travel on rough terrain or attempt to drive over obstacles without clearly understanding the capabilities and limitations of their machine. They should wear helmets. An off-road utility vehicle with ROPS is generally a safer alternative on farms.

25) Farmer Dies When Skid Steer Loader Rolls Over Him After It Plunged Over Edge of Bluff: A farmer died when his two-month-old skid-steer loader overturned and rolled down a bluff as he was filling in ruts on a dirt field road at the top of the bluff. He apparently backed too close to the edge, and was ejected from and rolled over by the loader as it tumbled down the bluff. The loader was found with the safety restraint bar up (out of position) and the seat belt unfastened.

Key Recommendation(s): Operators should always keep the safety restraint bar in place and the seatbelt fastened during operation, to stay within the zone of protection provided by the ROPS.

26) Farm Worker Dies When He Falls From Tractor Seat: A farm worker was killed after falling from the tractor he was operating. He had a medical condition that could cause sudden episodes of weakness or unconsciousness, and may have had a medical emergency that caused him to stop the tractor prior to his fall.

Key Recommendation(s): Tractors should be equipped with a ROPS and seatbelt to prevent falls. Medical conditions must be evaluated to decide if safety of the worker or others is endangered.

27) Amish Carpenter Dies after Falling from Scaffold: An Amish carpenter died after falling 11 feet from a mobile scaffold that was struck by a skid-steer loader. The loader was lifting trusses on a windy day on icy concrete and slid into the scaffold.

Key Recommendation(s): Personal fall arrest systems should be used on mobile scaffolds.

28) Laborer Dies when Crushed Between Forklift Cage and Mast: A forklift operator was killed after falling from an elevated load into the area between the mast and ROPS and contacting the control that caused the mast to tilt backwards toward the forklift and pin him. He was stacking bundles of lumber, apparently noticed that a spacer was missing between bundles, and had climbed up the forklift to the elevated bundle to replace it when he fell.

Key Recommendation(s): Forklift operators should follow proper procedures and safety standards for dismounting. They should also follow proper procedures and standards for load manipulation, unloading, and stacking.

29) Farmer Dies When Tractor Rolls Over on Sloped Terrain: A farmer died when his tractor rolled over in his barnyard while maneuvering to position a manure spreader. The farm was on sloping terrain and the tractor operator had to maneuver in tight quarters by coming downhill and then turning uphill.

Key Recommendation(s): Tractors should be equipped with a ROPS and seatbelt to protect the operator in case of an overturn.

30) Farmer Dies When He Is Pinned Under His Tractor That Rolled Over on an Incline: A farmer died when his tractor overturned while spraying weeds along a fence line on a hillside.

Key Recommendation(s): Tractors should be equipped with a ROPS and seatbelt to protect the operator in case of an overturn.

31) Snow Plow Driver Dies When Caught in Auger of Salt Spreader: The driver of a truck-mounted snow plow and salt spreader died after his clothing became entangled in the auger of the salt spreader. The salt spreader replaced the tailgate of a dump body and had an aggressive cross auger to break up and move salt to the spinner located at one corner. Apparently he had entered the dump body to break up clumps of salt or ice.

Key Recommendation(s): The machine drive and engine should always be shut off and prevented from being restarted prior to working on a machine.

32) Hispanic Butcher Dies After Being Struck By Semi-Trailer Gate: A Hispanic butcher in a livestock rendering plant was killed when struck by a falling tailgate of a semi-trailer during removal of a dead animal. The tailgate was supported in the raised position by an overhead cable with loops on each end that were looped over the tailgate locking pins on each side. Apparently one of the loops had slipped off a pin.

Key Recommendation(s): A positive method of securing the cable to both tailgate pins should be used to prevent the cable from slipping off. Instead using one cable with loops on each end, two separate cables could be used, one per side, so that loss of support on one side would not result in total loss of support.

33) Car Carrier Truck Driver Dies When Crushed By Ramp of Car Carrier: The driver of an open, 10-vehicle car hauler truck died when pinned between a car on the lower level and an overhead ramp that was inadvertently lowered. The ramp controls are designed to be operated from outside the carrier, but the driver was inside the carrier checking tie down chains when he inadvertently contacted the controls.

Key Recommendation(s): Ramps should always be pinned in place prior to entry into the carrier. Controls should be fully guarded to protect against inadvertent contact or operation from inside the carrier.

34) Maintenance Worker Dies After Pinned Between Overhead Bridge Crane and Roof Truss: A 55-year-old maintenance worker (the victim) was pinned between an overhead bridge crane and a roof truss. The victim was part of a two-man maintenance team that ascended 20 feet up a ladder and climbed onto a 30-ton Whitney bridge crane. The victim and another maintenance man were going to adjust the brakes on the 5-ton hoist on the crane. While the operator of the Whitney crane had his back turned from the controls, a second operator came over and moved the crane. He did not know that the victim and another maintenance man were working on the crane above. The first operator realized what was happening and yelled to stop the movement, but it was too late. Management notified the Emergency Medical Services (EMS) at 8:28 a.m. EMS arrived at 8:31 a.m. The conditions the rescue personnel worked in included extreme heat, poor illumination, noise, and the accident site that was located over 25 feet above them.

Key Recommendation(s): Employers should ensure that employees follow proper lockout tagout procedures on machinery before performing any repair, maintenance, or adjustments. Ensure that the employer conducts annual or more frequent inspections of the energy control procedures. Ensure that all controls are placed at the off position when adjustments and repairs are started on cranes. Also ensure that warnings or “out of order” signs are placed on the cranes as well as on the floor beneath or on the hood where they are visible from the floor.

35) Machine Operator Dies When Struck By Flying Wood Chipper Guard: A 56-year-old machine operator (the victim) died after he was struck by a flying guard from a wood chipper. The victim was working alone when he shut down the chipper. The chipper was a machine used to reduce wood edging and other wood waste into wood chips. The victim shut down the chipper and the blade continued to rotate for up to thirty minutes. The victim was found by one of the sawmill partners at approximately 6:00 p.m. The partner notified Emergency Medical Services (EMS) at 6:11 p.m. They arrived at 6:17 p.m. The EMS took the victim to the hospital located 20 to 25 miles away, at 6:23 p.m. The local EMS requested a paramedic intercept with a larger, better trained and more experienced crew. The EMS arrived at the hospital at 6:46 p.m. A doctor in the hospital declared the victim dead at 6:57 p.m.

Key Recommendation(s): Always ensure that guards are properly replaced or repaired. Ensure that rotating machine blades are stopped and hazardous energy is dissipated before blade removal begins. Ensure that workers are trained to recognize the hazards associated with working near or around rotating chipper blades. There should be an implement an effective Lockout Tagout program that at a minimum, meets standards set by the Occupational Safety and Health Administration (OSHA) in General Industry Regulation 29 CFR 1910.147.

Appendix B: Brief descriptions of the alerts with key recommendations.

1) Conveyor Equipment in Two Separate Incidents: Incidence #1: A 52-year-old male machinist died when he was pinned between a turnstile arm and a projecting metal beam on a conveyor system down-ender table. There were no guards in place at the pinch point between the beam and the turnstile arm. The worker paused the automatic cycle to manually push a metal coil from a turnstile to the down-ender, and then returned the system to the automatic cycle. He returned to the turnstile area, and apparently forgot the machine was cycling. A supervisor heard the victim yell, and then saw he was pinned. He went to the control panel and unsuccessfully tried to retract the beam. He then cut the hydraulic line to retract the beam and free the victim. Incidence #2 A 46-year-old male utilities worker died after being pinned by a belt conveyor at a paper company. The conveyor started and stopped automatically as fuel was needed by the company's steam plant. The victim apparently entered the enclosed area where the conveyor pulley was located to tighten the conveyor belt. He either stepped or fell onto an unguarded section of the moving conveyor belt, and was pinned between a wall and the metal chute frame that extended over the belt. A coworker found the victim after searching for him when he did not

take his lunch He used a radio phone to contact the control room and emergency medical services.

Recommendations: Employers who use conveyor systems should install guards on conveyor systems wherever workers may have contact with the moving parts and lockout/tagout programs cover all workers while they work near moving equipment.

2) Farmer Dies after Being Pinned Between Bucket and Frame of Skid Steer Loader:

A 70-year-old dairy farmer died after being pinned between the bucket and frame of a skid steer loader. The victim wore a knee brace while he worked, but found it difficult to climb in and out of the operator's seat. The victim and his son worked together throughout the morning of the incident, doing routine farm chores. When the victim finished cleaning the barn with the loader, he drove the loader behind a machine shed to remove a part from an old manure spreader, using the loader bucket to lift an edge of the spreader. Apparently, the victim lowered the safety bars, exited the loader with the bucket in the raised position, and then stood in front of the loader frame to operate the bucket control handle. The bucket came down and pinned the victim against the frame of the loader. The victim's son saw him pinned by the bucket, and climbed into the cab to raise the bucket. The son ran to the house and yelled to his mother to call for emergency services.

Recommendations: Farmers and other skid steer loader operators should remain seated in the operator's compartment while operating the loader and operate the loader with the seat belt fastened and restraint bar in place. In addition, skid steer operators who have difficulty getting onto the operator's seat should: · contact the county extension office to locate organizations and agencies that help farmers and other workers with conditions that limit their mobility.

3) Logger Dies After Log Skidder Rolls Downhill and Strikes Him While Felling A Tree: A

37-year-old male logger died after being struck by a log skidder. The skidder was over 20 years old and had originally been equipped with a mechanical brake system. The mechanical brake was replaced by a micro lock brake system. The victim was felling trees on a slope with a 20% grade. He parked the skidder about 20 feet uphill in line with the tree he was felling. He engaged the micro lock system, kept the motor running, and positioned the blade near the ground. Apparently, the brakes failed and the skidder rolled downhill, striking the victim with the rear wheel and crushing him against the tree. The co-worker heard the victim's cries for help and ran to the scene. He tried to use his CB radio to call for help, but it didn't work. The co-worker drove his own skidder to the victim, placed him in the skidder, and then drove the skidder to his truck. He carried the victim to the truck's passenger seat, and then drove almost 15 miles to the hospital. The victim died at the hospital.

Log Skidder Checklists: Maintain brakes according to manufacturer's specifications. Don't skid across a steep slope; always skid up or down a slope. On steep-sided hills, avoid abrupt uphill turns. Back downhill, and then go straight uphill. If it is necessary to park on a hill, set the brake and drop the blade. Use a tree or high stump for added bracing.

4) Two Farmers Die As A Result Of Failure to Turn Off Machines during Repair:

Incidence #1: A 24-year-old male farmer died after becoming entangled in the unguarded

rotating driveline shaft of a manure spreader. The spreader was connected to a tractor equipped with a power take-off (PTO), which powered the spreader driveline. The victim was working alone in the barnyard, replacing a bolt on the shaft. He apparently completed this task and was standing on ice covered soil near the rotating driveline. He either slipped or fell onto the driveline or his clothing was caught and pulled by protruding parts of the rotating shaft. He was spun around the driveshaft, and portions of his clothing were entangled on the driveshaft and torn from his body. Incidence #2: A 56-year-old male farm worker died after being struck by a flywheel of a PTO-powered hay baler. He was lying on his side under the baler, oiling a chain, while the baler was operating. A flywheel for the bale tosser cycled and struck the victim on the top of his head.

Recommendations: Farm machine/ equipment operators should disengage the PTO and stop the tractor engine before making repairs and adjustments or performing maintenance on the machines. Install appropriate guards on PTO-driven machine parts. Avoid wearing clothing that is loose-fitting or has loose ends that could be caught by moving machine parts.

5) Farmer and Landscaper Killed When Their Tractors Strike Objects In Ditches:

Incidence #1: A 36-year-old construction laborer died after the tractor he was driving struck a hidden culvert, and he was jolted from the seat and pinned under the rear wheel. He worked for a road construction company that was landscaping a highway overpass. The victim was assigned to finish up the silt fence plowing. He was jolted from the tractor seat, while the tractor continued to roll until it came to rest on his back. The tractor was not equipped with a rollover protective structure (ROPS) or seatbelts. Incidence #2: A 92-year-old farmer died after his tractor overturned and he was pinned under the seat. He had been using the tractor with a front bucket loader to grade the driveway on his property. The victim was backing the tractor into the driveway when the rear wheel hit the culvert and went into the ditch. The tractor overturned, pinning him under the tractor seat. The tractor was not equipped with a rollover protection structure (ROPS) or seatbelts.

Recommendations: Avoid using tractors that are not fully equipped with rollover protective structures (ROPS) and seatbelts; look over the terrain prior to beginning work with a tractor and mark hidden hazards for visibility.

6) Three Farmers Run Over and Killed When They Start Engines While Standing Next To the Tractor: Incidence #1: A farmer completed some repairs on a tractor carburetor. The tractor was turned off, but apparently left in second gear. The farmer was unable to climb into the operator's seat due to chronic knee pain, so he stood next to the tractor in front of the left rear tire, and turned the ignition key to start the tractor. The tractor lurched forward and knocked the victim face down to the ground, then pushed and pinned him as it moved forward. It stopped with the left rear wheel resting on his chest. He was found by a feed company deliveryman.

Incidence #2: A farmer was repairing a corn planter hitched to a tractor. The tractor was turned off, but apparently left in gear. After completing some repairs, he stood in front of the left rear tire, and used a screwdriver to cross the solenoid terminals to start the tractor. The tractor lurched forward and knocked the victim to the ground, then moved forward. The farmer was struck by the steel discs on the front of the planter and dragged until the tractor stopped. A hired hand found the farmer under the planter.

Incident # 3: A farmer was repairing his tractor while it was turned off, in gear. The farmer was unable to climb into the operator's seat due to degenerative hip disease. He started the engine while standing alongside the tractor. The tractor lurched forward, knocked him down, and ran over his legs. His son found him within 15 minutes of the incident.

Recommendations: To prevent similar occurrences, tractor drivers should: Sit in the operator's seat while starting a tractor. Place the transmission in neutral or park, set the brakes, and follow the manufacturer's starting procedure. In addition, tractor drivers who have difficulty getting on a tractor should: contact the county extension office to locate organizations and agencies that help farmers with conditions that limit their mobility.

7) Laborer Dies after Falling Through Snow-Covered Skylight on Rooftop: A 43-year-old laborer at a manufacturing company died after falling through a skylight and landing on a concrete floor 14 feet below. The victim and a co-worker had volunteered to clear snow from the roof of the company building after their regular work day was finished. A flat roof over the first story portion of the company was covered with drifted snow, which varied in depth from several inches to more than 3 feet in places. The snow completely covered the tops of skylights in this area of the roof. It is believed that the victim failed to see the unguarded, three-foot square skylight and stepped onto it while walking. The plastic bubble of the skylight broke, and the victim fell to the concrete floor.

Recommendations: Install barrier guards around skylight openings. Lock all doors that provide access to unguarded rooftops. Provide training in the recognition and avoidance of unsafe conditions to workers who are assigned tasks outside their normal duties.

8) Supervisor Crushed and Killed By Moving Parts of Injection Molding Machine: A 38-year-old supervisor died when his head was crushed between moving parts of an injection molding machine. About two weeks before the incident, a machine guard had been removed from the molding machine in preparation for a maintenance worker. At the time of the incident, the victim and a co-worker were examining the machine to determine the location of a hydraulic fluid leak. The molding machine was operating while the victim and co-worker peered into it so they could see the location of the leaks with the hydraulic hoses under pressure. The victim was bending forward into the back of the machine, with his head positioned next to a fixed metal bracket. The machine cycled automatically, causing a metal tie bar to move back and pinch his head against the bracket with about 500 pounds of pressure.

Recommendations: Maintain guards in place over machine pinch points when machines are operating. Develop and enforce specific lockout/ tagout procedures for injection molding machines.

9) Two Fatalities Result From Failure To Use Operator Restraint Systems With ROP: Incidence #1: A 45-year-old supervisor for an excavation construction company was loading a bulldozer onto a flatbed trailer when it slid sideways off the trailer. The trailer was parked with the right wheels on the sloped road shoulder and the left wheels on the paved surface. Light rain was falling, and the trailer was wet. The trailer had two ramps that led from the ground to a platform. The victim drove up the ramps and part way onto the platform. The tracks of the

machine slid sideways towards the ditch and off the trailer. He tried to jump out of the cab but was pinned beneath the cab structure when it landed on top of him. The bulldozer was equipped with a rollover protection structure (ROPS) and seatbelt, but apparently the victim was not using the seatbelt at the time of the incident. Incidence #2: An 18-year-old dairy farm worker died after the tractor he was driving overturned and he received crushing injuries from being tossed in the cab. He had almost completed raking a hay field and was turning around on a hillside with approximately 20o grade when the tractor overturned. The tractor was equipped with a rollover protection structure (ROPS) and seatbelt, but apparently the victim was not using the seatbelt at the time of the incident.

Recommendations: Always use an operator restraint system while operating equipment equipped with rollover protective structures (ROPS) and plan safe approach when driving equipment on sloping terrain. Arrange for an observer to provide verbal or signal directions when loading track equipment onto a trailer.

10) Two Fatalities Result From Improper Use of Tractors during Tree Removal: Incidence #1: A 56-year-old male part-time logger died while trying to push over a dead tree with a tractor when he was knocked off the tractor and pinned under the rear tire. The victim was operating a farm tractor with a front bucket attachment to knock down and remove trees. He elevated the bucket until it was about ten feet high, and then struck the trunk of a decayed tree with the bucket. The tree did not fall, so he struck it again with the bucket. This time, the top half of the tree cracked off and fell toward the victim sitting in the tractor seat. He was knocked from the seat and fell in front of the right rear tractor tire. The tractor came to rest with the tire on his chest. Incidence #2: A 49-year-old male part-time farmer died when the tractor he was using to uproot a small tree overturned on him. The victim was clearing an old cherry orchard that was no longer used for commercial purposes, to prepare the property for other uses. The victim attached a chain to the base of a small cherry tree, and the other end to the base of the operator's seat. He was in the operator's seat, and apparently accelerated the tractor to pull on the tree. The tractor flipped over backwards, and the farmer was pinned between the seat and the ground. His tractor was not fitted with ROPS.

Recommendations: To prevent similar occurrences, farm tractor operators should follow tractor and bucket loader manufacturers' recommendations when using a bucket. Follow manufacturer's recommendations for proper hitching techniques when using a tractor for pulling objects. Use tractors that are equipped with falling object protective structures (FOPS) when working in a situation where objects might fall on the operator. Use tractors that are equipped with rollover protective structures (ROPS) and seatbelts.

11) Youth Laborer Dies after Being Pinned Under Tractor While Doing Groundskeeping: A 14-year-old groundskeeper assistant died after being pinned under the wheel of a lawn tractor that rolled backward toward a pond on the grounds of a food processing plant. The youth was hired to provide lawn care services for the summer. He had been using the tractor, which was equipped with a mower deck, to mow grass around the pond. When the rear wheel of the tractor became stuck in mud on the edge of the pond, he apparently got off the tractor to push it from the rear. The tractor rolled backward, pinning him under the tire.

Recommendations: Tractor drivers should shift the tractor into neutral or park, set the brakes, and turn off the engine before getting off the tractor. Employers should know and comply with child labor laws which exclude employment of youths less than 16 years of age in hazardous occupations.

12) Farmer Dies After He was entangled In the Driveline Shaft of a Manure Spreader: A 24-year-old male farmer died after becoming entangled in the unguarded rotating driveline shaft of a manure spreader. The spreader was connected to a tractor equipped with a power takeoff (PTO), which powered the spreader driveline. The victim was working alone in the barnyard, replacing a bolt on the shaft. He apparently completed this task and was standing on ice covered soil near the rotating driveline. He either slipped or fell onto the driveline or his clothing was caught and pulled by protruding parts of the rotating shaft. He was spun around the driveshaft, and portions of his clothing were entangled on the driveshaft and torn from his body.

Recommendations: Disengage the PTO and stop the tractor engine before approaching the machinery to make repairs and adjustments or perform maintenance. Install appropriate guards on PTO-driven machine parts. Avoid wearing clothing that is loose fitting or has loose ends that could be caught by moving machine parts and lead to entanglement.

13) Youth Farm Worker Pinned Under Overturned Horse-Drawn Manure Sled: A 16-year-old male farm worker died when a horse-drawn sled loaded with manure overturned on him. The victim had driven the horses with the sled to a snow-covered hillside about a half-mile from the farmstead to spread the load of manure. He was in the wooden box that was piled high with manure, using a pitchfork to throw it out the back of the box. The long rectangular box sat on the cross braces attached to the sled runners. Wooden dowels projected up from the cross braces and through the bottom of the box to prevent the box from shifting side-to-side. Apparently, the box tipped sideways off the runners, trapping the victim under the load and the box. When the horses returned to the farmstead pulling the sled runners, the victim's family went to the field and found him under the box.

Recommendations: Farm workers who use box sleds should attach the box securely to the sled runners with devices that prevent it from lifting off and flatten the load and avoid standing in the box to keep a low center of gravity on the sled.

14) Utility Worker Asphyxiated When His Safety Rope Became Entangled In A Revolving Turbine Shaft: A 34 year-old victim was employed as a lineman for the city's hydroelectric utility. On the day of the incident, he was helping to repair a hydroelectric turbine, a duty outside of his regular job tasks. He and a co-worker were standing in the enclosed, concrete flume that carried river water to the turbine. (A flume is a channel for conveying water.) The victim wore a fall protection harness, attached to a rope held by a 2nd co-worker standing on the platform above the flume. Knee-high water flowed through the flume, causing the turbine's 4 1/4-inch diameter shaft to rotate about 20 rpm. The victim apparently slipped while he was repairing the turbine and fell toward the spinning shaft. His safety rope got caught on a shaft coupling, and his harness was pulled tight to the shaft. His body stopped the rotation of the turbine shaft. The co-worker cut the rope and called for help. The co-workers secured the generator wheel so the

victim could be cut loose without the wheel restarting. He was transported to the hospital, where he was pronounced dead.

Recommendations: Install a locking brake to stop the rotation of turbines when maintenance and repair is necessary. Develop and implement an energy control (lockout/tagout) program for all activities that could result in a release of hazardous energy. Train workers in the recognition and avoidance of unsafe conditions before they are assigned tasks outside their normal duties.

15) Road Construction Worker Run Over By Dump Truck: A 20-year-old construction laborer for a road construction company was pounding stakes into the roadbed next to where a dump truck had been laying gravel. A dump truck driver dumped a load of gravel, drove forward, and then backed up at an angle to avoid hitting a grader that was waiting to spread the gravel. The truck's back-up lights and alarms were working, and the driver was watching the mirrors on both sides of the truck. The victim was not in the view of the truck's mirrors. The victim, wearing an orange traffic safety vest, was crouching down with his back to the area where the truck was backing. He backed into the path of the moving truck, apparently unaware of the truck's presence. The grader operator tried to alert the truck driver by radio, but the signal didn't go through to the driver's radio. The truck driver then saw the victim's body in front of the truck. He was pronounced dead at the scene.

Recommendations: Road builders should develop and use an internal traffic control plan that coordinates the flow of vehicles, equipment, and workers within the activity area. Design the workflow to minimize backing equipment. Designate a spotter to direct vehicles that must back up within the work zone. Equip vehicles with devices to detect the presence of individuals or objects behind backing vehicles.

16) Beef Farmer Pinned Under Overturned All-Terrain Vehicle: A 50-year-old male farmer was using a six-wheel all-terrain vehicle to repair fences on a hillside. The vehicle was equipped with a raised cargo box where he carried his tools and supplies. ATVs, including this model, are not equipped with a rollover protection structure (ROPS) or a seatbelt. The vehicle struck a hay bale that was partially hidden in the grass and rolled over sideways down the hill. The victim either jumped or was tossed from the vehicle as it overturned, and was pinned underneath. When the victim did not return to the farmhouse for dinner as expected, his family searched the farm area and found him beneath the vehicle. Emergency services were summoned, and were onsite within six minutes. The coroner pronounced the victim dead at the scene.

Recommendations: Farmers and other workers who use off-road utility vehicles should select a non-ATV utility vehicle equipped with ROPS and designed to maintain a low center of gravity and conduct a thorough evaluation of the terrain to identify hazards in the pathway prior to beginning an operation with an off-road vehicle

17) Youth Run Over by Minivan while Delivering Newspapers: A 9-year-old boy died when he fell out of a minivan and was run over while delivering newspapers. He sat in the rear passenger seat while his stepfather drove from one newspaper box to another along the suburban streets. He stepped back into the minivan after placing a paper in a newspaper box, and the driver told him to close the door. The vehicle began to move forward slowly, when the sliding door

next to the victim slid open and he fell out. The rear wheel of the van ran over him before the driver could stop. Emergency services transported the youth to a hospital, where he died the following day.

Recommendations: Employers should require all employees who drive or ride in motor vehicles to wear seatbelts and keep all doors closed and locked. Employers should comply with child labor laws, including obtaining a valid work permit. Parents and school personnel should learn about youth job assignments, and take steps to remove youths from hazardous work situations.

18) Youth Camp Counselor Dies of Carbon Monoxide Poisoning from Malfunctioning

Furnace: A 15-year-old male camp counselor had worked at a youth camp for nine weeks, and then stayed after the camp closed to assist with clean-up. On the night of the incident, he was the only person assigned to sleep in the building that housed the health services. The furnace room in the building contained an LP gas fueled furnace and LP gas fueled water heater. The youth turned on the furnace before he went to sleep in a room next to the furnace room. He kept the windows and doors closed. The furnace malfunctioned while he slept, causing carbon monoxide to accumulate throughout the building. He was found dead in bed the following morning and the coroner noted the cause of death as carbon monoxide poisoning. There were no records to indicate when the furnace and water heater had been inspected or repaired, nor were there any carbon monoxide detectors in the building.

Recommendations: Ensure the appliances are installed and maintained to prevent production and buildup of carbon monoxide. Follow appliance manufacturer's recommendations for inspections. Install carbon monoxide detectors in buildings with gas fueled appliances.

19) Farm Worker Dies after being struck by a Flywheel of a Hay baler: A 56-year-old male farm worker died while repairing a PTO-powered hay baler. He was lying on his side under the baler, oiling a chain, while the baler was operating. He was struck on the top of his head by a flywheel when the bale tosser cycled. The victim's son had been working nearby, and approached the area to ask his father when the baler would be ready for field use. When the victim failed to respond, the son noted the head injury and called for help. EMS responders arrived at the scene within several minutes. The victim was pronounced dead at the scene by the medical examiner.

Recommendations: Disengage the PTO and stop the tractor engine before doing machine adjustments, repairs or maintenance. Include safety management as a basic part of their farm operation.

29) Youth Restaurant Cashier Shot to Death during Attempted Robbery: A 16-year-old female restaurant cashier died when she was shot during a robbery. The victim was the daughter of the owners of the small restaurant where the incident occurred. She assisted with most of the business activities including food preparation, receiving customers' food orders, and tending the cash register. At the time of the incident, she was standing behind the service counter, near the cash register. Her father was in the back of the restaurant, and her mother was standing next to her. A man entered the restaurant, pointed a handgun at the victim's head and demanded money. Almost immediately, the gun fired in the victim's face. She collapsed to the floor, and the

assailant ran from the building. The victim's father notified the security company, while the victim's mother called for emergency services. The EMS and police responded. The victim was pronounced dead at the hospital.

Recommendations: To prevent homicide in the workplace, business owners should develop and implement violence prevention programs in each workplace including management commitment and employee involvement, worksite analysis (e.g. risk factors, incident records and safety audits), hazard prevention and control, Safety and health training and evaluation

21) Farmer Dies When he Falls and is Pinned under Tractor Drawbar: A farmer refueled his tractor in the farmyard, in preparation for driving to a field to check his beef herd. He stood on a stepladder to reach the fuel cap, which was located on top of the tractor, about 65 inches from the ground. His habit was to place a 4-foot ladder on the tractor body in front of the left rear tire, climb two or three steps with the fuel pump in hand, remove the cap, fill the tank, replace the cap, and climb down the ladder. The farmer had a chronic disease that could cause dizziness, and had some leg weakness and joint pain. On the day of the incident, he apparently replaced the cap after adding the fuel, and fell toward the tractor wheel, striking the shift lever and throwing the tractor into a forward gear. As the tractor began to roll forward, the victim and the ladder rolled up and over the left fender and fell upside down. The victim was caught between the left rear wheel and under the drawbar, while the tractor rolled forward about 6 feet until it was stopped when it struck a block wall. The victim was found by his sister-in-law, who went to the farm to investigate when he did not answer his phone for several days.

Recommendations: Shift the tractor into park, set the brakes and turn off the engine before dismounting from the tractor. For tractors without a park position, farmers should shift into neutral, set the brakes and turn off the engine before dismounting. Seek and follow medical advice and take precautions to prevent falls if there are medical conditions that could cause loss of balance.

22) Florist Pinned Between Bucket of a Forklift and a Truck: A 36-year-old male florist died after being pinned between the bucket of a bucket loader/forklift (forklift) and the back of a semi trailer. The florist owned the floral shop on the street where the incident occurred. An employee of an excavating company, which was contracted to provide forklift services at the floral shop site, operated the loader. The employee had not received formal forklift operator training. The florist stood at the back of the trailer and directed the forklift operator to move closer to the trailer so a chain could be attached to the bucket. The forklift lurched 3-4 feet forward, pinning the victim against the trailer. After several unsuccessful attempts to shift into reverse, the forklift operator backed the machine away and the victim fell to the ground. Emergency services took the victim to a hospital, where he died. An inspection of the forklift after the incident revealed the brakes and transmission needed major repairs, and had been malfunctioned before the incident.

Recommendations: To prevent similar occurrences, companies that use forklifts and other industrial trucks should establish and enforce an industrial truck safety program, including inspection, maintenance and operator training and instruct employees and other individuals to stand away from the pathway of a forklift.