Washington Fatality Assessment and Control Evaluation Program

Final Report

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Abstract

The Washington State Fatality Assessment and Control Evaluation (FACE) Program has collected and compiled information on traumatic fatal occupational injuries since September 1, 1997. Washington FACE has become a visible and recognized program by industry and labor groups throughout the state. The program has provided over 30 presentations each year to industry groups and meetings in addition to widely disseminating targeted prevention and training materials to industry. Over 70,000 Washington FACE reports are downloaded from the web site and over 7,000 copies of Construction Fatality Narratives were emailed to targeted recipients each year from 2002-2006. Additionally, more than 8,000 hard copies of investigation and case series reports were mailed to industry-focused recipients. Washington FACE has also contributed to research by conducting studies, subsequently published in the peer-reviewed literature, on the use and adoption of roll-over protection structures on tractors, and the hazards of gases in hay silos.

The Washington FACE Program has developed a successful surveillance system that has been refined over the past eight years to track acute trauma fatalities in the state. These data are analyzed, summarized and distributed to industry and the public through presentations, mailings and publication on the Washington FACE web site. The most common work-related fatalities from 1998-2005 (686 total) involved motor vehicle incidents (30.5% of total), followed by machine related fatalities (16.6%), falls (12.2%), incidents where the victim was struck by a falling object (7.7%), and homicides (7.3%).

Prevention material has been developed and disseminated to stakeholders, resulting in 50 construction fatality narratives, 14 root-cause investigation reports, and 11 Fatal Facts case series/hazard alerts. Regular evaluations of the fatality narratives have shown that over 70% of both recipients and trainees intend to make changes in they way the conduct their work as a result of receiving the narrative or training using a narrative. Evaluation follow-up surveys showed that over 40% of companies reported making changes after receiving and reading a Washington FACE investigation report. These results show a positive impact toward reducing the risks of acute trauma fatalities in high risk occupations.

Highlights and Significant Findings

- Over 40% of employers receiving a Washington FACE report made changes to make their workplace safer by reducing a hazard identified in a report.
- The fatality rate in Washington State has dropped to 3.1 per 100,000 workers, which is below the Healthy People 2010 goal.
- The most common types of fatalities continue to be motor vehicle incidents, machine-related, and falls.
- Construction, Transportation and Agriculture/Forestry/Fishing were the industry sectors with both the largest numbers and rates of fatalities.
- A program evaluation showed that the surveillance system has been refined so that over 95% of the data on cases is obtained accurately and is present in the database approximately 16 days from the time of the incident.
- Over 85,000 copies of Washington FACE publications are distributed or downloaded during the project period. These data and written letters of support from many industry and labor organizations in the state demonstrate wide use of the materials in the workplace.
- Evaluation surveys of investigation report and fatality narrative recipients showed all measured aspects of the publications were rated as "very good" on average.
- Washington FACE contributed to the safety and health field by publishing seven papers in peer-reviewed journals and conference proceedings.

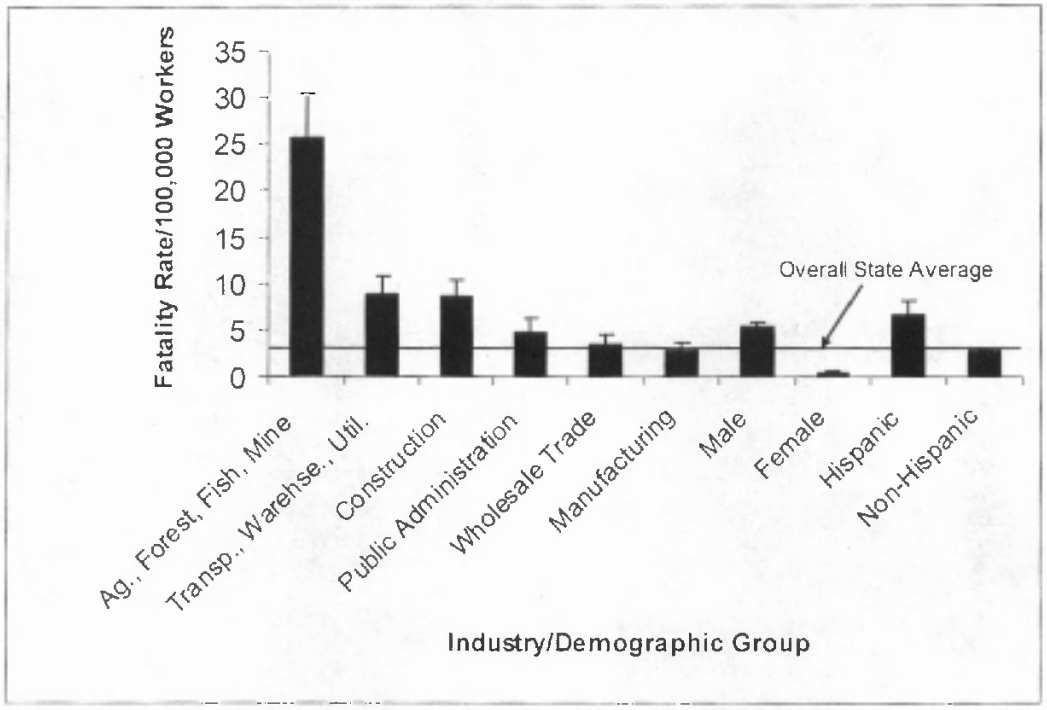

Figure 1. Selected fatality rates by industry and demographic groups per 100,000 workers in Washington State for the years 1998-2002.

Table 2. Previous Target Areas for Washington State FACE Program, Number (% of that year's fatalities)

Targeted type of fatality	1998	1999	2000	2001	2002	2003	2004	2005	Total
Machinery-related fatalities	9(8.2)	8(9.3)	16(22.2)	14(13.7)	17(21.5)	14(19.2)	19(20.7)	17(21.5)	**114(16.6)**
Youths	2(1.8)	1(1.2)	0	0	0	3(4.1)	0	0	**6(1.0)**
Street/highway construction work zones	1(0.9)	3(3.5)	**4(5.5)**	**4(4.2)**	2(2.5)	2(2.7)	0	**0**	**16(2.3)**
Construction	16(14.5)	17(19.8)	17(23.6)	18(18.9)	16(20.3)	13(17.8)	17(18.5)	9(11.4)	**123(17.9)**
Falls from elevation - construction (% of construction fatalities)	*7(43.8)*	*8(47.1)*	*3(17.6)*	*4(22.2)*	*5(31.3)*	*5(38.5)*	*6(35.3)*	*2(22.2)*	*40(32.5,*
Total	**110**	**86**	**72**	**95**	**79**	**73**	**92**	**79**	**686**

Key Partners

The SHARP Program has developed effective working relationships with numerous employers and employee associations, such as the Puget Sound Construction Safety Summit, Washington Trucking Association (WTA), Washington State Farm Bureau (WFB), Construction Advisory Committee (CAC), Association of General Contractors of WA (AGC), WA Contractor Loggers, and TOC Management (formerly the Timber Operators' Council). These relationships allow us to effectively disseminate information to critical employer groups.

The SHARP Program has worked with various local and state labor organizations on a wide variety of projects and has developed effective working relationships with these organizations. WA FACE provides lists of fatalities to these organizations for their annual workers' memorial day observations. SHARP reports to the State Labor Council's L&I Monitoring Committee on a quarterly basis. These relationships provide a natural

vehicle for dissemination of information from the FACE program. Regular partners include the Washington State Labor Council (WSLC), the Washington State Building Trades Council, and the Building Trades Labor-Management Organization of Washington State.

Methods

Case Definition

The FACE program conducts surveillance on workplace fatalities in Washington State or in/on its waters. The cases are defined as acute trauma fatalities that take place in the course of work in the state. Common types of fatal incidents that may occur at work, but not included are deaths due to "natural cause," such as heart attacks and aneurysms, unless there was a work-related underlying cause. Deaths from work-related diseases are also not included. An incident is counted in the year in which the incident occurred and tracked by a unique case number. The criteria for work-relatedness are derived from the Physician's Handbook on Medical Certification of Death. A worker's industry is defined by the North American Industry Classification System 2002 (NAICS) codes and the occupation by the Standard Occupational Classification System (SOC)[21]. The incident types included are defined by the International Classification of Diseases 9th revision (ICD9) external causes of injury codes (e-codes), where the event is due to acute trauma (including self-inflicted, acute chemical exposures, and motor vehicle collisions).

Reporting Process and Data Management

The WA FACE Program maintains, enhances, and periodically evaluates its surveillance system for traumatic work-related fatalities. Because of our Program's goal of using data for action, these activities focus on keeping the system timely and providing important data for prevention.

We have developed and maintain relationships with WISHA, the WA CFOI Program, and the state workers compensation program. We receive fatality data directly from these sources that help support and verify information received via other sources. We routinely evaluate the system for improvements that can be made to enhance specific needs of the FACE Program. The Washington FACE program works closely with the NIOSH program staff and other program partners to ensure data quality and consistency with the other States.

The primary goal of the surveillance system is to help focus resources on industries, incident types, occupations, demographics and circumstances, where work-related fatalities are occurring. Data is analyzed on a periodic basis to identify specific hazardous situations or worker populations for prevention activities. Data summaries are released at least quarterly. All data summaries and reports are posted on the Washington FACE web site. To allow for quick reporting and hazard identification, we continue to do our own industry (SIC and NAICS codes), occupation (SOC), and e-coding for our in-house system.

A major focus of data interpretation is the identification of key hazards. Key hazards are the opportunities for prevention identified as a result of surveillance and investigation activities. Using the FACE model, these key hazards are considered as candidates for development of special educational materials, industry-specific interventions, and outreach activities. Workers' compensation data may be used to augment the fatality reports.

As the surveillance system is currently structured, there is only one non-textual data element that can be used to describe the incident, the ICD-9 e-code. The use of this field maintains consistency with the National Traumatic Occupational Fatality (NTOF) system, but is not consistent with the BLS or Washington's workers' compensation system and may not adequately tell the story of the incident. We also are preparing for conversion to the ICD-10 coding system when it is fully implemented. To better describe our fatalities, we may also begin coding the incidents with either one of two systems (Occupational Injury and Illness Classification System[5] [OIICS] or the American National Standards Institute (ANSI Z16.2) codes[6]. These classification systems may provide further description of the incident type, the source and associated source of the incident, the nature of the injury, and body part injured. Because of our need for a data system with non-required fields (e.g. employer, workers' compensation claim, and survivor information), we have developed our own data system to incorporate these and other fields.

Washington FACE surveillance system also tracks the NIOSH-targeted incidents of 1) construction work zones, 2) machinery-related, and 3) youth (under 18 years old). Additionally, we track two additional target emphasis industries: Construction and Agricultural workers. Database queries and reports are also

developed to track specific types of incidents within target groups such as, trenching, falls from elevation, and tractor rollover incidents.

Surveillance of Emphasis Groups and Industries

Construction

The WA FACE Program tracks construction industry fatalities through weekly reviews, database queries and reports. Incidents are identified by NAICS code of the employer and not the occupation risk class, activity or location. Construction surveillance data supplements are published quarterly on the web site and presented to the Construction Advisory Committee (CAC). An annual report is prepared each January describing summary data for industry incidents over the past year. This information is presented at regular intervals to the CAC, Puget Sound Construction Safety Summit, Construction Safety Council, and Puget Sound ASSE. The information is also used as background for tailgate trainings and other construction-related presentations. Each incident is also identified for future development of a Construction Fatality Narrative.

Agriculture

Washington FACE has worked with the Farm Bureau on several projects over the last 7 years. Washington FACE has a paper currently in press in the Journal of Agricultural Safety and Health describing a survey of tractors and rollover protective structures in Washington State.

Hispanic workers are over-represented for workplace fatalities in Washington State, with about 14% of incidents involving Hispanics while being 6% of the population. The construction and agriculture industries employ a significant population of these workers in high-risk activities. WA FACE data shows that 35% of fatalities in agriculture have been Hispanic, while these workers make up 69% of the working population. The FACE Program published data surveillance reports on agriculture and Hispanic workers in 2002 and 2004 respectively.

Investigations of Selected Occupational Fatalities

The Washington State FACE Program conducts in-depth investigations of traumatic occupational fatalities using an enhanced NIOSH FACE model on targeted incidents. The current emphases are on machinery related fatalities, youth fatalities (victim less than 18 years old) and street/highway construction work zone fatalities. The WA FACE Program also evaluates, assesses and investigates construction industry fatalities that have significant knowledge, understanding and communication/information dissemination importance to the state of Washington.

The investigation process uses the NIOSH occupational fatality investigative model and expand on that model utilizing a *Systems Safety Process*[1,2] investigation approach coupled with a *Root-Cause* analysis procedure[3,4,5]. This is the procedure that the WA FACE Program has used in the past. The *Systems Safety Process* as defined by the "Systems Safety Society" is the understanding of "the optimum degree of safety and health features within the bounds of operational effectiveness, time, and cost attained by using system safety engineering and management principles to identify hazards and reduce risks throughout the life cycle of a system."[2]

The *Systems Safety Process* utilizes a variety of methods and tools to analyze desired system outcomes. The *System Safety Process* can help identify and define possible system failures that result in undesired outcomes, such as fatal injury incidents. In the systems safety approach there are a variety of influencers and components within a job that can affect the system's success or failure. Those influencers and components can include such elements as management processes, operational environment and processes, the physical plant, tools and equipment, people, training and supervision. These elements can be refined into subsystems such as safety management, safety engineering, safety analysis, hazard identification, hazard control, and control evaluation and documentation.

In concert with defining the "system(s)" involved in a fatal incident, the Washington FACE Program incorporates a *Root-Cause* analysis procedure that is designed to identify and categorize a root cause or root causes that had a predominant impact on precipitating the fatal event. Root-cause analysis expands on the basic principles of "incident (accident) investigation" and goes beyond the direct causes in identifying fundamental reasons for a system's failure, such as a fatality. Root cause analysis not only develops an

understanding of how and what happened in a fatal event, but also why it happened. Root causes are those factors that if controlled could have prevented the systems failure (fatality) from happening.

An investigation is normally initiated by the field investigator. A WISHA investigation file is obtained, which is a detailed report on the incident, required for each fatality within its jurisdiction. Contact is made with relevant parties which often include company representatives, the WISHA investigator, and manufacturers. Data collection is performed using the *Systems Safety and Root-Cause Analysis Processes*, in addition to completion of NIOSH instruments. All investigations are completed with voluntary consent of all informants. The findings and recommendations of the investigations are summarized in one or more of four different types of reports described in the Prevention Activities and Information Dissemination section.

Youth Fatalities (workers less than 18 years old)

Because of the relatively small number of youth fatalities (7 between 1998 and 2004), WA FACE investigates all of these incidents. Either a research or short root-cause report is developed and issued for each of these cases.

Street/Highway Work Zone Incidents (work zone incidents)

All work zone incidents are investigated if they are of the nature and type that could have potentially been prevented by Washington State's rules to enhance street and highway work zone safety. These include workers being struck by vehicles (e.g. vehicles intruding into the work zone or workers being struck by construction vehicles or machinery in the work zone) and construction machinery overturns, but may not include all "caught-in" types of incidents.

Machinery-Related Incidents

Because there has been an average of over 10 machinery-related fatalities each year, we are selective as to which of these incidents we investigate. Machinery-related fatal incidents may be investigated if:

- The incident or machinery are unique, but have the potential to expose a large number of workers to severe acute trauma injury hazards,
- There is a potential to work closely with equipment manufacturers and users to evaluate, re-design and test the re-designed machinery, or
- There are multiple incidents involving similar types of machinery that would lend themselves to a case series report.
- There is new technology involved.

Prevention Activities and Information Dissemination

The Washington FACE Program evaluates dissemination strategies using the *Diffusion of Innovations* model[8]. According to this model the social system, communication channels, external change agents and internal opinion leaders are evaluated. Attention is paid to addressing routes of dissemination to achieve a critical mass of adopters for the given prevention effort.

Investigation Reports

The Washington State FACE Program writes and develops a variety of investigation reports based on both on-site investigations and secondary investigations using others' investigation reports. The reports are categorized into the following formats: Research Investigation Reports, Short Root-Cause Reports, Case Series Reports, and Fatality Narratives.

Research Investigation Reports are developed and written based on facts and data gathered from on-site investigations. These reports utilize a systems safety approach and root-cause analysis in the determination of recommendations for future injury prevention. The Research Investigation Report expands beyond the level of incident investigation using extensive literature searches, communication and interaction with industry and labor associations, with regulatory agencies, and communication and site visits with manufacturers, distributors and manufacturers' associations. Through these interactions, we learn more about the processes involved and are better able to find and formulate innovative ideas for processes and equipment that currently go beyond the industry standards or are in the research or development stages. The research-based reports are generally 20-30 pages in length including appendices. These reports use an enhanced

NIOSH FACE model. The Short Root-Cause Reports use an approach similar to that of the research investigation reports, but do not have the research component.

The Case Series Reports are developed and written based on a combination of information sources including facts and data gathered from on-site investigations and review of others' investigations. These reports use a less in-depth systems safety approach and root-cause analysis. The Case Series Reports group summarizes similar fatal incidents with recommendations describing actions that can be taken to prevent fatalities of the type described, or occasionally one type of incident that is generalizable to an industry. The Case Series Reports generally are from 4-6 pages in length and are published under the name Fatal Facts.

Fatality Narratives are developed and written utilizing a variety of information sources. These reports were developed following the Mine Safety and Health Administration's (MSHA) model for their Fatalgrams[7] and are issued in conjunction with the WISHA Program. The one-page narratives describe a fatal incident and give brief potential recommendations for the prevention of similar incidents. Evaluations of the fatality narratives are reviewed to identify process improvements.

Recommendations for Prevention

Recommendations for prevention are an integral part of each outreach effort we conduct. These recommendations include epidemiologic assessment, safety systems engineering, and human factors/ergonomics approaches. In addition to recommendations aimed at changing the knowledge, attitude, and behaviors of employers and employees, machinery-related recommendations involve equipment manufacturers and suppliers. SHARP has developed experience with user-producer groups to evaluate and improve equipment in the construction industry to prevent injuries, and is applying this approach to the FACE recommendations as well[9].

Report Development and Review Process

Reports are developed and reviewed by the Program's safety engineer, principal investigator, and surveillance manager. Reports are also reviewed by a number of other people including the WISHA inspector who conducted the enforcement investigation, a WISHA technical expert on the topic, members of appropriate business and labor organizations, other technical experts if needed, equipment suppliers and manufacturers, our Agency's Assistant Attorney General, and the SHARP Program's Research Director, in addition to the NIOSH FACE staff.

Stakeholder Identification

Industry-specific stakeholder contacts have been developed throughout the grant period. Lists of employee organizations, trade associations, and other organizations or groups are developed and maintained. Lists of companies within specific North American Industrial Classification (NAICS) codes or state-specific industrial risk classes are produced from the Agency's insurance database as needed. Company information by specific industry is also obtained from the American Business Disk database.

Information Dissemination

Washington FACE reports are sent to the appropriate stakeholders. Investigation report mailings are targeted by industry with address information obtained from the American Business Disk and sources such as industry associations. Other outreach activities during this period included presenting materials at trade meetings, conferences and at topical health and safety workshops given by the Agency or other organizations (eg. residential construction and fall protection), writing articles for trade journals, and discussing cases with industry and labor groups. The Washington FACE program also presents case information as well as the general surveillance data at meetings (e.g. Construction Advisory Committee quarterly meetings, Safety Summit and Trucking Safety Council monthly meetings, and WISHA Advisory Committee quarterly meetings) and to trade journals; and conducting meetings with appropriate members of the industry, including employers, unions, and business associations.

Fatality notifications are sent by email to a distribution list once they become an official FACE case. Fatality investigation reports are also distributed to WISHA, in addition to Fatality Narrative distribution, by email. The Washington FACE web site contains all published reports and outreach materials. More materials are distributed by web download than by any other means.

In addition, to direct dissemination we submit reports and surveillance information to professional safety journals, industry trade magazines and association web sites. Washington FACE also supplies monthly updates to the Governor's Performance Review Program. This provides part of the surveillance information that drives oversight of prevention management on the agency and state level.

NIOSH FACE Program Evaluation of Dissemination Efforts

We have incorporated some of the recommendations found in Research Triangle Institute's initial evaluation of the FACE Program's dissemination component[10]. We offer shortened versions of the reports, increase access to the materials, use industry-specific channels to disseminate the materials, and obtain feedback from our dissemination efforts. In our cover letters accompanying our reports we attach a one-page summary of the incident and recommendations that can be easily duplicated or published in a newsletter. To increase the public's access to our materials, we have developed a web site with downloadable versions of our materials. To reach specific industries we have targeted our mailings to relevant business and labor groups, as well as using a statewide database of employers to target mailings to companies in select NAICS codes. To determine whether our materials are effective and to find ways to improve them, we have conducted surveys of the recipients of our outreach materials.

Special Emphasis Projects

A special emphasis project was conducted in the construction industry. This entailed developing, disseminating, and evaluating materials that can be presented at construction site tailgate safety meetings. In addition to using these fatality narratives, we also developed similar narratives of near-hit (also known as near-miss) incidents with a focus on the emphasis area of work zone incidents.

An email address list of over 600 construction industry and safety professional recipients has been developed by Washington FACE for distributing the Fatality Narratives. These are sent on a monthly basis and posted for downloading on the web site. The fatality narratives are also be presented at tailgate safety meetings and discussed by participants.

The FACE Program has developed relationships with multiple construction groups and individuals who act as opinion leaders and agents for change. This provides a greater impact for activities in this high-risk area. The Washington Farm Bureau has worked in conjunction with the FACE Program to address tractor-related incidents. Information gathered from the Washington Tractor Survey conducted by FACE along with surveillance data and informal interviews were used for development of prevention strategies for this area. From 1998-2005 there were 11 tractor over-turn fatalities, with 10 of these being tractors that are exempt from roll-over protective structures (ROPS), primarily in tree fruit orchards. This will be a target group for future prevention activities.

Program Evaluation

We evaluate all aspects of the WA FACE Program: the surveillance system, investigations, prevention activities, and project impacts. Formal evaluation was conducted at the end of the second year of the program. Depending on results from this evaluation, changes to improve the efficiency, effectiveness, and usefulness of the system were made at that time.

Surveillance System Evaluation

We use the Centers for Disease Control and Prevention's (CDC's) *Updated Guidelines for Evaluating Public Health Surveillance Systems*[11] as a reference for evaluating the performance of surveillance system components. The following surveillance system attributes are critically assessed:

- Flexibility. Several enhancements were made to the existing surveillance system during the first year of the project funding cycle, providing a unique opportunity to evaluate the flexibility of the system. We qualitatively assess the ability of the system to adapt to these changes, including the increase in the number of data fields and additional coding of data variables. Results were used to determine whether system changes need to be made in order to increase flexibility and the ease in which the system can adapt to change.
- Timeliness. We track the time between the fatal incident and notification to the FACE program. Additionally, we track the time between notification and investigation initiation, the time taken to complete

an investigation, and the time between investigation and completion of a written report. Results are used to assess which steps in the surveillance system are timely and which are untimely, and therefore, need improvement.

- Data Quality. We evaluate the data sources used in the surveillance system by calculating the fraction of the total number of fatalities found by each source, as well as estimating the accuracy and completeness of each source.

Evaluation of Investigations, Prevention Activities, and Project Impacts

In addition to evaluating the attributes and operation of the surveillance system, we also evaluate whether the data gathered and information learned is being used for effective public health action.

Process Evaluation

Activities:

The FACE program utilizes an outreach tracking log to document and monitor progress of FACE program activities, such as investigations and participation at partnership meetings. Specific measures to evaluate the investigation process include: (1) the number of investigations initiated and completed, (2) the time between notification and investigation initiation, (3) the time taken to complete an investigation, (4) the number of investigations conducted in each of the State's administrative regions and (5) the number of investigations conducted for each of the priority areas (machinery related fatalities, youth/juvenile fatalities, street/highway construction zone fatalities, as well as fatalities within WA FACE special emphasis projects).

Products:

We track the number of reports that we develop, as well as the number of each report that is disseminated. This is done for each type of report: Research Investigation Reports, Short Root-Cause Reports, Case Series (Fatal Facts) Reports, and Fatality Narratives. Website usage statistics are tracked for the FACE website, including the number of times the homepage was accessed and the number of times specific documents were downloaded. Additionally, feedback surveys are disseminated with a select number of reports. These are used to determine the quality and usefulness of the materials, as well as if worksite changes are being implemented as a result of the report's recommendations (see Short-Term Outcome Measures for more information).

Outcome Evaluation

Both short-term and long-term outcomes are assessed both quantitatively and qualitatively in order to demonstrate the impact of the FACE project on knowledge, attitudes, behaviors, and the prevention of fatalities.

Short-Term Outcomes (Knowledge, Attitudes, and Behaviors):

As stated above, feedback surveys with accompanying postage-paid return envelopes are disseminated with a select number of FACE reports. In addition to satisfaction with and usefulness of the materials, the surveys are also used to determine if worksite changes are being implemented as a result of the report's recommendations. These evaluations are mailed to all report recipients 60-90 days after the report mailing. The survey contains information on changes made and the type of methods that were changed as a result of reading the report, thus providing concrete data on the elimination or reduction of hazards as a result of the prevention activity.

Changes in workplace policy and practice decisions can be captured through feedback surveys, in addition to being collected qualitatively through interaction with business and labor partners. Changes by manufacturers or companies are also be collected anecdotally and documented for impact on hazard reduction.

Additionally, increases in knowledge and intent to implement positive changes in work practices can be captured during input forms filled out during Toolbox trainings.

Long-Term Outcomes:

The ultimate goal of the FACE program is a reduction in workplace fatalities in Washington State. However, workplace fatality numbers are very unstable on an annual basis and assessing the impact of the program at a state-wide level across all industries presents challenges. The program directs resources toward specific target areas in high-risk industries. Incident rates were calculated by industry sector over time and a trend analysis evaluates any changes. The rates by industry and demographic groups were compared over time to evaluate the impact of prevention activities or other external factors in the state.

Results and Discussion

During the first year of the WA FACE Program, the basic fatality surveillance system/network was developed. Each year thereafter, the system has been maintained and upgraded (e.g. the addition of company information, workers' compensation information, etc.). To be included in the FACE surveillance system, the acute occupational fatality event must have occurred in Washington State. Currently data sources for case ascertainment are the WA CFOI Program, the WISHA Services Division, the State's workers' compensation system, a newspaper clipping service, death certificates, internet, radio, and TV reports. Other secondary data sources include medical examiners' and coroners' office interviews and reports, police and sheriff interviews and reports, and online databases of the US Coast Guard, OSHA, DOE, NTSB, MSHA, and USDOT. With the exception of death certificates, we can get information daily from the reporting sources.

Reporting ties with the systems' two primary providers, WISHA and WA CFOI, were periodically strengthened. WISHA promptly notifies WA FACE of a reported fatality by email or hardcopy with the initial notification report, required for all fatal incidents in their jurisdiction. On a quarterly basis, we meet with a contact in WISHA to discuss fatalities and to ensure that FACE has all of the cases reported to them and *vice versa*. On a daily to weekly basis, we are in contact with the WA CFOI program discussing cases, coding, and classification of fatalities. Annually, we meet with WA CFOI to ensure that both groups have all fatalities in their systems.

There is often a long time lag between a death and our receipt of a death certificate. This issue was explored with both the State Department of Health and CFOI Program. After discussing the issue with the parties, we felt that getting death certificates any sooner than they are currently received would be resource intensive with little added benefit (death certificates were the first notification source for only 2-3% of fatalities from 1998-2005). We are able to obtain reports on workplace fatalities for cases in the compensation system in a timely manner.

In an effort to improve the reporting and data collection for motor vehicle collisions, we tried to gain access to the Washington State Patrol's (WSP) investigation reports. In a letter from the Patrol's Attorney's General, we were denied access because L&I was not on a list of Agencies legislatively authorized to have access to their confidential reports. It was also discovered that when the WISHA Program needs a report from the WSP, they are required to get a subpoena.

Database Enhancements

To improve the quality of data, ease of entry, and data elements used, we developed a surveillance database in Microsoft Access. This system allows us to easily summarize the data and export it to statistical programs for further analysis and report creation. We added more data fields related to workers' compensation claims, the company, and the victim that help us to better utilize our system. A number of *ad hoc* queries and reports (e.g. fatalities in a specific region, logging fatalities, fatalities with Hispanic victims, etc.) have been developed based on requests from various customers. We have also developed a number of routine reports that are generated for specific purposes (e.g. a quarterly summary of construction deaths, a quarterly summary of all deaths, a list of records for the State's annual worker's memorial ceremony, etc.). These and other materials generated by our system are summarized in the Information Dissemination section of this Progress Report.

To assist the Agency's efforts to collect information on fatal heart attacks (potentially investigated by WISHA), we keep track of these incidents using a Microsoft Access database similar to the one we developed for WA FACE, but with more limited data fields.

Investigations

The first Washington FACE investigation was initiated in March, 1998. Since then, a total of 22 investigations and 14 investigation reports have been completed. Additionally, 11 Fatal Facts reports and 50 one-page Fatality Narratives have been published. These materials result in dissemination of information statewide on incident facts, hazards and prevention strategies for more than 20 fatalities each year. Washington FACE conducts fewer full investigation reports but publishes more additional materials such as Fatality Narratives. The investigation reports completed are more detailed than the standard NIOSH FACE model for the following reasons:

- We use a systems approach to conduct the investigations that is overlaid with root-cause analysis to determine the potential causal factors. This is a time consuming technique that produces reports that have considered all elements of the system that failed and analyzes which ones may have been causal. See the investigation subsection of the Research Design and Methods section for a more detailed description.
- In many of our reports we attach Appendices that may cover issues that are not typically presented in FACE investigation reports. Examples of some of the appendices include forensic testing of splices for their failure modality, discussions of medical impairment and work, and alternate methods to ensure ladder stability.
- During the investigation and report writing processes, we contact a number of industry and equipment experts to get their input on the events and potential hazard remediation solutions. Draft copies of the report are also reviewed by the WISHA inspector who conducted the compliance investigation, a WISHA technical expert on the topic, members of appropriate business and labor organizations, other technical experts as needed, equipment manufacturers and suppliers, our Agency's Assistant Attorney General, and the SHARP Program's Research Director, in addition to the NIOSH FACE staff.

These steps make our reports in-depth assessments of the systems involved in the fatal incident with alternate discussions and safety applications that receive much input from a variety of stakeholders. Because the FACE Program and WISHA are both in the same agency, it was necessary to develop and maintain good relationships with the WISHA regional staff that conduct the enforcement investigations. Outreach meetings were initially held during the first year of the WA FACE Program and then periodically thereafter to inform the regional enforcement officers about the Program, to better understand their concerns about the Program, and reinforce the confidential nature of our investigations. Table 7 summarizes the investigation reports completed during the current grant cycle, from September 2002 to August 2006, and information about review, dissemination, and evaluation.

F.1.3 Information Dissemination

From the surveillance data we collect, we have developed a number of reports that are available on-line or in print. These reports have been developed for each year and consist of a list of all fatalities with pertinent information, summary figures and tables describing the incidents, and various industry specific reports. Industry trends over time have also been summarized. Electronic versions of these reports can be downloaded from our web site. Printed versions of these reports are routinely sent to L&I executive management, the Washington State Construction Advisory Committee (CAC - which is a statewide committee comprised of construction industry labor, management, and L&I), and legislatively mandated WISHA Advisory Committee. *Ad hoc* reports have also been developed on request. Some of these reports have covered topics such as trenching incidents, deaths to Hispanic workers, agricultural drownings, and WA State regional differences. Construction fatality narratives are distributed to an email list of over 600 people on a monthly basis.

One important method we have used to distribute our data has been through our web site (http://www.lni.wa.gov/safety/research/face). Our web site contains fatality data reports, investigation reports, WA FACE Fatal Facts, links to other sites related to workplace fatalities, and a list of Program staff. All reports generated by Washington FACE are available for download, which is done extensively. Over 6,000 investigation reports, fatality narratives, case series reports and data summaries are downloaded each month from the site.

The construction fatality narratives are presented to tailgate training sessions at building sites and companies in addition to email distribution and web posting. The worker and industry response has been very positive and evaluation results support the utility of these publications. Evaluations were completed by tailgate trainees following an interactive presentation using the fatality narratives. A total of 379 workers across seven different sites provided the following input:

- Overall Opinion, Usefulness and Readability – All Rated "Very Good" (~4.0 out of 5.0)
- 70% planned on making changes in hazard identification
- 50% planned on making changes in job set-up
- 25% planned on making changes in tool or safety gear use

In the fall of 2003, WA FACE conducted a web survey of the fatality narrative email recipients. A total of 110 respondents out of 579 valid email addresses completed an evaluation. The average ratings for Overall Opinion, Usefulness and Readability were all 4.1 (Very Good) on a 1 to 5 scale. Over 70% of the respondents stated that they had made changes in work practices at their company as a result of reading a narrative. Figure 2 presents a summary of the types of changes survey respondents made as a result of the construction fatality narratives.

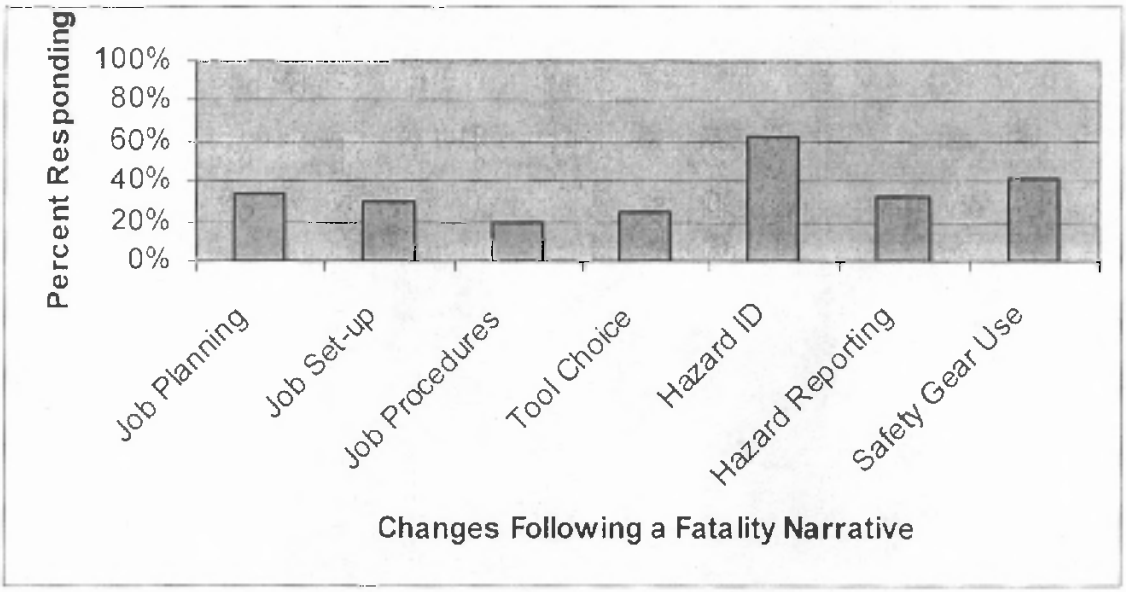

Figure 2. Changes reported made by email recipients as a result of the construction fatality narratives.

The WA FACE Program has taken responsibility within the Agency for maintaining the list of workplace fatalities due to acute trauma injuries. It is the most comprehensive data that the agency has and those in the workers' compensation and WISHA Divisions have drawn upon this list to help focus their fatality-based resources. This list is the basis for the annual list the agency uses for its Workers' Memorial Day ceremony. Each year the Agency holds a Workers' Memorial Day ceremony to commemorate the workers killed on the job the previous year and renew commitment to prevention. The WA FACE Program is responsible for developing the list of workers and their survivors. The ceremony, attended by the governor, representatives from business, labor, surviving family members and the public, unites the attendees in the fight to prevent work-related deaths.

We have also worked with regional L&I staff on a refinery stack collapse, construction falls through openings/from elevation and tractor-related incidents.

Washington FACE has published a range of outreach materials and reports in addition to fatality investigation reports during the current funding cycle. A total of 66 presentations were given to groups and conferences and 15 construction tailgate trainings were conducted. Table 3, below lists the numbers of each type of outreach during the current grant, excluding investigation reports. Numbers of publications are given for Fatality Narratives, Case Series (Fatal Facts), and Surveillance reports. Presentations are separated into

major presentations to conferences or meetings and regular monthly or quarterly presentations given to groups such as the Construction Advisory Committee, Trucking Safety Management Council, and Puget Sound Safety Summit. Please refer to the Appendix for a list of the reports and presentations. A peer-reviewed journal paper on the Washington FACE surveillance system and data was also developed and recently submitted for publication.

Table 3. Washington FACE Publications and Presentations (Excluding Investigation Reports) for the Previous Funding Cycle, September 2002- August, 2005 (Detailed List Contained in Appendix)

Type of Outreach Activity or Publication	Number Completed
Construction Fatality Narratives	50
Fatal Facts Case Series Reports	11
Surveillance Data Reports	15
Conference or Meeting Presentations	26
Regular Stakeholder/Partner Presentations	62
Construction Tailgate Trainings	20

F.1.4 Evaluation

During the first year of the Program, we developed an evaluation plan that covered the surveillance system, investigations, and information dissemination. Four evaluations have been conducted during the program. Below, we have summarized the evaluation methods and some of the findings.

F.1.4.1 Surveillance System

Evaluation of the surveillance system focused on two aspects of the system, 1) how well each source was reporting its data with respect to timeliness, completeness, and accuracy and 2) the effectiveness of each source to notify the system of a fatality.

F.1.4.2 Investigations

An investigation tracking sheet was developed for following task completion and outcomes. This tracking sheet lists all of the current and planned investigations, and gives dates for the various accomplishments such as the investigation, development of a research plan, an internal investigation report, a system safety review, draft report and stages of report review, mailing, and evaluation.

F.1.4.3 Information dissemination

To evaluate the quantitative output of our information dissemination activities, an information dissemination tracking form was developed. The form has four groups of data: surveillance, investigations, hazard alerts, and general information dissemination. We count the number of different activities on a quarterly basis. All investigation reports are evaluated by sending a survey out to report recipients 60-90 days after the report was sent. The survey asks questions about various qualities of the report, whether they will implement changes in their workplace and how they have used the presented information.

F.1.4.4 Highlights of Evaluation Results

Timeliness of Surveillance Data

Evaluations of the timeliness of the surveillance system were conducted annually. Table 4 shows the results of the most recent evaluation. The number of days between the incident, a report being filed, and the FACE Program being notified were calculated. These differences were tallied by data source, but we have only reported the summary for all sources.

The average time for an incident to be reported to WA FACE was approximately 16 days (up from an average of approximately 7 days in 1999 and 10 days in 1998) with a median time of 1.8 days, with the various sources having averages between 5.5 and 22.7 days (see Table 4). On average, we are notified of 80% of the

cases within 9 days of the incident. The incidents with the longer notification times tended to be from the death certificates which we get from the State Department of Health on a quarterly basis.

Data completeness and accuracy

Data completeness was evaluated by randomly selecting up to 20 incidents reported by each reporting agency, finding the first notification report and counting the number of first report fields in the database that could be completed per notification report. We estimated an average percentage of completeness from each data source. The accuracy was measured by comparing data in the report to those in the final data set. For agencies with more than 20 case reports, the 20 were randomly selected. Only agencies with 5 or more case reports were included in this analysis. A total of 68 cases were used.

In Table 5, the percent of fields supplied correctly and percent supplied inaccurately are listed. In general, we are able to accurately obtain between 50 and 70% of the data required for the NIOSH first reports from our first notifications. When we looked at death certificates supplied by the CFOI program, we found that they supplied 93% of required data, though they generally took months to arrive after the incident. Most of the data that are supplied to us were relatively accurate. Only between 0.4 and 4% of the required fields supplied to us in the first notifications were inaccurate. The newspapers were the most accurate and the workers' compensation system the least accurate. The inaccuracy of the workers' compensation system mainly involves industry coding.

Fraction of reported/notified

Table 6 lists which data sources were notifying the WA FACE Program of the most incidents. This table shows that WISHA, the workers' compensation system, and the newspapers provided approximately 80% of the WA FACE Program's first notification reports.

Fatality Investigations Reports

From 2004-2006 Washington FACE distributed 5 fatality investigation reports by mail to over 4000 total recipients in targeted industries. Within 60-90 days following the mailing, a survey was sent to recipients to allow us to better understand the usefulness and quality of the materials as well as to determine whether companies had implemented changes based on the recommendations and what effects the changes have had on safety. Below is a brief summary of these five most recent investigation report evaluations received:

Lineman Killed After Being Struck by a Car in Washington State (00WA040)

- 127 evaluation surveys returned
- Usefulness, Quality, Readability, Organization and Graphics all rated as "very good"
- 37% of respondents reported having made changes as a result of reading the report
- Specific changes included providing two-way radios, changing flagging configurations, and using trucks as barriers for work zones

City Worker Killed When Struck by a Dump Truck in Washington State (00WA041)

- 140 anonymous evaluation surveys returned
- Usefulness, Quality, Readability, Organization and Graphics all rated as "very good"
- 44% of respondents reported having made changes as a result of reading the report
- Specific changes included placing a rear-camera on trucks, providing spotters for backing trucks in work zones, and keeping drivers in trucks and workers out of the backing zone.

Temporary Worker Killed when Caught in Machinery at a Bottling Plant in Washington State (00WA012)

- 66 anonymous evaluation surveys returned
- Usefulness, Quality, Readability, Organization and Graphics all rated as "very good"
- 17% of respondents reported having made changes as a result of reading the report
- Specific changes included changing the lockout/tagout energy test, reorganizing equipment and materials, and providing additional training for employees.

Utility Construction Supervisor Killed When Struck by a Pickup Truck at a Work Zone in Washington State (02WA032)

- 120 anonymous evaluation surveys returned
- Usefulness, Quality, Readability, Organization and Graphics all rated as "very good"
- 30% of respondents reported having made changes as a result of reading the report
- Specific changes included implementing training, modifying physical barrier requirements for work sites and improving personal protective equipment.

Flagger Fatally Injured When Struck by a Car at a Highway Work Zone in Washington State (00WA0011)

- 88 anonymous evaluation surveys returned
- Usefulness, Quality, Readability, Organization and Graphics all rated as "very good"
- 30% of respondents reported having made changes as a result of reading the report
- Specific changes included implementing training, using physical barriers at work sites and improving personal protective equipment.

Table 4. Summary of Washington FACE Surveillance Data Timeliness

	Time in days from ...to...[1]		
Measure	**Incident to Report**	**Report to Notified**	**Incident to Notified**
Mean	2.1	11.7	16.5
Median	0.3	1.1	1.8
Maximum	87.8	201.0	223.4
80th %ile	1.2	6.3	8.8
N[2]	70.0	70.0	72.0
Std. Dev.	11.2	35.4	44.2

[1] "Incident" refers to the date of the incident; "report" refers to the date of the report used to first identify the incident; "notified" refers to the date when the FACE Program was notified of the incident.
[2] The number of incidents is not identical because data were missing for the date of a report.

Table 5. Completeness and Accuracy of Reporting Sources

Agency notifying FACE of the incident[1]	Required fields supplied		Fields supplied inaccurately	
	%	**Std. Dev.**	**%**	**Std. Dev.**
WA CFOI (n=21)	69	(18)	2	(3)
Newspaper (n=14)	67	(9)	0.4	(1)
WISHA (n=20)	63	(12)	1	(2)
Workers Compensation (n=13)	51	(24)	4	(5)
Total (n=68)	**63**	**(17)**	**2**	**(3)**

[1] Death certificates were provided to our program through the WA CFOI Program so are not directly represented in this table.

Table 6. Percent of Fatalities Identified Sources, 1998-2002

Source[1]	**Percent of Total**
WISHA	35.5
Newspaper	23.6
Workers' Compensation	17.2
Internet	8.3
Radio	4.2
TV	2.8
Death Certificates	2.8
OSHA	1.4

[1]The CFOI Program notifies us of 36% of the incidents in our system, but is not the principal reporting source listed above.

Table 7. Listing of Completed Fatality Investigation Reports from the WA Face Program (September 2002-August 2006)

Title	Case ID Report Number	Date Mailed	Report Reviewers[1]	Recipients	Evaluation	Web Downloads[2]
Flagger Killed When Struck by Dump Truck During Road Construction in Washington State	99WA07001 52-8-2002	November 2002	– WISHA investigator – WISHA P&TS topical expert – WSDOT – NIOSH – State labor representative	- 850 selected street/hwy construction and utilities companies - 150 other organizations and groups	- 150 surveys sent out - 55% of respondents made changes based on report	> 11,818
Logger Killed by Log During a Helicopter Logging Operation in Washington State	99WA07101 52-9-2003	June 2003	– Former logger and labor representative – WA Contract Loggers' Association – WISHA Inspector – WISHA P&TS topical expert	- 300 logging and helicopter-logging companies - Business and labor organizations - Emailed to all WISHA list - FACE Programs	- 125 surveys sent out - 40% of respondents reported changes	3036
Lineman Killed After Being Struck by a Car in Washington State	00WA04001 52-10-2003	December 2003	– WISHA investigator – WISHA P&TS topical expert – WSDOT – NIOSH – State labor representative	- 769 to targeted companies - Business and labor organizations - Emailed to all WISHA list - FACE Programs	- 127 surveys returned - 37% implemented changes based on report	1957
City Worker Killed When Struck by a Dump Truck in Washington State	00WA04101 52-11-2004	June 2004	– WISHA investigator – WISHA P&TS topical expert – WSDOT – NIOSH – State labor representative	- 1092 to targeted companies - Business and labor organizations - Emailed to all WISHA list - FACE Programs	- 140 surveys returned - 44% made changes based on report	1255
Temporary Worker Killed when Caught in Machinery at a Bottling Plant in Washington State	00WA01201 52-12-2004	December 2004	– Industry safety expert – WISHA P&TS topical expert – NIOSH – Temporary worker organization – State labor organization	- 775 to targeted companies - Business and labor organizations - Emailed to all WISHA List - FACE Programs	- 66 surveys returned - 17% of respondents made changes based on report	836
Utility Construction Supervisor Killed When Struck by a Pickup Truck at a Work Zone in Washington State	02WA03401 52-13-2005	July 2005	– WISHA safety manager – NIOSH – State labor organization – WSDOT	- 754 to targeted companies - Business and labor organizations - Emailed to all WISHA List - FACE Programs	-102 surveys returned -30% implemented changes based on the report	N/A[3]
Flagger Fatally Injured When Struck by a Car at a Highway Work Zone in Washington State	00WA01101	January 2006	– WISHA Const. safety manager – NIOSH – State labor organization – WSDOT	- 1059 to targeted companies - Business and labor organizations - WISHA List and FACE states	-88 surveys returned -30% had made changes based on the report	N/A[3]

[1] All reports were reviewed by NIOSH FACE staff, SHARP's Research Director, and SHARP's Assistant Attorney General.
[2] We were not able to track downloaded files when the first two reports were released, the totals are from April 2003 to July 2006.
[3] Web download data for the most recently completed investigation reports are not available.

Special Research Projects and Use of Carryover Funds

Washington FACE has the ability to conduct more in-depth research on specific topics. This is made possible in part by the resources and expertise available within the agency and program that FACE is located. Additional resources may also be granted for specific projects when the mission of SHARP and the Department coincide with a topic of interest to FACE.

In early 2005 WA FACE received carryover funds from the previous funding year to conduct two research projects that support emphasis area work. One project was to conduct a census of tractors in Washington State to determine what type of tractors exist on farms, how many have rollover protection systems, and how these tractors are used. This is important information for the design of intervention and outreach material to address tractor overturn incidents. A proportional stratified random sample of 1238 farms was extracted from the WA Labor & Industries and WA Department of Revenue databases. A mail survey was sent to each of these farms, with a postcard reminder, and telephone follow-up. A total of 522 surveys were completed out of 1000 valid farm businesses for a 52% response rate. Results showed that ROPS was less prevalent on tractors operated in orchards and hops farms, but that overall ROPS adoption was higher than reported in most other states, and particularly so on older tractors. The results were published in the Journal of Agricultural Safety and Health.

The second special research project was an investigation of exposure to gases when working with oxygen-deficient hay silos. This work was part of an on-going investigation into an incident in 2003 where two teens died in a silo on a dairy farm in eastern Washington. Silo gas concentrations were sampled in the worker breathing zone, at the top hatch face, and in the silo both before and during ventilation. The air sampling may provide evidence to support a theory on the un-witnessed incident in addition to providing information on the acute and chronic exposure to gases that farmers may encounter when using standard practices working with these silos. The field data collection and analysis for this project are complete. These results were presented at the 2006 FACE meeting, the 2005 Northwest Occupational Health Conference, and the 2005 AIHA conference in Chicago, and have been published in the Journal of Agricultural Safety and Health.

A no-cost extension of the grant project was granted which extended the work an additional year, through August of 2007. The existing funds from the grant were used in part to translate 52 construction fatality narratives into Spanish. These narratives have been shown to be important training tools and it is hoped that having them available in Spanish will help employers and trainers reach an important population of workers in this sector. The narratives were translated, reviewed by an independent third-party for accuracy, and then reviewed and edited by internal native Spanish-speakers with experience in construction before they were published on the Washington FACE website.

Publications

The following are peer-reviewed journal and conference proceedings publications prepared and submitted during the original funding cycle from September 1, 2002 to August 31, 2006:

Kedan G, Spielholz P, Sjostrom T, Trenary B and Clark R, (2007), "An Assessment of Gases in Oxygen-deficient Hay Silos and the Effects of Forced Ventilation," *Journal of Agricultural Safety and Health*, 13(1), pp. 83-95.

Spielholz P, Sjostrom T, Clark R and Adams D, (2006), "A Survey of Tractors and Rollover Protective Structures in Washington State," *Journal of Agricultural Safety and Health*, 12(4), pp. 325-333.

Cohen M, Clark R, Silverstein B, Sjostrom T and Spielholz P, (2006), "Work-related Deaths in Washington State, 1998-2002," *Journal of Safety Research*, 37, pp. 307-319.

Spielholz P, Sjostrom T and Clark R, (2006), "Electrocution Hazards to Workers Near Overhead Powerlines," Council of State and Territorial Epidemiologists Annual Conference, Anaheim, California, June 4-7, (poster).

Spielholz P, Clark R and Sjostrom T, (2006), "Development and Use of Fatality Narratives to Convey Hazard Information," *ASSE Professional Development Conference Proceedings - Safety 2006.*

Spielholz P and Chavez M, (2006), "Reducing Injury Risk Factors Through Building Specifications," *IEA 2006 Triennial Conference Proceedings*, Maastricht, Netherlands, July 10-14.

Spielholz P, Sjostrom T, Kedan G, Trenary B and Clark R, (2006), "Assessment of Gases in Oxygen-Deficient Agricultural Silos," *AIHA Conference Proceedings*, Chicago, IL, May 13-18, (abstract).

Inclusion of Women and Minorities

The human subjects involved in this research included minorities and women. However, the study involved understanding the root cause of a fatality. The scientific questions of this research were not supplemented or complemented by collection, analysis and interpretation of individually identifiable data on subjects interviewed for the fatality investigation.

Finally, as part of the fatality surveillance system, gender and race data on fatalities is collected. However, this information was not considered human subjects research by the IRB since the decedent is not 'living.' Thus the intent of the interaction with the 'research subjects' was not to collect their individual identifying information but to characterize the fatality event.

The decedents are not considered "human subjects," but for further description, Washington FACE data shows that approximately 92% of workplace fatalities involve men, and up to 12% involve Hispanics. Previously, 88% of incidents involved Caucasians, 3% Black, 3% Pacific Islander, and 2% Native American. Women and minorities were included in all activities.

Inclusion of Children

The human subjects involved in this research could have, but did not, include children. However, the project involved understanding the root causes of fatalities. The scientific questions of this research proposal were not supplemented or complemented by collection, analysis and interpretation individually identifiable data on subjects interviewed for the fatality investigation.

Finally, as part of the fatality surveillance system, age data on fatalities is collected. A federal priority is youth work-related fatalities and all youth related fatalities are investigated. However, this information is not considered human subjects research since the decedent is not 'living'. Thus the intent of the interaction with the 'research subjects' is not to collect their individual identifying information but to characterize the fatality event.

Fatalities in the workplace involving people under the age of 21 were investigated, specifically all incidents of youths, under the age of 18 are investigated. Less than 1% of fatal incidents involve youths in Washington State. No youths were interviewed during this funding cycle as a part of any investigation.

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