Final Progress Report
to the National Institute for Occupational Safety and Health

CORE SURVEILLANCE MODEL PROGRAM IN CALIFORNIA

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LIST OF ABBREVIATIONS

BLS – Bureau of Labor Statistics
Cal/OSHA – Division of Occupational Safety and Health, California Department of Industrial Relations
CDHS – California Department of Health Services
COC – Census Occupation Code
CRR – Clinical Radiology Report
CSTE – Council of State and Territorial Epidemiologists
CTS – Carpal tunnel syndrome
DFR – Doctor's First Report of Occupational Injury or Illness
ILO – International Labor Organization
MCOD – Multiple Cause of Death
MSHA – Mine Safety and Health Administration
NIOSH – National Institute for Occupational Safety and Health
OHB – Occupational Health Branch, California Department of Health Services
OHI – Occupational Health Indicator
OHW – Occupational Health Watch, OHB annual publication developed through this project
OSHPD – California Office of Statewide Hospital Planning and Development
PEL – Permissible Exposure Limit
PMF – Progressive Massive Fibrosis
SCIF – State Compensation Insurance Fund, a major California workers' compensation insurance carrier
SIC – Standard Industrial Classification
TOT – Training-of-Trainers
WCIS – California Workers' Compensation Information System

ABSTRACT

The Occupational Health Branch (OHB) of the California Department of Health Services (CDHS) proposed to develop and implement a core state-based surveillance model program for the prevention of targeted workplace diseases, injuries, and hazards. From 2000 to 2005, a multidisciplinary staff at the OHB conducted surveillance and investigation of multiple work-related diseases and injuries, including asthma, pesticide illness, carpal tunnel syndrome, selected fatal injuries, and lead poisoning. In addition, we added silicosis and selected nonfatal injuries as core surveillance activities. Several innovative approaches enhanced our previous surveillance activities: (1) all conditions that were recommended as "core" public health activities by the State-NIOSH Surveillance Work Group were placed under surveillance; (2) our surveillance model used multiple data sources - including electronic reporting through a new Workers' Compensation Information System - that can be replicated in other States; and (3) we conducted a broad-based intervention in the construction industry based on multiple-endpoint surveillance data. Our approach relied on the linking of surveillance data with intervention and prevention efforts to integrate occupational health into mainstream public health. The successes and lessons learned from these activities may assist NIOSH in recommending a model for core occupational health surveillance that can be undertaken in other states. For each core condition under surveillance, we conducted efficient case finding using existing NIOSH and/or CSTE case definitions, and employed standardized databases and coding systems to collect, analyze, and report aggregate data to NIOSH. Using established guidelines for prioritizing cases for follow-up, we performed hazard surveys and workplace investigations for purposes of targeted prevention activities. We used a variety of means to disseminate our scientific findings and prevention recommendations, including the preparation of an annual report to key constituents (*Occupational Health Watch)* and articles for scientific publication. The project developed and implemented a broad-based, industry-wide intervention activity that addressed simultaneously multiple health and safety hazards identified through the core surveillance system. Construction was targeted as the focus of the intervention component, which was identified, developed, and implemented in a collaborative process with key stakeholders. The intervention was a statewide training program designed to improve the quality and frequency of tailgate safety trainings, which all construction employers are required to conduct every ten working days. Each aspect of our project included an evaluation component.

HIGHLIGHTS OF SPECIFIC FINDINGS

Surveillance of Silicosis

- Approximately 79 cases of silicosis were diagnosed annually in California for the years 2000-2002. There were approximately seven additional deceased silicosis cases identified annually through review of Multiple Cause of Death files.

- The leading industries associated with California's confirmed silicosis cases were metal mining (17%); manufacture of stone, clay, glass, and concrete products (15.9%); special trades contractors (12.2%); and mining of non-metallic minerals (11%), i.e., sand and gravel. Additional industries in which cases were identified included agriculture, other manufacturing industries such as metal foundries and aircraft transportation equipment, and other construction industries.

- The most frequent occupations associated with confirmed cases were mining machine operators (14.6%), non-construction laborers (6.7%), construction laborers (5.6%), and

brickmasons/stonemasons (4.5%). Mining-related occupations (mining machine operators, operating engineers, mining occupations not elsewhere classified, mining engineers, crushing and grinding machine operators, and supervisors in extractive occupations) comprise the single largest group of occupations that were affected by silicosis in California and account for 25% of all cases.

- Evaluation of current silica exposure levels at selected California sand and gravel mining or dredging and processing operations indicated that significant overexposures to silica currently exist.

Surveillance of Nonfatal Falls in Construction

- Several key risk factors were identified among ladder fall cases, including performing work from the ladder (not just inspection); working with both hands off of the ladder; absence of ladder safety training; carrying items weighing more than five pounds while on the ladder; and working on a surface that is not level and/or hard. These findings suggest that taking steps such as securing the ladder at the top and bottom to prevent movement could have a substantial impact in reducing ladder fall injuries and fatalities. They also highlight the need for safer work practices and the use of alternative work platforms for certain tasks that cannot be done safely using a ladder.

- The majority of ladder fall cases (65%) were working on residential construction projects (66% new construction, 33% renovation or repair), and falls occurred most frequently among carpenters. These findings can direct future intervention efforts to increase safe ladder use and determine the need for equipment alternatives when the ladder cannot be used safely on residential construction sites.

- Spanish-speaking workers were significantly less likely to have received ladder safety training in the year prior to their fall, compared to English-speaking workers (27.5% of Spanish-speaking workers versus 45.5% English-speaking). Language issues may also influence the safety environment for Spanish workers, as only 37% of Spanish-speaking workers reported that their supervisor spoke their language very well or well, and 63% reported that their supervisor did not speak their language at all or spoke it very poorly (27/43 cases).

Occupational Health Indicators (OHIs)

- The OHIs offer an important method for states to develop baseline data on occupational health status, and to track these data over time to guide our program efforts. Inclusion of the OHIs as a Fundamental Program activity in the state-based occupational health surveillance programs funded by NIOSH in 2005 and onward will offer the opportunity to continue to work with other states, NIOSH, and CSTE to further develop and evaluate their usefulness for guiding prevention work. In California, we intend to utilize these simple measures of occupational health status as a starting point for further in-depth analysis of available data sources in order to set program priorities for prevention activities, and to track trends and progress over time.

Lead Poisoning Surveillance and Investigations

- Lead poisoning cases continue to be linked to a failure to comply with the basic requirements of the Cal/OSHA Lead Standards – lack of worker training in lead hazards,

poor or non-existent local exhaust ventilation, improper use of respirators, unsafe clean-up methods, poor hygiene facilities or practices, and lack of protective clothing and equipment.

- Since few employers conduct air monitoring for lead, most have no idea of the level of lead their workers were being exposed to. Among small employers, there was often a complete lack of awareness about lead hazards. Even when small employers were aware of lead hazards, they did not know how to control them.

- In the last several years there has been an increase in cases of lead poisoning in day laborers (workers who are employed casually in the construction trades) or their family members. In some of these cases, the worker did not know the name of his employer, or was uncomfortable sharing this information with us.

Construction Industry Intervention

- Conducting effective tailgate trainings can be a powerful tool toward building a safety program and culture in an industry known for high rates of injuries, illnesses, and fatalities. Well-done tailgate trainings can contribute significantly in raising safety awareness and building a safe working environment in this industry.

- Contractors, supervisors, and lead workers need to be trained and skilled at conducting tailgate trainings as part of their site safety supervision responsibilities. More opportunities should be created for improving skills in the delivery of tailgate safety trainings, and particularly to expand the capacity of tailgate trainers to provide Spanish-language safety training in a workforce increasingly comprised of Latino construction workers.

Dissemination Activities

- New and effective ways to disseminate surveillance and intervention findings to those who are in a position to act on this information are needed to improve safety and health in the workplace. It clearly is not adequate to report findings only through articles in scientific journals and presentations at meetings of safety and health professionals. The size of California and vast number of workplaces poses a unique challenge when it comes to effecting change in the workplace.

- Periodically communicating with key stakeholders and sharing information developed through OHB work in a clear and non-technical way is valuable, and the publication *Occupational Health Watch* proved to be a useful vehicle for achieving this goal. We have found that having *OHW* articles reprinted by other organizations in their newsletters is a low-cost and effective way to extend OHB efforts more broadly, particularly to the employer community; we intend to invest additional effort into encouraging other organizations to disseminate our information in this way.

TRANSLATION OF FINDINGS

The findings from our project can be used broadly for state-based efforts to develop a national surveillance system to detect work-induced diseases and injuries, and to conduct specific

intervention activities that can lead to recommendations to prevent future disability and death in the workplace. Specifically, our efforts in California have shown success in several approaches that can be used by other states in establishing and implementing occupational health programs. These include:

- Collecting and analyzing multiple data sources to conduct in-depth surveillance of selected diseases and injuries, and then using that data to perform selected case follow-up as well as targeted industry and occupational studies;

- Analyses of 19 occupational health indicators that can be used to track the status of work-induced diseases and injuries, evaluate our program efforts over time, and target specific occupations and injuries for intervention;

- Development and implementation of an intervention in a high-risk industry (construction), using methods that show that working with stakeholders who drive the process will result in better information and materials use by those who conduct workplace health and safety programs; and

- Development of a unique newsletter that translates scientific and technical findings into easily understandable information that can be used by a variety of audiences.

OUTCOMES AND IMPACT

The Core Surveillance Model Program in California has demonstrated that support of state-based occupational health surveillance and prevention can result in success in developing systems and programs that can lead to improvement in work-related diseases and injuries. The translation of data into public health practice may be very effective at the State level, and should be integrated into the current NIOSH efforts – NORA II. Keys to this success are the resources to support the ongoing involvement of a multidisciplinary team (epidemiology, industrial hygiene, occupational medicine, health education), collaboration with multiple stakeholders, effective dissemination, and evaluation.

SCIENTIFIC REPORT

INTRODUCTION – REFRAMING OF SPECIFIC AIMS

The Core Surveillance cooperative agreements between the National Institute for Occupational Safety and Health (NIOSH) and five states (California, Michigan, Massachusetts, New Jersey, and Washington) together represented a unique effort to strengthen state-based occupational health surveillance and prevention programs and develop models that would ultimately aid in the establishment of a future nationwide occupational health surveillance system. Each state proposed to accomplish a unique program of activities under Core Surveillance that was appropriate to their state's worker health and safety priorities and stage of occupational health program development. Over the period from 2000 through 2005, these five states and NIOSH staff shared their experiences by participating in the State Occupational Surveillance Consortium (SOSC) and in an Occupational Health Work Group (Work Group) convened by the Council of State and Territorial Epidemiologists (CSTE).

This report is organized to report on the progress made by the Core Surveillance Model Program in California toward accomplishing each specific aim of the project. This work was carried out by the Occupational Health Branch (OHB) of the California Department of Health Services, in collaboration with our grants administrator, the Public Health Institute. However, during the five-year period of the Core Surveillance cooperative agreement, some changes were made to the original specific aims. The specific aims, as originally stated and as reframed for the purpose of this final scientific report, appear in Table 1, along with a reference to the section of the report in which each specific aim is discussed.

Table 1. Core Surveillance Model Program in California: Reframing of Specific Aims

Aims as Originally Stated	Aims Reframed for Final Report Format *(Scientific Report Section)*
Surveillance 1. Enhance existing surveillance systems for asthma, carpal tunnel syndrome, pesticide illness, lead poisoning, and selected fatal injuries; and establish/implement new surveillance systems for silicosis and selected nonfatal injuries.	***Surveillance*** 1. Establish a new surveillance system for silicosis, including investigation of high-risk industries or occupations and development of prevention recommendations. *(Surveillance of Silicosis)* 2. Establish a new surveillance system for construction-related nonfatal falls, including case follow-up and development of prevention recommendations on falls from ladders. *(Surveillance of Nonfatal Falls in Construction)* 3. Participate in a collaborative, multi-state effort to develop and implement 19 Occupational Health Indicators. *(Occupational Health Indicators)*
Case investigations/ Intervention 2. Utilize surveillance data to identify selected cases for investigation and development of prevention recommendations. 3. Identify, develop, and implement—in collaboration with key stakeholders—a broad-	***Case investigations/ Intervention*** 4. Utilize the Occupational Blood Lead Registry to identify selected cases for investigation and development of prevention recommendations. *(Lead Poisoning Investigations)* 5. Identify, develop, implement, and evaluate—in

Aims as Originally Stated	Aims Reframed for Final Report Format *(Scientific Report Section)*
based intervention that simultaneously addresses multiple health and safety hazards identified within the construction industry.	collaboration with key stakeholders—a broad-based intervention that simultaneously addresses multiple health and safety hazards identified within the construction industry. *(Construction Industry Intervention to Improve Tailgate Trainings)*
Dissemination 4. Disseminate, using a variety of means, surveillance data for multiple endpoints, findings of case investigations, and intervention results.	***Dissemination*** 6. Produce a new annual publication to disseminate surveillance and intervention findings to key stakeholders. *(New Communication Method: "Occupational Health Watch")*
Evaluation 5. Evaluate these aspects of a model core surveillance system: a) the endpoint-specific systems established for surveillance; b) the utility of a core surveillance database to analyze trends in aggregate data; c) the feasibility of replicating the model in other states; and d) the process of working with key stakeholders to identify, develop, and implement a broad-based intervention targeting multiple health/safety hazards.	***Evaluation*** *Any evaluation conducted for the activities above is included in each specific report section.*

In this report we describe California's progress in creating two new surveillance systems for silicosis and construction-related falls, which together constitute a substantial effort carried out under this cooperative agreement (Sections 1 and 2). Activities related to existing surveillance systems (asthma, carpal tunnel syndrome, pesticide illness, and fatal injuries) are omitted because scientific reports have or will be submitted separately under other cooperative agreements that funded those activities.

A new specific aim was added to this project after the CSTE Work Group, NIOSH, and the five Core Surveillance states agreed to refine and pilot newly established Occupational Health Indicators; this activity is presented in Section 3. Lead poisoning investigations are included in this report as an example of the worksite follow-up typical in our surveillance projects (Section 4); this is a mandated OHB activity that continues with permanent state funding beyond the completion of the cooperative agreement.

A major intervention effort proposed and carried out under this cooperative agreement, which serves as a model for how a state health agency can work with an industry stakeholder group to plan, implement, and evaluate a broad-based intervention project, is described in Section 5. Section 6 reports on a new publication OHB developed to communicate with constituents about our surveillance and prevention efforts. Rather than describe evaluation activities for each specific aim in a separate section, we have included this information within the section describing what was evaluated (for example, the evaluation of the construction industry intervention appears in Section 5).

One evaluation activity originally proposed was to "evaluate the utility of a core surveillance database to analyze trends in aggregate data." In the first year of the cooperative agreement, we selected twelve key variables from five separate OHB surveillance systems using 1999 data; examined data across endpoints; and concluded that an insufficient number of shared variables limited the aggregate analysis approach, and that separate, in-depth analyses of data for

individual health conditions is a more useful approach. Therefore, this activity is not addressed in this report.

Another original specific aim that was dropped from this project was an effort to assess the replicability of the Core Surveillance Model Program in California by other states. Initially, this activity was eliminated when the five Core Surveillance states planned and agreed to conduct a standard evaluation process of the Core Surveillance cooperative agreements that was intended to assist NIOSH in further development of funding initiatives for state-based surveillance. However, when NIOSH implemented its current program for Fundamental and Priority Health Condition surveillance cooperative agreements, the need for evaluating the Core Surveillance program became less apparent, so the collaborative evaluation plan was dropped by the five states. Therefore, the final progress reports from each of the five Core Surveillance states will serve as the overall documentation of the accomplishments and lessons learned under the Core Surveillance program supported by NIOSH.

1. SURVEILLANCE OF SILICOSIS

1.1 Background

Silicosis is a potentially fatal, typically chronic, and almost always preventable fibrotic lung disease caused by exposure to respirable crystalline silica dust. In addition to silicosis, exposure to silica has been associated with chronic obstructive pulmonary disease (COPD); tuberculosis; chronic renal disease; and rheumatoid arthritis, scleroderma, and other autoimmune disorders. Silica exposure and the development of silicosis are also associated with an increased risk of lung cancer (IARC 1997, Checkoway 2000).

Although reported deaths from silicosis have declined overall in the U.S. since 1968, silicosis deaths and rates increased slightly from 1998 to 1999 (NIOSH 2003). Silicosis deaths totaled 2,405 nationwide and represented 8% of all pneumoconiosis deaths in the U.S. during the 10-year period from 1990 to 1999. Silicosis is an especially difficult occupational disease to count in employer-based statistics (e.g., U.S. Bureau of Labor Statistics Annual Survey of Occupational Illness and Injury), as most identified cases are no longer working (mean age of California cases = 73 years) and rarely file for workers' compensation (21% of California cases filed). NIOSH researchers have estimated that over the previous decade (1990-1999), 26,740 years of potential life were lost due to silicosis (NIOSH 2003). Silicosis is a larger problem than death records indicate, as many retired workers suffering from silicosis are not reported or identified (Rosenman 2003).

The most frequently recorded industry on U.S. death records for silicosis cases is construction (13.4%), followed by metal mining (9.8%), coal mining (7.8%), blast furnaces and steel works (5.8%), and non-metal mining and quarrying (5.5%). Together, the construction and mining industries account for one-third of all silicosis decedents from 1990-1999 (NIOSH 2003). Occupations frequently reported on death records for silicosis cases include mining machine operators (15.7%), non-construction laborers (9.6%), supervisors in production occupations (3.6%), janitors and cleaners (3.4%), machine operators not specified (3.4%), and construction laborers (3.0%). Recorded overexposures to silica are common across many industries (31% of all OSHA silica samples exceed the Permissible Exposure Limit (PEL)); this is most notable in construction where 41% of OSHA exposure samples exceeded the PEL during the period 1993-1999. In mining, which is recognized as an industry with excess risk of dust diseases of the lung, silica exposures persist; data from 1990-1999 show that 6% of samples for silica

measured by the Mine Safety and Health Administration (MSHA) were above the PEL (NIOSH 2003).

California ranked third among all states for the largest number of silicosis deaths (n=107) over the years 1990 to 1999 (NIOSH 2003) and has a significant number of workers and employers involved in construction and surface mining industries. These factors encouraged the Occupational Health Branch to initiate comprehensive surveillance for silicosis and to seek opportunities for preventing continued silica overexposures.

1.2 Specific Aims

As one component of the Core Surveillance Model Program in California, the Occupational Health Branch addressed the important problem of silicosis among California workers by carrying out the following specific aims:

- Establish a statewide surveillance system for the ascertainment of silicosis cases, including interviews of cases or next of kin, medical records review, and classification of cases according to the NIOSH Silicosis Case Classification Guidelines;
- Use surveillance findings to identify the silicosis-related industries and occupations associated with diagnosed California silicosis cases, including those industries with probable recent and ongoing silica overexposure, for the purpose of targeting intervention efforts;
- Conduct silica exposure assessment at selected worksites in target industries; and
- Disseminate silicosis surveillance data, exposure assessment findings, and prevention recommendations.

1.3 Procedures/Methodology

Surveillance System

Case Ascertainment

Multi-source reporting was established to identify the maximum number of diagnosed silicosis cases in California. The primary data sources used for silicosis surveillance are described as follows. All California hospitals (approximately 540) were requested to report diagnosed silicosis cases upon receipt of annual mailed requests. Patient discharge data files compiled by California's Office of Statewide Hospital Planning and Development (OSHPD) were reviewed to identify silicosis cases not previously reported by hospitals. In addition, all pulmonologists in California (approximately 944) were mailed requests to report silicosis cases. All reporters were asked to identify ICD-509 or ICD-10 J62 diagnosis codes, for either primary or tertiary diagnoses.

Some additional sources of data were explored to assess their utility in case identification. California Workers' Compensation Information System (WCIS) electronic data files for 2000-2001 were reviewed to assess the usefulness of this reporting source to identify new silicosis cases; cases with "nature of injury code" for silicosis (237062) were selected. Mine Safety and Health Administration (MSHA) Part 50 reports of inhalation injuries were reviewed to identify deaths or illness reports related to silicosis in the California mining industry. Because these reports are only completed for currently employed miners, most chronic conditions that are

typically diagnosed post-retirement will not be included. Lastly, Multiple Cause of Death (MCOD) files for California deaths were reviewed to identify previously unidentified cases.

Follow-up Interviews of Silicosis Cases or Next-of-kin

A case follow-up telephone interview was developed, incorporating all of the NIOSH core variables for silicosis surveillance plus additional employer, language, disability, and workers' compensation status information. Standardized interview questionnaires previously developed by the Michigan, New Jersey, and Ohio silicosis programs were used as a guide for the development of the California's questionnaire. Four questionnaire versions were developed, including English and Spanish versions of a standard case questionnaire (Appendices 1A and 1B), and a slightly modified Next-of Kin interview (English and Spanish) (Appendices 1C and 1D).

All study protocols and materials, including standardized questionnaires with an informed consent script for telephone interviews of cases or next-of-kin, were approved by the California Health and Human Services Agency Committee for the Protection of Human Subjects and the Public Health Institute Research Review for the Protection of Human Subjects.

Interview follow-up was attempted for all cases or identified next-of-kin. Case telephone and address contact information was requested of all reporting sources. Up to eight call attempts were made for each case or possible next-of-kin before classifying the case as unreachable.

The online service, Search America (http://www.searchamerica.com/), was used to locate silicosis cases or their next-of-kin when phone numbers from the Silicosis Report Form or medical records did not work. This service was also used when we had only a name and address for a next-of-kin listed on the death record. In addition to Search America, other Web sites were used including: http://www.whitepages.com/ , http://people.yahoo.com/, http://www.smartpages.com/whitepages/, http://www.superpages.com/, and http://www.switchboard.com/.

Medical Records Review for Silicosis Cases

Available medical records, including summary and discharge notes, patient histories, clinical radiology reports, chest x-ray films, other imaging results, and biopsy or pathology results, were requested from reporting hospitals or physicians. Additional medical records identified from medical provider data collected during case follow-up interviews were also utilized to obtain confirmatory medical data.

B readings were completed for all diagnosed silicosis cases for which chest x-rays could be obtained. A single NIOSH-certified B-reader completed all of the B-readings for California silicosis cases using the most recent International Labor Organization (ILO) classification guidelines (ILO 2002).

Clinical Radiology Reports (CRRs) were used as a secondary source for case confirmation when chest x-ray films were unavailable. CRRs were reviewed for specific findings (i.e., nodular/rounded densities/opacities which at the minimum involve the upper lobes/lung zones) to confirm the silicosis diagnosis. To supplement the NIOSH criteria for confirmatory CRRs, OHB developed a hierarchy of criteria to consistently classify CRRs as consistent, inconsistent, or inconclusive for silicosis (Appendix 1E).

Pathology results for lung tissue were requested and reviewed when available. Pathology reports considered consistent for silicosis met the NIOSH criteria for confirmatory pathology (i.e., fibrosis with bi-refringent particles) and were the "gold standard" for confirmatory medical confirmation of silicosis.

Assessment of Silica Exposure History

Work exposure history information was assessed to determine a primary employment classification ("primary silica exposure") and total years of exposure to silica ("aggregate silica exposure") as described below.

Industry and occupation information used to determine Standard Industrial Classification (SIC) codes and Census Occupational Code (COC) for employment with likely silica exposure was typically obtained through occupational histories provided by cases or next-of-kin during telephone interviews. When follow-up interviews were not possible, available industry and occupation description information was abstracted from medical and/or death records.

Many silicosis cases have multiple employments (we collected up to seven employment intervals), often performing many jobs in different industries, all of which involved silica exposure. In order to consistently determine the primary employment, the following hierarchy was applied for primary employment classification:

1. The employment with the longest duration was chosen. The longest could be a combination of different employers, as long as the SIC and COC were identical.
2. If multiple employments had the same duration, the employment with the greatest exposure intensity/earliest exposure was chosen. The employment with the reported greatest exposure intensity (i.e., sandblasting or very high reported dust exposure) was chosen unless the latency was insufficient (less than three years prior to diagnosis for simple, chronic silicosis).
3. All else being equal, the employment with the earliest exposure was chosen.

The "aggregate silica exposure" measure was developed to summarize, across all cases with occupational exposure data, the total number of years of exposure for each industry and occupation. This method better represents the relative exposure contribution of each industry and occupation. Severity of exposure was not included in this measure, only total years of exposure.

Interviews completed by next-of-kin were often adequate to confirm occupational exposure, but lacked the occupational history detail required for a comprehensive silica exposure history. When medical records were relied upon for occupational exposure information, full histories were nonexistent; if occupational exposure history was noted in medical records, the information was typically adequate to confirm the case, but insufficient to characterize the exposure history in any detail.

Case Confirmation

Silicosis cases were classified into five categories:

1. Confirmed case - matches NIOSH silicosis case confirmation criteria;
2. Probable case - physician diagnosis of silicosis and confirmed occupational silica exposure but lacking NIOSH medical confirmation criteria;

3. Inconsistent case - medical documentation that indicates non-silicosis pulmonary or other health condition;
4. Incomplete information - some confirmatory medical information but lacks occupational silica exposure confirmation; or
5. Environmental silicosis case - medical confirmation of silicosis, an absence of occupational exposure, and confirmed environmental exposure (i.e., living near a mine).

Data Management and Analysis

All data were maintained in Microsoft Access databases developed for the multi-source reporting project. A complete list of database variables and data dictionary are available.

Descriptive statistics were used to analyze interview and medical summary data, including case status distributions.

Worksite Investigations with Silica Exposure Assessment

Based on preliminary analysis of industries and occupations most frequently associated with diagnosed California silicosis cases, surface sand and gravel-related operations were selected as a focus for worksite investigations. Three exploratory site visits to sand and gravel mining or processing operations were conducted jointly with Mine Safety and Health Administration (MSHA) Program Officers from the Vacaville, California, MSHA District Office, in order to gain initial familiarity with this type of industry.

Potential worksites were then selected for exposure assessment based on MSHA air sampling and silica overexposure violation data. MSHA air sampling data over a five-year period (January 1992 to January 1997) indicated a total of 34 California mines with documented silica overexposures. Twenty-eight of these mines produced a commodity of sand and gravel or crushed rock. These 28 mines were further investigated to identify mines that had received a MSHA citation. Seven potential sampling sites were identified based on meeting both of the following criteria:

- At least one mine worker had an MSHA-documented overexposure to silica in 1992-1997; and
- The mine was cited by MSHA for silica overexposure in 1997-2000.

Three OHB worksite investigations, including silica exposure assessments, were conducted at two different sand and gravel operations. Worksite investigations followed an established protocol and included pre-conferencing with the employer and union representatives; conducting personal air monitoring to assess respirable crystalline silica/quartz exposures; conducting bulk sampling for silica; interviewing employer representatives and workers; notifying workers, employers, and union representatives of results and exposure reduction recommendations; and issuing written investigation reports.

Dissemination of Educational Materials, Surveillance Data, Exposure Assessment Findings, and Prevention Recommendations

Silicosis cases that were contacted and interested in receiving educational materials were sent relevant materials selected after an OHB staff review of available materials on silicosis and workers' compensation issues produced by various state and federal agencies. Additionally,

when deemed appropriate, silicosis cases and family members were sent a contact list developed by OHB of silicosis support groups and Web sites.

Comprehensive dissemination of results related to the two worksites that received silica exposure assessments was conducted through written reports to the employers, written reports designed for the workers, individual letters for sampled workers that interpreted their sampling results, and an oral presentation to workers and management at both worksites. Written reports and follow-up phone communications were provided to the MSHA District office and local Operating Engineers and Laborers Unions that represent the workers at the assessed worksites.

Surveillance data has been disseminated primarily through presentations at occupational health professional meetings and a summary article in the OHB annual newsletter, *Occupational Health Watch*.

1.4 Results and Discussion

Surveillance System Findings

Case Ascertainment: Primary Data Sources

A total of 238 cases were ascertained from the primary reporting sources for the three years, 2000-2002 (Table 2). Case ascertainment did not vary widely from year to year, and ranged from 66 to 84 cases annually. Overall, 37.4% (n=89) of cases were NIOSH-confirmed cases; 26.1% (n=62) were probable cases (typically lacking medical information necessary to meet NIOSH confirmation); 18.1% (n=43) were inconsistent for silicosis diagnosis; 16.8% (n=40) had incomplete information (typically lacking occupational exposure data); and 1.7% (n=4) were confirmed environmental silicosis cases.

Table 2. Silicosis Case Ascertainment by Classification Status and Year

Case Classification Status	2000 N	2001 N	2002 N	Total N (%)
NIOSH-confirmed case	40	28	21	**89 (37.4)**
Probable case	21	26	15	**62 (26.1)**
Inconsistent for silicosis	15	18	10	**43 (18.1)**
Incomplete information	5	15	20	**40 (16.8)**
Environmental silicosis	3	1	0	**4 (1.7)**
Total	**84**	**88**	**66**	**238 (100)**

Silicosis cases were primarily identified from hospital admissions and diagnoses, although some hospital-reported cases were identified from outpatient care settings (Table 3). Annual requests to hospitals to report silicosis cases (ICD-509 or ICD-10 J62) yielded 75.2% of all cases, and review of hospital discharge data files identified another 19.7% previously unidentified cases from the same pool of hospitals. The hospital reports and patient discharge files for silicosis yielded 94.9% of all cases, of which 36% were confirmed. Pulmonary physicians reported only 4.6% of all cases (n=11), though the confirmation rate was higher (54.5%) than for hospital-diagnosed cases. Probably and inconsistent classified cases were equally likely to be reported

from hospitals or physicians. Incomplete information that prevented case confirmation (typically insufficient medical or exposure history information) was an obstacle related to all reporting sources (16.8% to 21.3% incomplete information), except for physician-reported cases that contained sufficient information 100% of the time.

Table 3. Silicosis Case Classification by Primary Reporting Source

	Hospital Report		Hospital DIscharge		Physician		Other	
Case Classification Status	**N**	**%**	**N**	**%**	**N**	**%**	**N (%)**	**Totals**
NIOSH-confirmed case	66	36.9	17	36.2	6	54.5	0	**89**
Probable case	46	25.7	12	25.5	3	27.3	1	**62**
Inconsistent for silicosis	33	18.4	8	17.0	2	18.2	0	**43**
Incomplete information	30	16.8	10	21.3	0	0	0	**40**
Environmental silicosis	4	2.2	0	0	0	0	0	**4**
Total	**179**	**75.2**	**47**	**19.7**	**11**	**4.6**	**1 (0.4)**	**238**

Case Ascertainment: Exploratory Data Sources

Data from the Workers' Compensation Information System (WCIS) were reviewed to identify possible silicosis cases for the years 2000-2001. Eighteen cases were selected for interview based on the silicosis nature of injury code; we were successful in interviewing one-third (Table 4). No confirmed cases were identified, although six interviewed cases had documented exposure to silica; one case had respiratory symptoms related to overexposure during unprotected sandblasting while working in maintenance for a municipality.

Table 4. Follow-up of Potential Silicosis Cases in WCIS, 2000-2001

Case Status	**N (%)**
Interview completed	6 (33)
Interview refused	1 (0.6)
Unreachable	9 (50)
Inappropriate diagnosis/exposure	2 (11)
Total	**18 (100)**

MSHA maintains a database of Part 50 illness reports, and a request was made for all illness reports related to "inhalation of caustic, toxic, or noxious substances" or incidents classified as "dust diseases of the lungs". Four reports were identified, however, non were for the ascertainment years relevant for the surveillance program (cases were identified for 1983, 1987, 1990, and 1993).

Multiple Cause of Death (MCOD) data files for 2000-2002 were reviewed to identify deaths with silicosis as a primary or tertiary diagnosis. A total of 15 potential cases, not otherwise identified from the primary reporting sources, were identified and follow-up medical records were requested. Death records yielded 3 confirmed, 4 probable, 4 inconsistent, and 4 cases with

incomplete information. The occupations of the confirmed cases were two miners (one coal and one sand and gravel) and one carpenter. Probable cases included a laborer in a foundry, machine operator in a sand plant, and construction welder.

Silica Exposure Duration

The year first exposed to silica among confirmed silicosis cases was available for interviewed cases with a complete work history (n=56). Among confirmed cases, the first year of silica exposure ranged from 1926 to 1980, with a median of 1946.

The duration of exposure for confirmed cases with complete exposure histories (n=72) ranged from 3 to 68 years, with a median duration of occupational silica exposure of 26 years (Table 5). The duration between the year first occupationally exposed and silicosis diagnosis ranged from 21 to 75 years, with a mean of 51.6 years between first exposure and report of diagnosis to the silicosis program (reporting source year). Some cases may have received earlier diagnoses of silicosis, though this information was not consistently available for confirmed cases as many cases were unaware of the first year that a physician diagnosed or suspected silicosis.

Table 5. Confirmed Silicosis Cases by Silica Exposure Duration (N = 72)

Exposure Duration (years)	N	%
3-5	4	5.6
6-10	3	4.2
11-15	7	9.7
16-20	8	11.1
21-25	7	9.7
26-30	13	18.1
31-35	9	12.5
39-40	3	4.2
41-45	7	9.7
46-50	6	8.3
51+	5	6.9
Total	**72**	**100.0**

Primary Industry and Occupation: Confirmed Cases

Primary employment with silica exposure (established using methods described above) for confirmed cases (n=89) is presented by industry (Table 6) and occupation (Table 7). The leading industry groups associated with California's confirmed silicosis cases are metal mining (17%); manufacture of stone, clay, glass, and concrete products (15.9%); construction special trade contractors (12.2%); and mining nonmetallic minerals (11%).

The most frequent occupations associated with confirmed cases were mining machine operators (14.6%), non-construction laborers (6.7%), construction laborers (5.6%), and brickmasons/stonemasons (4.5%). Mining-related occupations (mining machine operators, operating engineers, mining occupations, n.e.c, mining engineer, crushing and grinding machine operators, supervisor of extractive occupations) comprise the single largest group of occupations associated with silicosis in California and account for 25% of all cases. In the

mining sector, supervisors and engineers receive sufficient exposure to develop silicosis. One confirmed non-occupational silicosis case reported exposure from living near a California sand plant. Twenty-seven percent of confirmed cases reported during the interview that they had done sandblasting.

Table 6. Confirmed Silicosis Cases by Industry Group and 4-Digit Standard Industrial Classification (N = 89)

Major Group (N)	SIC Description	SIC	N	%
Agricultural production - crops or livestock (3)				
	Farms - crop	0191	1	1.1
	Livestock - beef	0212	1	1.1
	Livestock - general	0291	1	1.1
Metal mining (14)				
	Copper ores	1021	1	1.1
	Lead and zinc ores	1031	2	2.2
	Gold ores	1041	6	6.7
	Silver ores	1044	3	3.4
	Ferroalloy ores	1061	1	1.1
	Uranium, radium ores	1094	1	1.1
Coal mining (1)				
	Bituminous coal	1221	1	1.1
Nonmetallic minerals mining (9)				
		14	1	1.1
	Crushed and broken stone	1429	1	1.1
	Construction sand and gravel	1442	2	2.2
	Industrial sand	1446	4	4.5
	Misc. nonmetallic minerals	1499	1	1.1
Heavy construction - other than building construction (5)				
	Highway and street constr.	1611	1	1.1
	Bridge and tunnel constr.	1622	2	2.2
	Water, sewer, pipeline	1623	2	2.2
Construction - special trades contractors (10)				
	Masonry, stone setting	1741	4	4.5
	Terrazzo tile, marble work	1743	3	3.4
	Special trades, nec	1799	3	3.4
Food and kindred products (1)				
	Malt beverages	2082	1	1.1
Textile mill products (1)				
		22	1	1.1
Petroleum refining (1)				
	Petroleum refining	2911	1	1.1
Manufacture of stone, clay, glass and concrete products (13)				
		32	1	1.1

Major Group (N)	SIC Description	SIC	N	%
	Glass containers	3221	2	2.2
	Pressed and blown glass	3229	1	1.1
	Brick and structural clay tile	3251	1	1.1
	Clay refractories	3255	2	2.2
	Vitreous china fixtures	3261	1	1.1
	Vitreous china table products	3262	1	1.1
	Cut stone and stone products	3281	2	2.2
	Minerals and earths, ground or treated	3295	2	2.2
Primary metal industries (6)				
		33	3	3.4
	Gray and ductile iron foundries	3321	1	1.1
	Malleable iron foundries	3322	1	1.1
	Copper foundries	3366	1	1.1
Fabricated metal products (1)				
	Coating, engraving, and allied services	3479	1	1.1
Industrial and commercial machinery (1)				
	Industrial and commercial fans	3564	1	1.1
Transportation equipment (4)				
	Aircraft	372	1	1.1
	Aircraft	3721	1	1.1
	Aircraft parts and equipment	3728	2	2.2
Misc. manufacturing industries (1)				
	Signs and advertising specialties	3993	1	1.1
Railroad transportation (2)				
	Railroads, line-haul operating	4011	2	2.2
Pipelines (1)				
	Refined petroleum pipelines	4613	1	1.1
Building materials (1)				
	Lumber and other building materials	5211	1	1.1
Health services (2)				
	Dental laboratories	8072	2	2.2
Educational services (1)				
	Elementary and secondary schools	8211	1	1.1
Engineering, research, management (1)				
	Engineering services	8711	1	1.1
National security and international affairs (3)				
		97	1	1.1
	National security	9711	2	2.2
Nonclassifiable (7)		99	7	7.9
Total			**89**	**100.0**

Table 7. Confirmed Silicosis Cases by Occupation (Census Occupation Code) (N = 89)

COC Occupation Category	COC	N	%
Mining machine operators	616	13	14.6
Laborers, except construction	889	6	6.7
Construction laborers	869	5	5.6
Brickmasons, stonemasons	563	4	4.5
Industrial machinery repairers	518	3	3.4
Plumbers, pipefitters, steamfitters	585	3	3.4
Explosives workers	615	3	3.4
Welders and cutters	783	3	3.4
Operating engineers	844	3	3.4
Farm workers	479	2	2.2
Construction trades, nec	599	2	2.2
Mining occupations, nec	617	2	2.2
Supervisors, production occupations	628	2	2.2
Hand molders and shapers	675	2	2.2
Dental lab and medical appliance techs	678	2	2.2
Molding and casting machine operators	719	2	2.2
Misc. metal/plastic processing machine operators	725	2	2.2
Furnace, kiln and oven operators	766	2	2.2
Crushing and grinding machine operators	768	2	2.2
Managers and administrators	022	1	1.1
Accountants and auditors	023	1	1.1
Mining engineers	046	1	1.1
Civil engineers	053	1	1.1
Teachers, secondary school	157	1	1.1
Secretaries	313	1	1.1
Farmers, except horticultural	473	1	1.1
Heavy equipment mechanics	516	1	1.1
Mechanics, repairers not specified	549	1	1.1
Supervisors, brickmasons	553	1	1.1
Supervisors, precision production not specified	558	1	1.1
Tile setters	565	1	1.1
Electricians	575	1	1.1
Supervisors, extractive occupations	613	1	1.1
Misc. plant and system operators	699	1	1.1
Heat treating equipment operators	724	1	1.1
Packaging and filling machine operators	754	1	1.1
Mixing and blending machine operators	756	1	1.1
Misc. machine operators	777	1	1.1
Machine operators, not spec.	779	1	1.1

COC Occupation Category	COC	N	%
Hand molding, casting, forming occupations	787	1	1.1
Production inspectors	796	1	1.1
Production testers	797	1	1.1
Misc. material moving equipment	859	1	1.1
Supervisors, handlers, equipment cleaners, laborers	864	1	1.1
Freight, stock and material handlers, n.e.c.	883	1	1.1
Total		**89**	**100.0**

Primary Industry and Occupation: Probable Cases

Primary employment information was available for most probable cases (58/63 = 92%), as most probable cases lacked NIOSH-established confirmatory medical information rather than silica exposure confirmation. The industry and occupation distributions are very similar for probable and confirmed cases. Similar to confirmed cases, the top four primary industry sectors associated with exposure to silica among probable cases were construction special trade contractors (15.5%); manufacture of stone, clay, glass, and concrete products (15.5%); mining nonmetallic minerals (13.8%); and metal mining (12.1%). Occupations associated with probable cases were also similar to confirmed cases, and at least 27% (16/60 cases) of these occupations were in the mining sectors. Small numbers in each industry and occupation category prevent statistical comparisons between the industry and occupation distributions of confirmed and probable cases.

Total Silica Exposure Years of Confirmed Cases

For each industry associated with a confirmed silicosis case that completed an interview, "total silica exposure years" were summarized from all reported employments (up to seven employers per case) (Table 8). The industries that contributed the most person-years of exposure were Industrial sand (112 person-years, 6.9%), mining of gold ores (100, 6.1%), dental laboratories (91, 5.6%), manufacture of cut stone and stone products (65, 4.0%), and manufacture of minerals and earths, ground or treated (63, 3.9%). The collective number of years of exposure attributed to the nonmetallic minerals mining sector (SIC Group 14) was 247 years (15.1%).

Table 8. Total Person-years of Silica Exposure by Industry Reported by Confirmed and Interviewed Cases (N = 58)

SIC Code	SIC Description	Total Person-years	%
1446	Mining, industrial sand	112	6.9
1041	Mining, gold ores	100	6.1
8072	Dental laboratories	91	5.6
3281	Cut stone and stone products	65	4.0
3295	Minerals and earths, ground or otherwise treated	63	3.9
1499	Mining, misc. nonmetallic minerals, except fuels	59	3.6
1741	Masonry, stone setting and other stone work	52	3.2
1031	Mining, lead and zinc ores	50	3.1

SIC Code	SIC Description	Total Person-years	%
1442	Mining, construction sand and gravel	50	3.1
1044	Ming, silver ores	48	2.9
3255	Clay refractories	47	2.9
3321	Gray and ductile iron foundries	45	2.8
1021	Mining, copper ores	42	2.6
1799	Special trade contractors, nec	41	2.5
3366	Copper foundries	41	2.5
8711	Engineering services	41	2.5
1623	Water, sewer, pipeline, and communications and power line construction	40	2.5
4011	Railroads, line-haul operating	40	2.5
3469	Metal stamping, nec	37	2.3
3221	Glass containers	32	2.0
1743	Terrazzo, tile, marble, and mosaic work	31	1.9
3993	Signs and advertising specialties	30	1.8
8211	Elementary and secondary schools	30	1.8
3262	Vitreous china table and kitchen articles	29	1.8
3322	Malleable iron foundries	28	1.7
2082	Malt beverages	27	1.7
3261	Vitreous china plumbing fixtures and china and earthenware fittings and bathroom accessories	25	1.5
212	Beef cattle, except feedlots	21	1.3
3315	Steel wiredrawing and steel nails and spikes	21	1.3
291	General farms, primarily livestock and animal specialties	18	1.1
5211	Lumber and other building materials dealers	17	1.0
1094	Mining, uranium-radium-vanadium ores	16	1.0
1429	Crushed and broken stone, nec	16	1.0
191	General farms, primarily crop	15	0.9
1622	Bridge, tunnel, and elevated highway construction	14	0.9
9711	National security	14	0.9
1611	Highway and street construction, except elevated highways	13	0.8
3229	Pressed and blown glass and glassware, nec	13	0.8
1221	Bituminous coal and lignite surface mining	11	0.7
723	Crop preparation services for market, except cotton ginning	10	0.6
1422	Mining, crushed and broken limestone	10	0.6
	All others	127	7.8
	Total	**1632**	**100.0**

Medical Data: All Cases

Appropriate chest x-rays and a B-reading were obtained for a total of 205 identified silicosis cases (76.5% of all ascertained cases). The distribution of ILO result by case classification status is shown in Table 9. Overall, 49.8% of cases that received a B-read were consistent for silicosis, 47.8% were inconsistent, and only 2.4% were inconclusive. For B-readings that were consistent for silicosis (n=102), 78.4% of the cases were classified as confirmed, 3.9% were probable, 13.7% were incomplete, and only 1 case was inconsistent for silicosis. Cases with

ILO results inconsistent for silicosis (n=98), were classified as probable 51%, 25.5% as inconsistent and 19.3% as incomplete. Pulmonary pathology was available for only 10% of confirmed cases, of which 5 cases (56%) were consistent for silicosis and the remaining 4 pathology results were inconclusive. The ILO result was the single most important medical finding that enabled case confirmation in accordance with the NIOSH criteria.

Table 9. Cases by ILO Result and Case Classification Status

	Case Classification Status					
	Confirmed N (%)	**Probable N (%)**	**Inconsistent N (%)**	**Incomplete information N (%)**	**Environ. N (%)**	**TOTAL N (%)**
ILO Result						
Consistent	80 (78.4)	4 (3.9)	1(1.0)	14 (13.7)	3 (2.9)	**102 (49.8)**
Inconsistent	3 (3.1)	50 (51.0)	25 (25.5)	19 (19.3)	1(1.0)	**98 (47.8)**
Inconclusive	2 (40)	0	3 (60)	0	0	**5 (2.4)**
Total	**85 (41.5)**	**54 (26.3)**	**29 (14.1)**	**33 (16.1)**	**4 (2.0)**	**205 (100.0)**

Medical Data: Confirmed Cases

An ILO report was available for 96% of confirmed cases. The distribution of ILO small opacity profusion ranged from 1/0 (minimum for confirmed case) to 3+ (Table 10). The median case had small opacity profusion of 2/2 (moderate disease). Of note, for confirmed cases with small opacities, 25% had severe disease with 3/3 or greater (20 cases). The distribution of ILO large opacities is shown in Table 11. While 48% of cases had no large profusions, 40.8% had Category B or C, representing the most severe form of silicosis disease. This is consistent with the finding that 47% of confirmed cases had ILO readings consistent with Progressive Massive Fibrosis (PMF).

Table 10. Confirmed Silicosis Cases by ILO Small Opacity Profusion (N = 85)

Profusion	**N**	**%**
1/0	12	14.1
1/1	10	11.8
1/2	1	1.2
2/1	8	9.4
2/2	11	12.9
2/3	11	12.9
3/2	7	8.2
3/3	16	18.8
3+	4	4.7
Missing information	5	5.9
Total	**85**	**100.0**

Table 11. Confirmed Silicosis Cases by ILO Large Opacity Category (N = 85)

Category	N	%
0 (no large opacities)	41	48.2
A	4	4.7
B	19	22.4
C	16	18.8
No entry on ILO	5	5.9
Total	**85**	**100.0**

Clinical radiology reports (CRR) were available for 83.1% (n=74) of confirmed cases, and the distribution of CRR classification by case status is shown in Table 12. Using the NIOSH criteria for classifying CRRs, 39.3% were consistent, 1.1% were inconsistent, and 42.7% were inconclusive for silicosis.

Table 12. Confirmed Silicosis Cases by CRR Result and Case Classification Status (N = 85)

	Case Classification Status					
CRR Result	Confirmed N (%)	Probable N (%)	Inconsistent N (%)	Incomplete N (%)	Environ. N (%)	Total N (%)
Consistent	35 (77.8)	1(2.2)	1(2.2)	8 (17.8)	0	**45 (23.1)**
Inconsistent	1 (2.3)	19 (43.2)	16 (36.4)	7 (15.9)	1(2.3)	**44 (22.6)**
Inconclusive	38 (35.8)	32 (30.2)	17 (16.0)	17 (16.0)	2 (1.9)	**106 (54.4)**
Total	**74**	**52**	**34**	**32**	**3**	**195 (100.0)**

Demographic Data

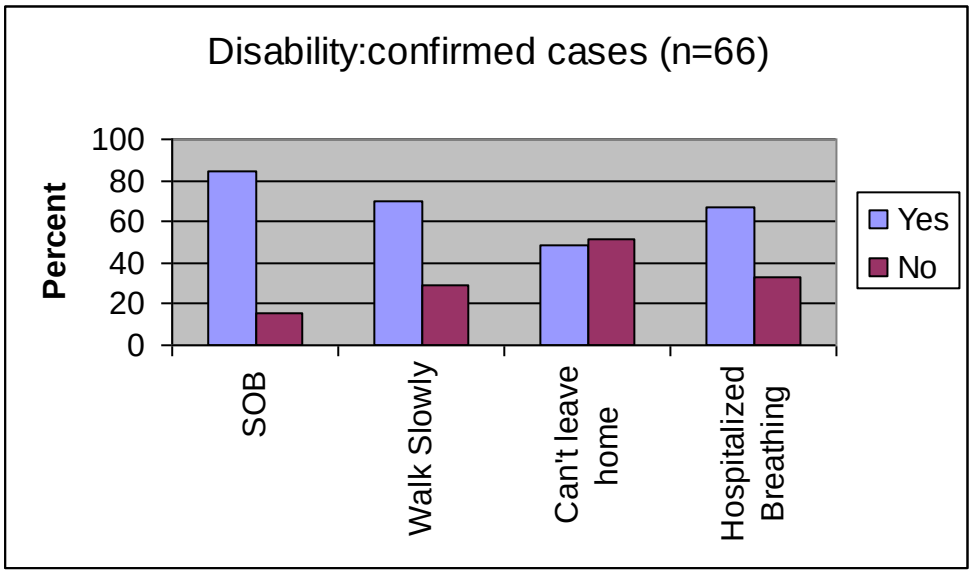
California silicosis cases were predominantly male (93.3%) with a mean age of 72 years when the case was reported (range: 25 to 91 years). For confirmed cases willing to report their race (n=72), 78% identified themselves as white, 9.7% as other/mixed race, and 7% as black. Ethnicity was available for 89% of confirmed cases (n=79): 68% were non-Hispanic and 32% were Hispanic. At the time of case follow-up, 46.1% (n=41) of the confirmed cases were deceased.

Disability and Workers' Compensation Status

Information about disability and quality of life impact were available for 66 confirmed cases that were living and completed interviews. Next-of-kin were not asked the questions about quality of life impact due to concerns about sensitivity and accuracy. Silicosis severely impacted the quality of life and, inevitably, longevity for those with severe disease. Shortness of breath was

reported by 84.8% of confirmed cases, 69.7% needed to walk slowly due to breathlessness, 48.5% of cases were too breathless to leave the house or manage activities of daily living, and 67% had been hospitalized for their breathing problems (Figure 1). The mean number of hospitalizations for breathing problems was 5.5.

Figure 1.



In spite of the rigorous evidence in support of occupationally-caused silicosis in medical records and occupational histories, only 27.3% (n=18) submitted a claim for silicosis. Because the average age of confirmed cases was 72 years old, and beyond typical working years, most cases did not pursue a workers' compensation claim. Of those confirmed cases that did pursue a workers' compensation claim, 7 were awarded a silicosis claim, 4 were denied, and 7 were pending.

Worksite Investigations with Silica Exposure Assessment

Personal silica exposure assessments were conducted at two different sand-related operations. Site 1 was a facility that conducted river dredging to obtain sand which was cleaned, screened, and graded, into specialty sand products (SIC 1442). Site 2 was an open-pit surface mining operation that produced crushed and broken stone (SIC 1429). Written investigation reports and recommendations provided to the employers, employees, and unions can be found in Appendices 1F and 1G. The major findings and recommendations from each report appear below.

Major Findings and Recommendations for Site 1: Sand dredging, cleaning, sifting, drying, and bagging

- Workers' exposures to respirable (invisible fine dust) silica dust ranged from 5% to 60% of the MSHA allowable exposure limit of 0.1 mg/m^3. Therefore, we found no evidence that exposures at SRI exceed the regulatory limit. Based on existing data, the MSHA limit is not low enough to protect all workers from getting silicosis — it has been

estimated that one worker out of four could get silicosis when exposed for a working lifetime at the MSHA level. Therefore throughout this report we will compare workers' exposures to the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) of 0.05 mg/m^3.

- Workers' exposures to respirable silica dust ranged from 7% to 90% of the NIOSH REL. In order to better protect its workers from silicosis, we recommended that this employer adopt the NIOSH REL as the company standard and take steps to reduce workers' exposure to respirable silica dust.

- The two employees working in the air-bagging and palletizing operation had the highest silica exposure levels at 90% and 78% of the NIOSH REL. Respirable silica dust exposure to workers doing air-bagging and palletizing should be reduced. Dust exposure controls should be put in place at the semi-automated palletizing machine with air slide. The company should assess how well the local exhaust ventilation is working at the air-bagging stations.

- The employee driving the front-end loader was exposed to silica at 34% of the NIOSH REL. The front-end loader operator's exposure should be reduced through regular wet cleaning or HEPA vacuuming of the cab, maintaining a well-sealed cab, keeping the windows closed as much as possible, and installing a cab filtration and pressurization system with air conditioning and heating ("environmental cab").

- Dry sweeping and using air guns expose workers to fine silica dust. A HEPA (special high efficiency vacuum) vacuum should be used instead of dry sweeping whenever possible. If this is not possible, hosing down (using water truck as water source), wet sweeping, or using a sweeping compound are preferable to dry sweeping. If possible, air guns should not be used to clean off equipment; HEPA vacuuming or wet wiping should be used instead.

- Short-term dusty tasks expose workers to respirable silica dust. Where these tasks cannot be controlled by changing work methods, workers should wear half-mask respirators with P-100 filters. These tasks include any dry sweeping; any shoveling of fine, dry material; blowing out the air-bagger; and loading "super sacks."

Major Findings and Recommendations for Site 2: sand and gravel mining and crushing operation

- Silica exposure sampling found that employees were exposed to respirable silica over the MSHA permissible exposure limit (PEL). Exposures ranged from 66% to 495% of the MSHA limit. It has been estimated that as many as one worker out of four could get silicosis when exposed for a working lifetime at the MSHA level. We recommend that the employer take immediate steps to reduce respirable silica exposure by implementing effective engineering controls and work practices.

- The primary crusher groundsman was found to be exposed at 252% of the MSHA permissible exposure limit; the secondary groundsman was exposed at 209% and 495% of the MSHA PEL. The floating groundsman was exposed at 138% of the MSHA PEL, and the mechanic was exposed at 275% of the MSHA limit. In the short term, the employer should ensure that all workers have medical clearance to wear fit-tested, half-

mask respirators with P-100 filters (or a respirator with at least an equivalent level of protection) at all times until respirable silica levels are demonstrated to consistently be in compliance with MSHA exposure limits. All work zones and shifts should be evaluated for silica exposure levels.

- The employee operating the primary crusher control booth was found to be exposed at 263% of the MSHA permissible exposure limit. The employer should install a new control booth equipped with a temperature-controlled positive pressure, filtered air ventilation system. Adequate dust suppression spray bars should be installed, maintained in operating condition, and brought under the direct control of the booth operator. In the interim, this employee should wear a fitted half-mask respirator equipped with P-100 filters.

- None of the five sampled workers reported receiving training on silicosis in the last year. The employer should provide training on silica hazards and silicosis at least annually and before any worker begins employment.

- None of the five sampled workers reported receiving a chest x-ray for silicosis screening in the last five years. The employer should implement a medical monitoring program for all silica-exposed workers which includes periodic chest x-rays. The chest x-ray is recognized as the most important screening tool to identify early lung damage from silica.

Dissemination of Educational Materials, Surveillance Data, Exposure Assessment Findings, and Prevention Recommendations

Educational Materials disseminated to all interviewed cases and/or next-of-kin included:

- Letter templates in English and Spanish to assist workers or next-of-kin to request information about workers' compensation
- NIOSH Alert: Preventing Silicosis and Deaths from Sandblasting (English)
- California Workers' Compensation Factsheet #1: What Every Worker Should Know (English and Spanish)
- Workers' compensation information: How to File a Claim Form (English and Spanish)
- Pamphlets: Silica Exposure of Surface Coal Miners, Silica Exposure of Metal and Nonmetal Miners, Tips for Preventing Silicosis, Controlling Dust for a Healthier Work Environment, Dust – What You Can't See CAN Hurt You!, A Guide to Working Safely With Silica
- California listing of silicosis support groups and Web sites

Comprehensive dissemination of results related to the two worksites that received silica exposure assessments was conducted through written reports to the employers, written reports designed for the workers, individual letters to ten sampled workers that interpreted their sampling results, and an oral presentation to workers (approximately 30 total attended) and management at both worksites. Written reports and follow-up telephone communications were provided to the MSHA District office and local Operating Engineers and Laborers Unions that represent the workers at the assessed worksites.

The following presentations of silicosis surveillance data were made during the project period:

- "Surveillance of Occupational Silicosis in California," American Public Health Association annual meeting, San Francisco, November 2003;
- "California Silicosis Program," NIOSH National Silicosis Meeting, Ohio, 2001;
- "Operationalizing the Silicosis Case Definition," NIOSH National Silicosis Meeting, San Diego, CA, 2003;
- "Three Years of California Silicosis Surveillance Data," NIOSH National Silicosis Meeting, Morgantown, WV, 2004.

An article for occupational health stakeholders (primarily lay audiences) was written for the Summer 2004 issue of *Occupational Health Watch*, the OHB annual newsletter. It presented preliminary findings from the first 2.5 years of silicosis surveillance and described one case of silicosis in a 58-year old man who was an operating engineer in a rock quarry.

The summary data tables included in this report were provided to the Cal/OSHA Research and Standards Unit in February 2006 to support a proposal for a special emphasis program on silica.

California surveillance data for 2000 and 2001 have been submitted to NIOSH for publication with other state-based silicosis surveillance data in an upcoming Work-Related Lung Disease (WoRLD) report.

1.5 Conclusions

Using multi-source case ascertainment and thorough case follow-up for medical, silica exposure, and quality-of-life outcomes, a recent profile of diagnosed silicosis cases in California is now available. Other than the longstanding NIOSH publication of deaths from silicosis cases for each state (http://www.cdc.gov/niosh/docs/2003-111/pdfs/2003-111d.pdf), no other data set exists that demonstrates the prevalence of diagnosed silicosis cases in California. While there was an average of 10.7 silicosis deaths per year reported on death records for the period 1990-1999, these numbers underestimate the extent of the silicosis problem, since a small percentage of diagnosed silicosis cases have silicosis as a cause of death on the death record.

The major findings from this California silicosis surveillance project show that approximately 79 cases of silicosis were diagnosed annually in California for the years 2000-2002. There were approximately seven additional deceased silicosis cases identified annually through review of Multiple Cause of Death files. Case confirmation rates from the pool of ascertained silicosis cases, using rigorous NIOSH-established criteria, were low at 37.4% for all identified cases, and with an additional 26.1% of identified cases classified as probable. Cases classified as probable typically had adequate silica exposure information but lacked the medical documentation required for classification as confirmed silicosis cases.

Clearly, the burden of the disease is strongly felt by those with the diagnosis, as 85% of 66 interviewed silicosis cases reported shortness of breath when walking on level ground or slight hills, and one-half of the cases were too short of breath to leave the house or accomplish daily living activities such as dressing. In spite of the rigorous evidence in support of occupationally-caused silicosis in medical records and occupational histories, only 27.3% (n=18) submitted a claim for silicosis.

The leading industries associated with California's confirmed silicosis cases were metal mining (17%); manufacture of stone, clay, glass, and concrete products (15.9%); special trades contractors (12.2%); and mining of non-metallic minerals (11%), i.e., sand and gravel.

Additional industries in which cases were identified included agriculture, other manufacturing industries such as metal foundries and aircraft transportation equipment, and other construction industries.

The most frequent occupations associated with confirmed cases were mining machine operators (14.6%), non-construction laborers (6.7%), construction laborers (5.6%), and brickmasons/stonemasons (4.5%). Mining-related occupations (mining machine operators, operating engineers, mining occupations not elsewhere classified, mining engineers, crushing and grinding machine operators, and supervisors in extractive occupations) comprise the single largest group of occupations that were affected by silicosis in California and account for 25% of all cases.

Occupations outside of mining with the greatest silicosis burden include non-construction laborers (6.7%) and a variety of construction-related workers, including construction laborers (5.6%), brickmasons/stonemasons (4.5%), plumbers/pipefitters (3.4%), welders/cutters (3.4%), and operating engineers (3.4%).

Clearly, workers heavily exposed to sand-containing materials, either in mining and processing of sand, downstream manufacturing operations, or in construction work involving exposure to silica dust in building materials, have some risk of developing silicosis. Because the occupational exposures of confirmed and probable silicosis cases were remarkably similar, a surveillance approach that focuses on the identification of industries and occupations from diagnosed silicosis cases, rather than with the added confirmation of silicosis diagnosis through medical records review, may be more economical and still effective for focusing future intervention efforts aimed at workers at high risk for current silica overexposure.

Evaluations of current silica exposure levels at selected California sand and gravel mining or dredging and processing operations indicated that significant overexposures to silica currently exist. In mid 2004, there were 362 construction sand and gravel mines with approximately 10,000 employees (64% of all mines in California). The OHB silicosis program measured exposures 1.4 to 5 times the PEL in 2001 at one sand and gravel mining and processing operation. The full extent of silica overexposure in the surface mining sector cannot be described from the limited worksite silica sampling that was conducted; however, the results suggest that silica overexposure may be a significant health concern for the surface mining sector. Further attention is needed to assess and improve conditions at these worksites to prevent future silicosis cases, as well as particulate air pollution that may affect workers and community residents.

2. SURVEILLANCE OF NONFATAL FALLS IN CONSTRUCTION

2.1 Background

Construction work is recognized as one of the most hazardous occupations, and falls are the leading cause of death and injury in the construction sector. Fatal work injuries in the U.S. involving falls were up 17 percent in 2004, and the 815 fatal falls recorded in 2004 represented the highest annual total reported by the fatality census for this event. The increase in fatal falls was led by a 39 percent increase in the number of workers who were fatally injured after a fall from a roof (from 128 fatalities in 2003 to 178 in 2004) and a 17 percent increase in the number of fatal falls from ladders (from 114 fatalities in 2003 to 133 in 2004) (http://stats.bls.gov/news.release/cfoi.nr0.htm). Fatalities among specialty trade contractors

increased from 629 in 2003 to 752 in 2004 and account for a large proportion of the overall increase in fatal falls.

In 2004, the construction sector also reported a high number nonfatal injuries related to falls, with 20,950 falls to lower level, out of 153,200 injuries in construction that required days away from work (http://stats.bls.gov/news.release/osh2.t05.htm). In many cases, there are few differences between the circumstance of fatal and non-fatal falls; the safety failures often overlap, and the outcome is determined by the extent of impact to the head and neck.

Internationally, it has been demonstrated by the Construction Safety Association in Ontario, Canada, that long-term, regularly funded, and comprehensive programs which increase awareness of the safety and health hazards in construction, change the "safety culture", support new safety regulations based on scientific evidence of safety benefit, and provide numerous quality resources and training to employees and employers can substantially reduce deaths and injuries in the construction sector (http://www.csao.org/UploadFiles/AnnualReport/Annual%20Report%202004.pdf). Ontario has experienced an 85% reduction in construction fatalities and injuries since 1969. The 2004 fatality rate in the construction sector (approximately 50% due to falls) is less than half of the rate in the U.S. (11.7/100,000 employed in the U.S. versus 5.4/100,000 employed in Ontario). The same comparison is true for construction-related injuries, where the data are also driven by falls.

The recent U.S. statistics magnify the importance of addressing the fall risk in the construction sector despite the many challenges to improving safety in this industry. These challenges include a highly mobile workforce, large numbers of workers who may be limited in their English and/or literacy skills, a relatively low level of unionization, large numbers of small businesses that may lack staff with safety expertise, and industry organizations that frequently oppose more protective safety regulations.

2.2 Specific Aims

As one component of the Core Surveillance Model Program in California, the Occupational Health Branch addressed the important problem of falls in the construction sector by carrying out the following specific aims:

- Establish and implement a new surveillance system for construction-related nonfatal falls in California;
- Follow up selected cases of falls from ladders, to obtain additional information about the circumstances of the injury incident and develop recommendations to prevent falls from ladders; and
- Disseminate the surveillance findings and prevention recommendations for falls among California construction workers.

2.3 Procedures/Methodology

Surveillance System

The *case identification source* for construction-related nonfatal falls was the Doctors' First Reports of Occupational Injury or Illness (DFR), a mandatory reporting and provider reimbursement system for all suspected occupational injuries and illness in California workers.

Approximately 750,000 DFRs are filed and reported to the Department of Industrial Relations annually.

The *case definition* for construction-related nonfatal falls captured by the surveillance system included the following criteria for defining falls, date of injury, industry, and occupation:

1. Fall definition - The fall must be classified into one of the following ICD-10 external cause of injury codes: W00-W19 or V85.4 (involving a slip, trip or fall). The fall definition excluded rolled ankle or foot; foot gave out; near misses-caught self; walking or stepped down and twisted knee/ankle; and repetitive injuries.

2. Date of injury - Potential construction-related fall injuries that occurred from January 1, 2001, through June 30, 2003, were selected. If the date of injury was not available, then the examination date or report date was used to select cases. Cases lacking date of injury, exam *and* report were excluded.

3. Industry - The industrial classification of the employers of fall cases was determined using business databases (Info USA's Phonedisc and/or Think Direct Marketing Business), coding based on the employer description provided on the DFR, or a phone call to the employer for a business description. Cases with employers classified in one of the following 1987 Standard Industrial Classification (SIC) categories were included:

   - Construction, Major Group 15 - Building Construction - General Contractors and Operative Builders
   - Construction, Major Group 16 - Heavy Construction other than Building Construction-Contractors
   - Construction, Major Group 17 - Construction - Special Trade Contractors

   Cases employed in the following 4-digit SIC industries were included when the case had a construction-related occupation or was performing a construction task:

   - 7361 Employment Agencies
   - 7363 Help Supply Services
   - 7389 Business Services, NEC (only building inspection services)
   - 8711 Engineering Services
   - 8712 Architectural Services
   - 8741 Management Services (only construction management services).

4. Occupation - 1990 Census Occupational Codes (COC) were used to code fall cases. Occupations consistent with the construction sector were selected based on the job title or narrative injury description found on the DFRs; cases with undetermined occupation but with SIC major group codes 15-17 were included. Cases with the following construction-related COCs were included:

   - 022 – Managers and Administrators, NEC (Construction Manager)
   - 035 – Construction Inspectors
   - 043 - Architect
   - 053 - Civil Engineers
   - 213 – Electrical and Electronic Technicians
   - 216 – Engineering Technicians, NEC

- 218 – Surveying and Mapping Technicians
- 503 – Supervisor, Mechanics and Repairers
- 516 – Heavy Equipment Mechanics
- 518 – Industrial Machinery Repairers
- 523 – Electronic Repairers, Communications and Industrial Equipment
- 534 – Heating, Air Conditioning, and Refrigeration Mechanics
- 543 – Elevator Installers and Repairers
- 547 – Specified Mechanics and Repairers, NEC
- 553 – Supervisors; Brickmasons, Stonemasons, and Tile Setters
- 554 – Supervisors, Carpenters and Related Workers
- 555 – Supervisors, Electricians and Power Transmission Installers
- 556 – Supervisors, Painters, Paperhangers, and Plasterers
- 557 – Supervisors; Plumbers, Pipefitters, and Steamfitters
- 558 – Supervisors, Construction, NEC
- 563 – Brickmasons and Stonemasons, Except Apprentices
- 564 – Brickmasons and Stonemasons Apprentices
- 565 – Tile Setters, Hard and Soft
- 566 – Carpet Installers
- 567 – Carpenters, except Apprentices
- 569 – Carpenter Apprentices
- 573 – Drywall Installers
- 575 – Electricians, except Apprentices
- 576 – Electrician Apprentices
- 577 – Electrical Power Installers and Repairers
- 579 – Painters Construction and Maintenance
- 583 – Paperhangers
- 584 – Plasterers
- 585 – Plumbers, Pipefitters, and Steamfitters, except Apprentices
- 587 – Plumber, Pipefitter, and Steamfitter Apprentices
- 588 – Concrete and Terrrazzo Finishers
- 589 – Glaziers
- 593 – Insulation Workers
- 594 – Paving, Surfacing, and Tamping Equipment Operators
- 595 – Roofers
- 596 – Sheetmetal Duct Installers
- 597 – Structural Metal Workers
- 598 – Drillers, Earth
- 599 – Construction Trades, NEC
- 615 – Explosive Workers
- 616 – Mining Machine Operators
- 653 – Sheet Metal Workers, Except Apprentices
- 654 – Sheet Metal Worker Apprentices
- 657 – Cabinet Makers and Bench Carpenters
- 696 – Stationary Engineers
- 753 – Cementing and Gluing Machine Operators (Cementer)
- 756 – Mixing and Blending Machine Operators (Asphalt-Mixing-Machine Operator)
- 769 – Slicing and Cutting Machine Operators
- 779 – Machine Operators, Not Specified

- 783 – Welders and Cutters
- 784 – Solderers and Brazers
- 804 – Truck Drivers
- 814 – Motor Transportation Operators
- 844 – Operating Engineers
- 848 – Hoist and Winch Operators
- 849 – Crane and Tower Operators
- 853 – Excavating and Loading Machine Operators
- 855 – Grader, Dozer, and Scraper Operators
- 856 – Industrial Truck and Tractor Equipment Operators
- 859 – Miscellaneous Material Moving Equipment Operators
- 866 – Helpers, Construction Trades
- 867 – Helpers, Surveyor
- 869 – Construction Laborers

A Microsoft Access database was created and used to manage the data on construction fall cases. Duplicate reports were removed by identifying repeat social security numbers and/or names in combination with matching dates of injury. Quality assurance/control measures to ensure accuracy of data transferred between case reports, data coding, and information entered in the database were performed on at least 50% of the DFR data and all of the questionnaire data for the duration of the project.

All analyses were performed using SPSS statistical software. Descriptive statistics, including injury code, industry, and occupation, were calculated using simple frequencies. Comparisons of differences between categorical variables were evaluated using the Chi-Square statistic.

Follow-up of Ladder Fall Cases

Ladder fall cases were identified from the narrative section of the DFR and assigned the injury code W11 – fall on or from a ladder. In order to balance the large number of ladder fall cases with limited resources for follow-up, fall cases that occurred in the odd months over an 18-month period (January 1, 2002, through June 30, 2003) were considered eligible for telephone follow-up interview. An on-line service, Search America, was used to locate workers who either had no phone number or a wrong/disconnected phone number listed on the DFR. Other online search engines were also utilized to improve contact rates, including http://www.whitepages.com/, http://people.yahoo.com/, http://www.smartpages.com/whitepages/, http://www.superpages.com/, and http://www.switchboard.com/. Once a case contact phone number was identified, interviewers attempted to contact each case a minimum of three times at different times and days of the week. An average of four calls was made to each case, and some cases received up to ten call-back attempts.

The content of the ladder fall interview questionnaire (Appendix 2A in English, Appendix 2B in Spanish) was developed to answer three primary questions:

- What was the specific task being performed at the time of injury?
- What were possible risk factors associated with the fall incident?
- From the perspective of the injured worker, were there opportunities to prevent the fall using different work methods or access equipment?

Additional demographic, employer-related, and personal work-related (job title, time in trade) questions were developed to better understand the characteristics of ladder fall cases.

All study protocols and materials, including standardized questionnaires with an informed consent script for telephone interviews of workers, were approved by the California Health and Human Services Agency Committee for the Protection of Human Subjects and the Public Health Institute's Research Review for the Protection of Human Subjects.

Dissemination of Surveillance Findings and Prevention Recommendations

Ladder fall prevention educational materials (Ladder Fall Prevention Guidelines, Appendix 2C) were developed by an industrial hygienist using materials distributed by ladder manufacturers (e.g., Louisville Ladder), Ladder Safety Guidelines from the Cal/OSHA Pocket Guide for the Construction Industry, and educational materials accessed from the Construction Safety Association of Ontario (www.csao.org) Web site in 2001. A Spanish translation of Ladder Fall Prevention Guidelines (Appendix 2D) was completed by a bilingual OHB staff and reviewed by a trained translator.

All interviewed ladder fall cases were offered and, if requested, sent copies of the Ladder Fall Prevention Guidelines.

Various presentations of the surveillance data on construction-related falls and, specifically, ladder falls were prepared and presented to audiences that included construction industry stakeholders (e.g., employers, trade association and union representatives), occupational health and safety professionals, and epidemiologists in other areas of public health. These presentations included prevention recommendations developed by project staff based on the surveillance findings. In addition, several lay articles were prepared to disseminate findings and recommendations to various constituent groups including construction trade associations and unions.

2.4 Results and Discussion

Construction-related Nonfatal Falls

Over a 2.5-year period from January 1, 2001, through June 30, 2003, 4,357 construction-related nonfatal fall cases among California workers were ascertained from Doctors' First Reports of Occupational Injury or Illness (DFRs). The age distribution for fall cases ranged from 14 to 83 years, with a mean of 34.8 years. Only 1.4% of the cases were female.

The most common type of fall was on or from a ladder (36.7%), followed by falls from, out, or through a structure (19.7%), and general falls from one level to another (16.6%, see Table 13). Carpenters were the occupational group with the greatest number of falls (17.9%), followed by construction laborers (16.7%), and construction trades not classified due to insufficient information (16.3%). The industry groups with the largest number of falls were General Contractors, Non-residential Buildings (16.9%); General Contractors, Industrial Buildings and Warehouses (13.6%); and Plastering, Drywall, Acoustical, and Insulation Work (13.3%). For complete distributions of occupations and industries, see Tables 14 and 15.

Table 13. California Construction-related Nonfatal Falls by Type of Fall
Doctors' First Reports of Occupational Injury or Illness, January 1, 2001 – June 30, 2003

ICD-10 Injury Code	External Cause of Injury	N (%)
W11	Fall on and from ladder	1,597 (36.7)
W13	Fall from, out of, or through building or structure	857 (19.7)
W17	Other fall from one level to another	721 (16.6)
W12	Fall on and from scaffolding	533 (12.2)
W19	Unspecified fall	348 (8.0)
W10	Fall on and from stairs and steps	175 (4.0)
	All others	126 (2.9)
	Total	**4,357**

Table 14. California Construction-related Nonfatal Falls by Occupation
Doctors' First Reports of Occupational Injury or Illness, January 1, 2001 – June 30, 2003

1990 COC Code	Occupation	N (%)
567	Carpenters, Except Apprentices	778 (17.9)
869	Construction Laborers	728 (16.7)
	Construction - general (insufficient information for coding)	709 (16.3)
595	Roofers	313 (7.2)
579	Painters, Construction and Maintenance	271 (6.2)
573	Drywall Installers	239 (5.5)
575	Electricians, Except Apprentices	214 (4.9)
585	Plumbers, Pipefitters, and Steamfitters, Except Apprentices	181 (4.2)
558	Construction Trades Supervisors, NEC	121 (2.8)
534	Heating, Air Conditioning, and Refrigeration Mechanics	108 (2.5)
584	Plasterers	96 (2.2)
	All others	599 (13.7)
	Total	**4,357**

Table 15. California Construction-related Nonfatal Falls by Industry
Doctors' First Reports of Occupational Injury or Illness, January 1, 2001 – June 30, 2003

1987 SIC Code	Industry	N (%)
1542	General Contractors-Nonresidential Buildings, Other than Industrial Buildings and Warehouses	737 (16.9)
1521	General Contractors-Single-Family Houses	593 (13.6)
1742	Plastering, Drywall, Acoustical, and Insulation Work	581 (13.3)
1711	Plumbing, Heating, and Air-Conditioning	427 (9.8)
1761	Roofing, Siding, and Sheet Metal Work	411 (9.4)
1721	Painting and Paper Hanging	263 (6.0)

1987 SIC Code	Industry	N (%)
1731	Electrical Work	258 (5.9)
	Nonclassifiable construction establishments	163 (3.7)
1751	Carpentry Work	130 (3.0)
1771	Concrete Work	128 (2.9)
1799	Special Trade Contractors, NEC	106 (2.4)
	All others	560 (12.9)
	Total	**4,357**

Falls from Ladders

Over a 1.5-year period from January 1, 2002, through June 30, 2003, 553 ladder fall cases were identified during the "odd" months (therefore the total number of ladder falls over this 1.5-year is estimated to be 1,106). Although follow-up telephone interviews were attempted for all cases, 247 cases (44.7%) were unreachable due to wrong number/disconnected number or no answer; 37 cases were inappropriate for follow-up because they did not meet the case definition, and 4 cases spoke languages other than English or Spanish (Table 16). A total of 169 interviews were completed from 265 reachable participants. The refusal rate among reachable cases was 36% (96 out of 265).

Table 16. Interview Participation Among Ladder Fall Cases
January 1, 2001 – June 30, 2003 (odd months)

Status	N (%)
Unreachable	247 (44.7)
No answer / unreachable	116
Disconnected / wrong number	131
Completed	**169 (30.6)**
Refused	96 (17.4)
Inappropriate (did not meet case definition)	37 (6.7)
Language other than English or Spanish	4 (0.7)
Total	**553**

Occupation and Industry

The occupational distribution of ladder fall cases closely parallels the occupational distribution for all construction-related falls, with the greatest proportion of falls among carpenters (22.3%) and construction laborers (12.7%), followed by painters (construction and maintenance) (12.0%) and electricians (10.8%) (Table 17). However, the industry distribution for ladder fall cases differs from that of all construction-related falls since the leading industry group was general contractors, single family houses (28.6%), followed by plumbing, heating, and air conditioning contractors (16.8%) and electrical work (12.4%) (Table 18). The SIC code distribution does not adequately portray the fact that 65% of interviewed ladder cases were working on residential projects at the time of fall, as the special trades industry classification represents work performed across all types of construction projects.

Table 17. Interviewed Ladder Fall Cases by Occupation (1980 COC)
California**,** January 1, 2001 – June 30, 2003 (odd months)

COC Code	Occupation	N (%)
567	Carpenters, Except Apprentices	37 (22.3)
869	Construction Laborers	21 (12.7)
579	Painters, Construction and Maintenance	20 (12.0)
575	Electricians, Except Apprentices	18 (10.8)
586	Plumbers, Pipefitters, and Steamfitters, Except Apprentices	15 (9.0)
534	Heating, Air Conditioning, and Refrigeration Mechanics	11 (6.6)
573	Drywall Installers	10 (6.0)
	All others	34 (20.5)
	Total	**166**

Table 18. Interviewed Ladder Fall Cases by Industry (1987 SIC)
California, January 1, 2001 – June 30, 2003 (odd months)

SIC Code	Industry	N (%)
1521	General Contractors-Single-Family Houses	46 (28.6)
1711	Plumbing, Heating, and Air-Conditioning	27 (16.8)
1731	Electrical Work	20 (12.4)
1542	General Contractors-Nonresidential Buildings, Other than Industrial Buildings and Warehouses	17 (10.6)
1721	Painting and Paper Hanging	16 (9.9)
1742	Plastering, Drywall, Acoustical and Insulation Work	12 (7.5)
	All others	23 (14.3)
	Total	**161**

Characteristics of Employment

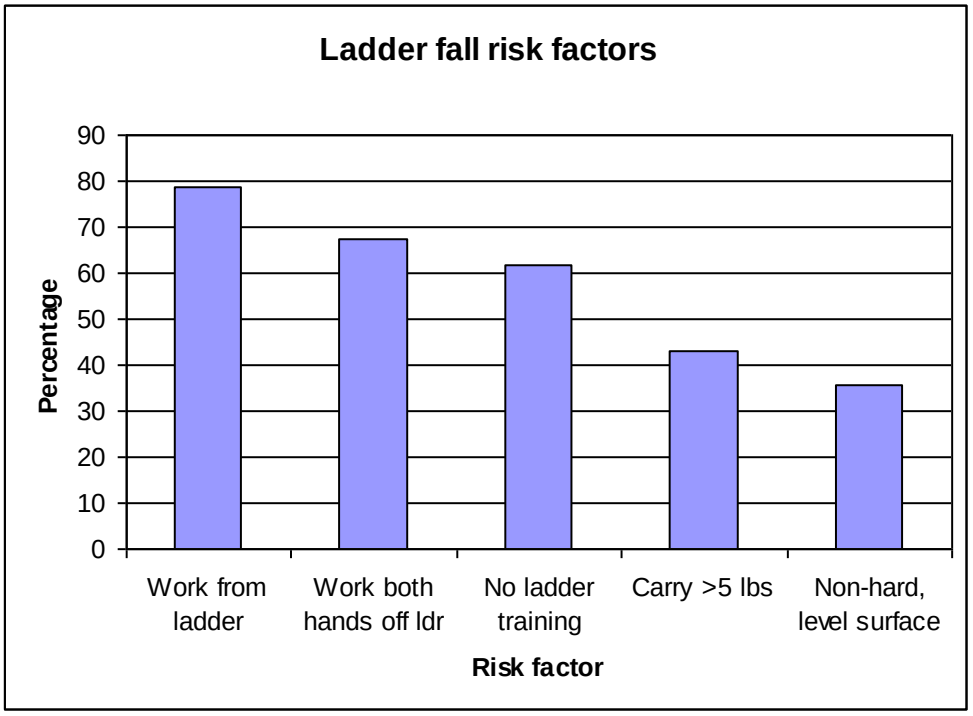
The vast majority of interviewed ladder fall cases (79.3%) worked for non-union employers, and the average number of employees on the worksite was 5.8 workers. The employer size ranged from 1 to 1000 employees, with a mean of 67 employees. The workers typically had significant work experience in the construction sector (mean of 11.4 years), although this varied considerably from 0.1 year to 40 years of prior experience. The majority of workers (73.7%) had more than three years of construction-related experience using ladders.

Ladder Type and Fall Risk Factors

Of the 169 interviewed ladder fall cases, the majority of cases fell from step ladders (63.7%), and the remainder fell from extension ladders (36.3%). The mean fall height was 7.3 feet, median fall height was 6.0 feet, and the range was 1 to 25 feet. The typical fall was from a height of 10 feet or less, as 80.4% cases fell 1 to 10 feet. Probable risk factors for falling from a ladder were collected for interviewed cases. The five most common risk factors related to

ladder fall cases were working from the ladder, as opposed to using the ladder just for access or inspection purposes (78.6%); working with both hands off of the ladder (67.3%); having had no ladder training in the last 12 months (61.9%); using hands to carry tools or materials weighing more than five pounds (42.9%); and having the ladder placed on a non-hard/non-level surface (35.7%) (Figure 2). The mean weight of equipment and materials carried (among those that carried 5 lbs or more in their hands while on the ladder) was 28.9 lbs, and the range was 5 lbs to 250 lbs.

Figure 2.



Risk Factors by Type of Ladder

Work practices that may reduce the likelihood of falling from an extension ladder include securing the top and/or bottom of the ladder; however, 80.4% of interviewed cases did not secure either the top or the bottom of the ladder. This is important since the overwhelming primary cause of extension ladder falls was reported to be the ladder slipping or falling (78.7%), as opposed to the user losing their balance (16.4%) or structural failure (4.9%). A separate risk factor particular to step ladders, failure to use the ladder in a fully open position, occurred in 15% (16/107) of the step ladder cases.

It is important to note that 69.2% of stepladder fall cases and 65.6% of extension ladder cases believed that their fall could have been prevented.

Type of Work Performed

It is notable that almost all interviewed workers, 93.3%, were performing a typical and regular work task at the time of the fall. Stated differently, ladder falls were not the result of performing

an unusual and new work task, but rather the fall resulted from a typical task and the confluence of one or multiple risk factors (e.g., excess carry weight, unstable ground for ladder placement, excessive kick-back force when using a power or hand tool). The type of work being performed at the time of the fall was fairly evenly distributed into three categories: finishing work (36.9%), structural work (29.8%), and mechanical work (29.2%). The majority of the work was new construction (60%), and the remainder was renovation (40%) except for one demolition case. The majority of ladder fall cases (65%) were working on residential construction projects, of which 66% of jobs were new construction projects, 33% were renovation or repair projects, and 1% were demolition projects.

Education and Training: Comparison of English and Spanish-Speaking Workers

Interviewed cases reflect the diversity typical among the California construction workforce, as 59% of case completed interviews in English and 41% preferred to complete the interview in Spanish. For the ladder fall cases for which information on educational level was available (n=154), 11.7% of cases had 0-6 years of formal education, 49.4% had 7-12 years of education, and 39% of cases had more than 12 years of education. There were educational differences between the cases whose primary language was Spanish versus English: 86.9% of Spanish-speaking workers had 12 years or less of education versus 43.3% of English-speaking workers with 12 years or less of education. There were statistically significant differences between English- and Spanish-speaking workers' likelihood of receiving ladder safety training in the year prior to their fall, as 45.5% of English-speaking workers had received ladder safety training, and only 27.5% of Spanish-speaking workers received similar training (Chi Square = 5.5, $p<.05$). Of importance for jobsite safety, Spanish-speaking workers reported that their supervisor spoke their language very well or well in the 37% cases for which there was detailed language information (16/43 cases), and 63% reported that their supervisor did not speak their language at all or spoke it very poorly (27/43 cases).

Dissemination of Surveillance Findings and Prevention Recommendations

The following presentations of findings and prevention recommendations based on the surveillance of construction-related falls among California workers were made during the project period:

- "Construction and Ladder Fall Project Approach and Objectives" at the OHB in-house staff seminar series, July 2003, Oakland, CA;
- "Construction-Related Falls in California" at the National Occupational Injury Research Symposium, November 2003, Pittsburgh, PA;
- "The Science and Politics of Falls" at the CSTE Annual Meeting, June 2003, Boise, ID;
- "Construction-Related Falls in California" at the CSTE Annual Meeting, June 2003, Boise, ID; and
- "Construction-Related Falls in California" at a construction stakeholder meeting for the BuildSafe California project, November 2004, Sacramento, CA; and
- "Construction-Related Falls and Ladders" at the CDHS Quarterly Epidemiologists Meeting, March 2005, Oakland, CA.

Three articles based on construction falls surveillance data were written for separate issues of *Occupational Health Watch (OHW)*, OHB's annual newsletter which is disseminated to over 3,500 individuals and organizations including construction trade associations and unions:

- "Ladder Falls Injure Many In Construction," *OHW*, Summer 2004;
- "Falls Case Studies: Little Difference Between Life and Death," *OHW*, Summer 2004; and
- "Carpenters are Most Likely to Fall," *OHW*, Fall 2005.

Copies of the Ladder Fall Prevention Guidelines were disseminated to interviewed ladder fall cases.

In February 2004, the OHB epidemiologist for the falls surveillance project prepared and submitted to the Cal/OSHA Occupational Safety and Health Standards Board a summary of the relevant scientific literature on construction-related falls for consideration in a rulemaking process regarding the Cal/OSHA standard on fall protection for residential-type framing activities.

2.5 Conclusions

While construction work is known to be one of the most hazardous occupations, and falls are the leading cause of death and injury in the construction sector, most falls are preventable. The ability to prevent many falls is understood by the workers themselves, as the majority of ladder fall cases we interviewed reported that they believed their fall could have been prevented. Ladder falls are common because this piece of equipment is often used improperly or for inappropriate tasks.

In California, the data on extension ladder falls indicate that 80% of the cases did not secure the top or the bottom of the ladder. Few workers had personal safety restraint systems to prevent their falls or reduce injury. The following key risk factors were also identified among ladder fall cases:

- performing work from the ladder (not just inspection);
- working with both hands off of the ladder;
- absence of ladder safety training;
- carrying items weighing more than five pounds while on the ladder; and
- working on a surface that is not level and/or hard.

These findings suggest that taking steps such as securing the ladder at the top and bottom to prevent movement could have a substantial impact in reducing ladder fall injuries and fatalities. They also highlight the need for safer work practices and the use of alternative work platforms for certain tasks that cannot be done safely using a ladder.

The majority of ladder fall cases (65%) were working on residential construction projects (66% new construction, 33% renovation or repair), and falls occurred most frequently among carpenters. These findings can direct future intervention efforts to increase safe ladder use and determine the need for equipment alternatives when the ladder cannot be used safely on residential construction sites.

The ladder fall data indicate that Spanish-speaking workers were significantly less likely to have received ladder safety training in the year prior to their fall, compared to English-speaking workers (27.5% of Spanish-speaking workers versus 45.5% English-speaking). Language issues may also influence the safety environment for Spanish workers, as only 37% of Spanish-speaking workers reported that their supervisor spoke their language very well or well, and 63%

reported that their supervisor did not speak their language at all or spoke it very poorly (27/43 cases).

Together, the risk factors common to most ladder falls and the identified gap between Spanish and English workers' safety training and ability of supervisors to communicate with their staff point to useful intervention efforts to reduce occurrence of ladder falls. In particular, many ladder fall injuries could be prevented if intervention efforts focus on the residential construction sector. Possible interventions should include efforts by public health and enforcement agencies to ensure that ladders are used properly and for appropriate tasks (e.g., those of short duration and light duty, those that do not require working with both hands off the ladder). Interventions should also be implemented to ensure that ladder safety educational materials are available in Spanish and accessible to all literacy levels.

In 2004, one year following the collection of falls surveillance data in California, BLS reported a 17% increase in the number of fatal, construction-related ladder fall cases in the U.S. The reduction of ladder falls is of statewide and national importance; the growing problem can be addressed through an increasing worker awareness and training on this common piece of equipment, strict adherence to the limits of the ladder as a piece of construction equipment, and an integrated construction safety campaign that reduces the acceptability of risk and tolerance of ladder falls.

3. OCCUPATIONAL HEALTH INDICATORS

3.1 Background

Experts in various fields of public health, such as chronic disease and injury prevention, have developed proposed "indicators" to enhance public health surveillance. An indicator is a measure of health or factor associated with health in a specified population.

Prior to the start of the Core Surveillance cooperative agreements in September 2000, the CSTE Occupational Health Surveillance Work Group, in collaboration with NIOSH, had initiated development of a set of occupational health indicators that states could use to track work-related health conditions and other factors related to them. Dr. Robert Harrison served as the California representative to the Work Group at that time; approximately ten states were represented on the Work Group. The Work Group utilized a consensus process to develop the occupational health indicators for use by states as a minimum occupational health surveillance activity. The indicators also promote consistency in time-trend analysis and allow for comparisons of occupational health status among states. They are intended to inform program and policy development at the national, state, and local levels and to promote improved worker safety and health. Indicators were selected based on the availability of easily-obtainable statewide data, public health importance of the health condition or exposure to be measured, and potential for workplace intervention.

3.2 Specific Aims

The five Core Surveillance states (California, Michigan, Massachusetts, New York, and Washington) agreed to work together with the CSTE Work Group and NIOSH to advance the Occupational Health Indicators (OHI) project as follows:

- Finalize definitions and descriptions of the original 13 OHIs which represented measures of health status;
- Explore defining additional OHIs that are factors associated with worker health (i.e., measures of hazard, intervention, or impact);
- Develop "How To" instruction guides for each OHI;
- Pilot test the OHIs, along with any other interested states, using year 2000 data;
- Produce and disseminate a report with the baseline year 2000 data for all participating states; and
- Take steps to evaluate the process and impact of the OHI project.

3.3 Procedures/Methodology

The CSTE Work Group, including representatives from CSTE, NIOSH, and several states, continued to use a consensus process to move forward with the OHI project. The Work Group met twice per year in person and frequently via telephone conference calls to continue this work. Representatives from California (Robert Harrison, Barbara Materna, and Florence Reinisch) actively participated in the Work Group activities. Within OHB, a team of epidemiologists and other staff (John Beckman, Rupa Das, Jennifer Flattery, Nancy Fleischer, Barbara Materna, Susan Payne, Florence Reinisch, and Laura Styles) divided up the Indicators work and met periodically to share information.

First the original 13 OHIs, all measures of health status, were completed; then, six more Indicators were added (measures of factors associated with worker health such as hazard, intervention, or impact) and an employment demographics profile that states could use to obtain an overview of important demographic characteristics of their workforce. A lead state person was designated to make final revisions to each Indicator definition and draft a "How To" guide that spelled out in clear steps exactly how to calculate each required measure of frequency (OHB staff volunteered to write five of the "How To" guides). Each state pilot tested the Indicators, using the "How To" guides to calculate the Indicator data for the year 2000, and reported back to the Work Group on any problems encountered. Additional states, including some with newly-developed occupational health surveillance programs, joined to participate in a second round of pilot testing.

The process involved many hours of discussion about the pilot testing results, making revisions as needed to the documents, and determining as a group how to best portray the results of the pilot test in a multi-state data report with year 2000 data. NIOSH staff contributed to this process and also calculated U.S. measures for each Indicator where possible. In addition, discussions were held in the Work Group to develop an initial evaluation of the OHI project.

3.4 Results and Discussion

The final employment demographics profile and 19 Occupational Health Indicators are listed in Table 19 with their primary data sources; the OHIs are described in detail, with a "How To" guide provided for each, in a CSTE document (CSTE 2004) available at http://www.cste.org/pdffiles/Revised%20Indicators_12.14.04.pdf. OHB staff prepared the "How To" guides for Indicators 11, 13, and 14 through 16.

Table 19. Occupational Health Indicators and Data Sources

Indicator	Data Source(s)
Employment Demographics Profile	Bureau of Labor Statistics (BLS) Current Population Survey and Geographic Profile of Employment and Unemployment
Indicator 1: Non-fatal injuries and illnesses reported by employers	BLS Annual Survey of Occupational Injuries and Illnesses
Indicator 2: Work-related hospitalizations	State hospital discharge data
Indicator 3: Fatal work-related injuries	Census of Fatal Occupational Injuries
Indicator 4: Amputations reported by employers	BLS Annual Survey of Occupational Injuries and Illnesses
Indicator 5: Amputations identified in state workers' compensation systems	State workers' compensation system (CA Workers' Compensation Information System)
Indicator 6: Hospitalizations for work-related burns	State hospital discharge data
Indicator 7: Musculoskeletal disorders reported by employers	BLS Annual Survey of Occupational Injuries and Illnesses
Indicator 8: Carpal tunnel syndrome cases identified in the state workers' compensation systems	State workers' compensation system (CA Workers' Compensation Information System)
Indicator 9: Pneumoconiosis hospitalizations	State hospital discharge data
Indicator 10: Pneumoconiosis mortality	State vital records
Indicator 11: Acute work-related pesticide poisonings reported to Poison Control Centers	American Association of Poison Control Centers
Indicator 12: Incidence of malignant mesothelioma	State cancer registries
Indicator 13: Elevated blood lead levels among adults	State Adult Blood Lead Epidemiology and Surveillance (ABLES) programs
Indicator 14: Workers employed in industries with high risk for occupational morbidity	Census Bureau County Business Patterns
Indicator 15: Workers employed in occupations with high risk for occupational morbidity	BLS Current Population Survey
Indicator 16: Workers employed in industries and occupations with high risk for occupational mortality	BLS Current Population Survey
Indicator 17: Occupational safety and health professionals	Current membership rosters of occupational health professional organizations
Indicator 18: Occupational Safety and Health Administration (OSHA) enforcement activities	OSHA Office of Statistics
Indicator 19: Workers' compensation awards	National Academy of Social Insurance

By the end of the cooperative agreement period, OHB staff had completed calculation of California OHI data for the years 2000 and 2001 (see Appendix 3A); year 2002 data were obtained for some Indicators.

In September 2005, CSTE and NIOSH jointly released "Putting Data to Work: Occupational Health Indicators from Thirteen Pilot States for 2000" (CSTE 2005). This document contains an introduction about the OHIs and their potential use by states to track progress on occupational health issues, a description of data sources, and presentation of OHI data in bar graphs and tables for 13 states and the U.S. Each of the Core Surveillance states, including California, contributed substantially to the development and production of this baseline OHI data report.

To date the Work Group has primarily evaluated the process of developing and calculating the occupational health indicators rather than their utility in promoting occupational health capacity at the state or national level. This project has involved an exceptional collaborative effort

between states, NIOSH, and CSTE, enhancing relationships and promoting future collaborations. Within our state, we have found that the process of obtaining indicator data has promoted or enhanced relationships with other agencies and programs whose data we are required to access (e.g., Cancer Registry, Poison Control Centers, hospital discharge data, OSHA, Division of Workers' Compensation, Vital Statistics, Bureau of Labor Statistics). We have also increased our skills in using available data sources, many of which we had not extensively explored prior to this effort. State personnel also gained additional knowledge through participation in a one-day meeting convened by NIOSH in April 2004 with the U.S. Census Bureau and Bureau of Labor Statistics (attended by Barbara Materna and Florence Reinisch). This meeting included an overview of multiple sources of denominator data (e.g., statistics on employment and number of establishments) and hands-on demonstrations of how to access and use available data sources.

The Work Group also discussed methods by which to use the indicators to promote awareness of and support for occupational health programs. CSTE contracted with Fenton Communications, Inc., to assist states in communicating clear messages about the value of occupational health surveillance, developing accessible, understandable language with which to discuss the indicators, and strategizing on how best to influence policymakers and funding agencies to support occupational health programs. The most recent work with Fenton Communications, in summer-fall 2005, focused on development of a plan for national and state-specific dissemination of the 13-state OHIs report.

3.5 Conclusions

We believe the OHIs offer an important method for states to develop baseline data on occupational health status, and to track these data over time to guide our program efforts. Inclusion of the OHIs as a Fundamental Program activity in the state-based occupational health surveillance programs funded by NIOSH in 2005 and onward offers the opportunity to continue to work with other states, NIOSH, and CSTE to further develop and evaluate their usefulness for guiding prevention work. In California, we intend to utilize these simple measures of occupational health status as a starting point for further in-depth analysis of available data sources in order to set program priorities for prevention activities, and to track trends and progress over time.

4. LEAD POISONING INVESTIGATIONS

4.1 Background

The Occupational Lead Poisoning Prevention Program (OLPPP) was established in the California Department of Health Services following passage of the Occupational Lead Poisoning Prevention Act in 1991. OLPPP is a statewide program aimed at preventing work-related lead poisoning among California workers.

In 1986, the California Legislature passed a law that created a laboratory report-based tracking system for lead poisoning cases in children and adults. Laboratories performing blood lead analyses on samples drawn in California are required to report electronically all blood lead levels (BLLs) to the California Department of Health Services. OLPPP receives reports for adults 16 years of age and older. Laboratories are required to report BLLs and sample collection history, patient identifiers and demographics, and employer information. OLPPP collects test results and enters them into the California Occupational Blood Lead Registry.

4.2 Specific Aims

OLPPP investigates cases of work-related lead poisoning and lead poisoning in children that resulted from lead brought home from the workplace. The aim of the OLPPP investigation program is to ensure that workplace sources of lead exposure are identified and controlled by the employer to prevent future cases of lead poisoning. The goal of OLPPP is also to ensure that individual workers receive appropriate medical care.

4.3 Procedures/Methodology

OLPPP initiates intensive case management efforts when a report is received for a worker with a BLL of 50 ug/dl or greater or when a local health department suspects that a child has been poisoned by lead brought home from the workplace. OLPPP defines a case as take-home lead poisoning when the following criteria are met: 1) a child or other household member has a BLL of 10 ug/dl or greater; 2) an adult worker in the household has a BLL of 10 ug/dl or greater; and 3) a source of lead in the workplace has been confirmed. The worker, employer, and health care provider are contacted by phone and interviewed with a standardized questionnaire. OLPPP provides employers with a detailed letter specifying recommendations for controlling lead exposure and a timeline for implementing needed improvements. OLPPP frequently has additional contact with all parties to answer questions and provide technical assistance. OLPPP's policy is to work cooperatively with employers to identify and address lead hazards. However, if an employer fails to address significant lead hazards, OLPPP will refer an employer to Cal/OSHA for a compliance inspection.

4.4 Results and Discussion

During the period October 1, 2000 through September 30, 2005, 50 workers met the OLPPP criteria for case investigation (Table 20). We investigated each of these cases of lead poisoning (representing 33 employers) and made specific recommendations for correcting working conditions that resulted in a worker becoming lead poisoned. In addition, OLPPP investigated 30 cases of take-home lead poisoning (representing 21 employers) (Table 21). OLPPP referred four employers to Cal/OSHA for failing to comply with our recommendations. These employers included two industrial painting companies, a scrap yard, and a firing range.

The industry segment reporting the greatest percentage of serious worker lead poisoning cases was construction (54%) followed by the service (24%) and manufacturing (20%) sectors. Painting and Paper Hanging (SIC 1721) had the largest number of reported cases (18). Fourteen of these 18 cases were employees of two large industrial painting contractors working on earthquake retrofit projects on San Francisco Bay Area bridges. Among take-home cases, the largest number of children affected had household members in the service industry. The blood lead levels of workers associated with take-home cases ranged from 10 - 59 ug/dL. Many of these workers had BLLS at or below 20 ug/dL showing that even when a worker has a relatively "low" BLL a child or other household member can still be poisoned.

Table 20. Worker Lead Poisoning Case Investigations
October 1, 2000 – September 30, 2005

Industry Standard Industrial Classification	**# of workplaces**	**# of workers with BLL ≥ 50 ug/dL**	**Range of BLLs (ug/dL)**
1541: General Contractor, Industrial Bldgs.	1	1	50
1629: Heavy Construction	1	2	50,55
1721: Painting and Paper Hanging	6	18	50-84
1741: Masonry, Stone Setting, Other Stone Work	1	1	59
1791: Structural Steel Erection	1	1	72
1795: Wrecking and Demolition	1	2	50,51
1799: Special Trade Contractors	2	2	55
3269: Pottery Products, not elsewhere classified	1	1	56
3366: Copper Foundries	1	1	63
3442: Metal Doors, Sash, Frames, etc.	1	1	50
3444: Sheet Metal Work	2	3	55-62
3482: Small Arms Ammunition	1	2	58,59
3691: Storage Batteries	1	1	61
3714: Motor Vehicle Parts	1	1	58
5093: Scrap and Waste Materials	1	1	60
7539: Automotive Repair, not elsewhere classified (radiator repair)	9	10	51-67
7999: Amusement Services (firing ranges)	2	2	51,57
Total	**33**	**50**	**50-84**

Table 21. Take-home Lead Poisoning Case Investigations
October 1, 2000 – September 30, 2005

Industry Standard Industrial Classification	**# of workplaces**	**# of children with BLL ≥ 10 ug/dL**	**Child's BLL (ug/dL)**
1721: Painting and Paper Hanging	2	2	18,25
1741: Masonry, Stone Setting	1	1	20
3341: Nonferrous Secondary Smelting	1	1	21
3444: Sheet Metal Work	1	1	20
3482: Small Arms Ammunition	1	1	18
3691: Storage Batteries	3	4	11-27
3714: Motor Vehicle Parts	1	2	15,16
3949: Sporting and Athletic Goods	1	1	20
5093: Scrap and Waster Materials	1	1	11
7011: Hotels and Motels	1	2	18,24
7539: Automotive Repair (radiator repair)	3	3	13,13,13
7641: Reupholstery, Furniture Repair	1	4	10-34
7999: Amusement Services (firing range, do-it-yourself pottery decoration)	2	3	18-29

Industry Standard Industrial Classification	**# of workplaces**	**# of children with BLL ≥ 10 ug/dL**	**Child's BLL (ug/dL)**
Unknown Construction Trades	2	4	10-40
Total	**21**	**30**	**10-40**

4.5 Conclusions

As in previous years, lead poisoning cases were linked to a failure to comply with the basic requirements of the Cal/OSHA Lead Standards – lack of worker training in lead hazards, poor or non-existent local exhaust ventilation, improper use of respirators, unsafe clean-up methods, poor hygiene facilities or practices, and lack of protective clothing and equipment. In addition, very few employers had ever conducted air monitoring for lead and had no idea of the level of lead their workers were being exposed to. Among small employers, there was often a complete lack of awareness about lead hazards. Even when small employers were aware of lead hazards, they did not know how to control them. Finally, OLPPP has seen in the last several years cases of lead poisoning in day laborers (workers who are employed casually in the construction trades) or their family members. In some of these cases, the worker did not know the name of his employer, or was uncomfortable sharing this information with OLPPP. Without the employer's identify, OLPPP's case investigation was incomplete.

5. CONSTRUCTION INDUSTRY INTERVENTION TO IMPROVE TAILGATE TRAININGS

5.1 Background

At the time when the Occupational Health Branch proposed the "Core Surveillance Model Program in California" to NIOSH, OHB had developed considerable experience collecting surveillance data on outcomes such as lead poisoning, asthma, carpal tunnel syndrome, pesticide poisonings, and fatalities. These surveillance projects include case follow-up activities to assess the causes of injuries and illnesses and to form the basis for making prevention recommendations. Established since 1978, OHB also had extensive experience in conducting a range of research and intervention activities; however, a lack of sufficient resources often precluded us from initiating large-scale intervention projects where a statewide focus and impact on health and safety within a high-risk industry was desired.

In the proposal for this cooperative agreement, we proposed to work with partners to conduct a statewide project to reduce injuries and illnesses in the construction industry. Our goal was to use stakeholder group input to identify, implement, and evaluate an intervention project that would ideally address multiple construction health and safety hazards simultaneously. We also planned to develop useful resources for this project that could continue to be distributed after the completion of the intervention project, in order to extend the potential impact of this work beyond the period of time for which NIOSH funding was available.

We chose to focus on the construction industry because it has widely been identified as having a high incidence of illness and injury, including fatalities. The OHB surveillance systems (e.g., lead poisoning) have frequently found construction work to be among the top high-risk industries and occupations. Construction work is unique, with changing work assignments and site conditions, episodic employment patterns, intense competition, multiple contractors working under completion schedules, and large numbers of small businesses that frequently lack trained

health and safety staff. The construction workforce in California is increasingly comprised of immigrant workers, often with limited English-speaking ability and education. These characteristics present challenges for implementing effective injury and illness prevention programs.

OHB had previously completed substantial work in the area of lead-related construction, so we had developed relationships with many construction-related organizations and individuals across the state. This credible history provided a platform and a natural transition for us into a broader construction health and safety agenda. We chose to work with construction industry stakeholders with the expectation that, by involving them in the process from the beginning and presenting the promise of together fulfilling a desired outcome, they could become the project's most enthusiastic supporters. We also expected to learn from their experiences, tap into their interests and priorities, and gain assistance from them in carrying out the project.

We used existing data and other information we collected to engage stakeholders in a process to identify, prioritize, plan, conduct, and evaluate a prevention project to reduce injury and illness at California construction sites.

5.2 Specific Aims

As one component of the Core Surveillance Model Program in California, the Occupational Health Branch implemented an intervention to reduce injury and illness in the construction industry by carrying out the following specific aims:

- Conduct information-gathering and needs assessment, including establishment of a stakeholder advisory committee process, to guide in the selection and design of an intervention project;
- Choose the focus of the intervention project;
- Develop the intervention project, a statewide seminar series called "BuildSafe California: Conducting Effective Tailgate Trainings," including a training curriculum and resource materials ("Safety Break Cards" in English and Spanish, and a listing of other Internet-based resources for tailgate trainings);
- Carry out the intervention project; and
- Evaluate the impact of the intervention and the process of working with the stakeholder group to carry out the project.

5.3 Procedures/Methodology

Information Gathering and Needs Assessment

Our information gathering and needs assessment process included:

- Reviewing the scientific literature on construction health and safety (with particular attention to intervention efforts) and compiling available injury and illness statistics;
- Obtaining input from California construction industry stakeholders through an advisory committee process;
- Conducting key informant interviews of industry subject-matter experts; and
- Undertaking research of possible model intervention programs as suggested by the advisory committee and key informants.

The literature review included a comprehensive look at the published and unpublished literature on construction injury and illness rates by trade, size, union/non-union status, and other variables. We also reviewed successful and unsuccessful construction interventions reported on by others in peer-reviewed journals and other publications.

As part of the needs assessment process, we established two construction industry stakeholder advisory committees in northern and southern California. We started a process of engaging stakeholders by inviting individuals and organizations with whom we had prior relationships in the context of conducting lead safety trainings for the commercial and industrial construction industry. We announced that we had been the recipient of a NIOSH cooperative agreement and were looking for their guidance on a direction to take for a construction industry intervention project. The stakeholders initially recruited included small and large contractors, contractor trade associations, local and statewide construction union representatives, and Cal/OSHA staff; we subsequently also recruited representatives from day laborer programs and additional public agencies (e.g., California Department of Transportation).

In our first round of meetings with industry stakeholders in both northern and southern California, we provided an overview of the project's purpose and a brief outline of the four-year work plan. We then asked participants to:

- Brainstorm a list of the most important health and safety issues they faced;
- Identify programs or approaches they knew of that successfully reduced injuries and illnesses; and
- Discuss how the Occupational Health Branch could work with them to make the construction industry safer.

With many injury and illness prevention programs already existing in the construction industry, we considered replicating a modified version of an existing (and successful) program rather than creating a whole new program. With that in mind, we conducted key informant interviews by telephone of experts in the field. These people were not members of the stakeholder advisory committees, but were respected and experienced people from industry, unions, universities, safety councils, and industry trade associations. From key informants we sought information on: successful intervention projects and educational materials they were aware of; what they believed to be the most important construction safety issues to focus on; suggestions for conducting outreach and publicity in order to gain the participation of contractors in activities to promote safety; and recommendations for how to motivate contractors to address safety issues. We also asked their opinion about whether our proposed intervention project should focus on multiple health and safety issues simultaneously, or a single high-priority issue.

These interviews helped to identify additional individuals and organizations who have implemented model health and safety programs in the United States and internationally from which we could learn and obtain feedback on proposals we were developing. From these interviews and connections made, we gathered many examples of construction health and safety programs and educational/training materials that had merit and could possibly be replicated in California. For intervention efforts that addressed important construction health/safety issues and seemed like possibilities for us to consider, we did further research through additional telephone discussions with experts, review of materials and curricula, estimation of costs and resources needed, etc.

Choosing the Intervention Focus

Our project staff took the stakeholder advisory committees' initial input, the needs assessment results (literature search, key informant interviews, surveillance data from OHB and other sources, results of a few worksite investigations), and descriptions of work done by others, and formulated numerous proposals for potential intervention projects. We then outlined eight possible intervention projects and used internally-developed rating criteria to narrow the eight projects down to four possibilities. We then further developed the possible interventions by gathering some additional information on each of the four proposals.

Next, we again convened the two advisory committees in northern and southern California, this time recruiting more broadly and adding some new advisory committee members, including representatives from day labor support organizations and public agencies. We presented a description of OHB, our plans for this four-year project, and the progress made to date. We also provided an overview of available data on injuries, illnesses, and hazards in construction work.

We presented to the advisory committees four possible interventions with background information, relevant data supporting each one, and our assessment of the strengths and weaknesses of each proposed intervention. The four proposed projects included:

- Conducting a program to improve tailgate safety training (i.e., short, onsite safety trainings, which are required by Cal/OSHA to be conducted at least every ten working days on construction jobsites)
- Developing a new ladder safety video;
- Implementing a day laborer safety training program; and
- Implementing a fall prevention program based on West Virginia University's "Fall-Safe" program.

Each proposal was presented in detail, with time allotted for further discussion of its strengths and weaknesses. The information was presented in a matrix format so that the reviewer could easily compare the different proposals, and a narrative on each project was also provided (Appendix 5A).

We then asked the advisory committee members to use specific criteria to provide us with written feedback and a preferred ranking of these four proposals (from "most preferred" to "least preferred"). Each proposed project was to be rated based on the extent to which it would:

- Address one or more significant health and safety problems;
- Build on the successful efforts by others;
- Have a statewide focus;
- Involve collaborations with many partners;
- Reach significant numbers or test an approach that could be expanded later to reach larger numbers; and
- Create materials and resources to last beyond the funded project period.

Project staff carefully considered the comments and rankings from advisory group members, including an analysis of the ranking results by type of stakeholder (i.e., whether the rater represented a trade association or employer representative, union, community-based organization, or public agency). We also asked non-attendees to look over the materials presented at the meetings and send in their preferences. Finally, we conducted our own

assessment of the degree to which each project met the criteria listed above and considered the feasibility of carrying them out (e.g., resources or technical expertise needed).

Project staff made the final decision and selected improving the quality of tailgate safety training as the focus of the intervention.

Developing the Intervention Curriculum and Materials

We titled the intervention project "BuildSafe California: Conducting Effective Tailgate Trainings" and determined that the objectives would be to:

- Deliver statewide, a minimum of 15 half-day training-of-trainers (TOT) programs on conducting effective tailgate trainings;
- Train 450 to 1500 supervisors, foremen, and union representatives who are positioned to deliver or ensure delivery of tailgate trainings;
- Improve the capacity of participants to deliver effective tailgate trainings;
- Develop new "Safety Break" tailgate training materials in English and Spanish, and other useful resources;
- Partner with organizations to reach contractors and workers;
- Evaluate whether participants improved the frequency and quality of their tailgate trainings, leading to jobsite safety changes;
- Identify barriers to conducting tailgate trainings and best practices; and
- Make policy recommendations if appropriate.

To inform us on the development of the curriculum and materials we:

- Contacted contractors to determine what they were doing currently as far as providing tailgate trainings (e.g., content, length and timing of trainings, materials used, who delivers trainings, recordkeeping practices, oversight done to ensure trainings are delivered);
- Observed tailgate trainings at residential, commercial, and heavy construction jobsites;
- Videotape-recorded tailgate trainings conducted by others at several different worksites;
- Interviewed company and union trainers on what they felt were the barriers, benefits, and best approaches to delivering tailgates; and
- Identified and reviewed tailgate training materials developed by others.

Training Curriculum

We identified four key themes that we wanted to emphasize in the training curriculum to convey and illustrate the "best practices" of tailgate training. We also planned to encourage attendees to come back to these theme questions whenever doing a tailgate training to assess how well they were doing. The criteria for success or what makes for an effective tailgate training should have affirmative responses to:

- Does the topic fit the job? Training must be made relevant by talking about hazards the crew is facing, or about to face, on that job.
- Does the crew participate? Get the crew involved with questions, ideas, observations, stories and solutions.
- Do I demonstrate what I am talking about? Whenever possible, have crew members show and demonstrate tools, equipment, or procedures.

- Does the tailgate lead to action? Follow up on good ideas that come out of the training. Focus on concrete changes in the way the job is set up or run.

The half-day training curriculum was designed to provide a mix of speakers (from OHB and Cal/OSHA as well as contractors who would serve as peer educators) and activities. We aimed to maximize interaction between participants and integration of the material through discussion, questions and answers, and participatory exercises. We recruited speakers from Cal/OSHA Consultation Service and peer contractors, and worked with them to develop their role in the curriculum.

We decided to use video-taped examples of tailgate trainings as a key teaching tool because:

- They provided concrete examples of trainings;
- Allowed for a discussion of effectiveness of training techniques;
- It was easier to talk about real trainings than abstract ones;
- You don't have to discuss the training techniques of someone in the room;
- It demonstrates effective tailgates can be done quickly; and
- It illustrates well how a few simple techniques applied to a "canned" tailgate can greatly improve it.

The curriculum evolved somewhat during the course of the project based on participant evaluations and the assessment of the trainers about what aspects worked well or less well.

Educational Materials and Resources

To assist participants in delivering tailgate trainings, we developed a set of "Safety Break" cards in both English and Spanish. These materials utilized content and graphics from the Construction Safety Association of Ontario tailgate materials, but were adapted into a new format designed to emphasize the themes of effective tailgate training stated above. The Safety Break cards were designed to:

- Help the trainer to prepare quickly;
- Promote discussion and problem solving ("active learning") ;
- Provide content information on 22 common topics;
- Include illustrations with simple graphics;
- Refer to regulations and background material on each topic from the *Cal/OSHA Pocket Guide to Construction;*
- Cover content in both English and Spanish versions;
- Give users a template to guide development of tailgates on new topics; and
- Include a training documentation form.

While in a draft stage, the cards were reviewed by experts, contractors, workers, union representatives, and others for accuracy, usefulness, and understandability. The Spanish language cards (translated by a bilingual OHB staff) were also reviewed by bilingual construction personnel and a Mexican native-speaking translator for translation and understandability issues.

Other resources were also assembled for distribution to participants in a resource folder. These included the *Cal/OSHA Pocket Guide to Construction* in English

(http://www.dir.ca.gov/dosh/dosh_publications/const_guide.pdf) and Spanish (http://www.dir.ca.gov/dosh/dosh_publications/constr_g_sp.pdf), flyers about other tailgate training materials, and a listing developed by OHB of websites that contain tailgate training materials or other useful information trainers can use to develop their programs (http://www.dhs.ca.gov/ohb/BuildSafe/links.htm).

Carrying Out the Intervention

Co-Sponsors/Endorsers

We sought and obtained the co-sponsorship of the State Compensation Insurance Fund (SCIF, the workers' compensation carrier that insures a majority of small construction contractors in California); Cal/OSHA Consultation Service; and the Golden State Builders Exchange (statewide contractor trade association). We anticipated that these co-sponsors would contribute to the project in various ways, including providing additional resources necessary to carry out the intervention.

SCIF provided graphic artist services for invitation design (Appendix 5B), supported large mailings to their insured businesses, co-produced the Safety Break training cards (including providing funds for the initial printing run), supported a special reprinting of the *Cal/OSHA Pocket Guide for Construction*, and provided training locations at their district office sites which are centrally located throughout the state. These substantial contributions were essential to the implementation of the project.

Cal/OSHA Consultation Service provided a speaker at each training who focused on the agency's expectations for a construction site safety program. Cal/OSHA also provided copies of the *Pocket Guide for the Construction Industry* in English and Spanish.

The Golden State Builders Exchange and local county affiliates provided outreach and publicity among members and training locations. Under some circumstances, the local Builders Exchange offices hosted the trainings at their offices or another site.

We also obtained the endorsement of 15 contractor organizations and the state building construction union organization. All of these organizations assisted in doing publicity and outreach to recruit participants to the trainings.

The Endorsing Organizations included: Local Builders Exchanges; Associated General Contractors of California; State Building and Construction Trades Council of California; Southern California Builders Association; Associated Roofing Contractors of the Bay Area Counties, Inc.; Construction Employers Association of California; American Subcontractors Association California, Inc.; California Conference of Mason Contractors; Southern California Contractors Association; Roofing Contractors Association of California; Union Roofing Contractors Association of Southern California; Western Electrical Contractors Association; California Building Industry Association; Painting and Decorating Contractors of California; and the California Landscape Contractors Association.

Outreach/Marketing

Our project's outreach/marketing strategy was to use a number of approaches simultaneously, including working with SCIF on outreach to their insured and working with other stakeholders to conduct outreach to their members and beyond. We worked with organizations that routinely do

broad industry outreach, in addition to communication with members, since many contractors do not belong to any organization.

Outreach and publicity methods used to recruit contractors/supervisors/foremen to attend the trainings included:

- Large mailings by the SCIF to their insured businesses;
- Mailings using an OHB database of over 1800 contractors who previously attended lead construction trainings;
- Articles in the Contractors State Licensing Board (CSLB) newsletter that goes to every licensed contractor in the state;
- Contractor organization publicity to members through their newsletters, web sites, mailings, and fax blast announcements;
- Union publicity to signatory contractors and union representatives;
- Public agency publicity to bidders and other purchasers of construction services;
- Email announcements sent out with an attached pdf announcement and registration form, and link to our program website.

Based on previous experience recruiting for construction industry trainings, we learned that our best turnouts took place where we were able to reach busy contractors at least three times through three different media. In order to have that level of exposure, it often required having local affiliates of statewide contractor organizations taking “ownership” of the event by their publicizing the event through announcements in their weekly mailed bulletins, fax blasts, emails and websites. Meanwhile the recipient would also read about it in a SCIF mailing they received and perhaps also read about it in the CSLB newsletter.

Our outreach message to contractors stated:

“As a contractor, are you aware that you are required by Cal/OSHA to conduct "tailgate" trainings every 10 working days? Maybe you know this, but have been too busy to organize this part of your business? Maybe you are doing these trainings, but in the back of your mind wonder if they are doing any good? Maybe you wish you had some easier-to-use and more effective training materials? Maybe you are wondering if your Spanish-speaking workers understand what the safety hazards are on the jobsite? If any of this sounds familiar, then you should check out the program on "Conducting Effective Tailgate Trainings" that the Occupational Health Branch of the California Department of Health Services is doing. Jobsite tailgate trainings are an effective way to promote workplace safety, get everyone's "buy-in" around safety, reduce injuries and illnesses, and comply with many of Cal/OSHA's training regulations. This training goes a long way toward getting you there.”

The training invitation stated clear and desirable goals and course objectives to the potential participant as follows:

Conducting Effective Tailgate Trainings: What every supervisor needs to know for conducting effective tailgate trainings.

- Hear a contractor talk about why, how, and when to conduct tailgate trainings
- Learn about effective training techniques that will improve your safety presentations
- Assess the quality of your company's tailgate trainings and identify areas for improvement
- Find out what Cal/OSHA is looking for in your construction safety program

- Receive a tailgate training kit in English and Spanish including 23 “Safety Break” topic cards
- Obtain a certificate of course completion and other health and safety resource materials

Evaluating the Intervention

Formative and Process Evaluation: Training Program Quality

We conducted formative and process evaluation in order to get feedback from the participants on the quality of the training program and materials, for the purpose of making improvements during the course of the intervention period. At each training we collected feedback from participants via a simple one-page questionnaire with questions such as:

- Was this training helpful?
- What did you learn that was most useful?
- What could be improved?
- What are your tailgate trainings like now?

In addition, the questionnaire asked participants to rate the effectiveness of each speaker.

These data were entered into an Excel spreadsheet for descriptive analysis.

Following each seminar, the trainers met to discuss the questionnaire results and to assess how well each training had gone. Based on these discussions, improvements were made to the curriculum over time.

Impact/Outcome Evaluation

Our outcome evaluation was designed to determine if, six months after having attended the training, it had made an impact on their tailgate trainings and on their workplace safety culture. Outcome evaluation consisted of a baseline questionnaire (Appendix 5O) at the time of the training asking about the current frequency and quality of the trainings. We followed-up six months later with a survey with the same questions and some additional questions (Appendix 5P: letter and questionnaire) regarding tailgate training improvements and the usefulness of the resources provided.

For the six-month survey after the trainings, we tried to reach contractors by email and regular mail. This was our first time using email to re-contact people and have them respond by using a Web-based survey instrument. We made a total of three attempts at 2-3 week intervals to obtain a written or Web-based response from each contractor/participant. When the email addresses were rejected, we switched over to regular mail. Successful completion of the Web-based survey provided the respondent with electronic access to some free on-line health and safety resources.

Since there was a six-month lag time between the surveys and then an additional 6-8 weeks lag time while attempting to obtain a response, we limited participation in the follow-up survey to attendees of the first 18 trainings.

For both surveys we asked questions that were frequency related, i.e., how often:

- are tailgate trainings conducted;
- are topics chosen because of what's happening on the jobsite;
- does the crew speak up during the tailgate;
- do you demonstrate what you are talking about;
- does the tailgate cause a change in equipment or work method that will improve jobsite safety.

For the six-month follow-up survey, we also asked some additional questions including:

- Has the effectiveness of your trainings increased?
- How often do workers raise safety concerns?
- Has worker compliance with safety rules increased?
- Has workers' role in solving safety problems increased?
- How useful were the "Safety Break" cards?
- Was the blank card a useful tool for creating new tailgate topics?
- What other Safety Break card topics would be useful?
- How useful were the web sites we provided?
- What other improvements have been made?

To assess their opinion on a policy issue, we asked the respondents if they thought all contractors should be required to send someone to a basic health and safety training.

The baseline and six-month follow-up responses from the first 18 trainings were matched and entered into a database for descriptive analysis conducted using SAS software.

5.4 Results and Discussion

Information Gathering and Needs Assessment

The literature review we conducted provided a broad overview of important health and safety issues in construction identified through epidemiological research and analyses of various injury and illness data sources, as well as intervention efforts conducted by others.

At our first round of meetings with industry stakeholders (December 15, 2000, in northern California and February 28, 2001, in southern California), participants brainstormed a list of the most important health and safety issues they faced; identified successful programs that they knew of that reduced injuries and illnesses; and discussed how the Occupational Health Branch could work with them to make the construction industry safer. Summaries of the responses obtained are included in Appendix 5C.

We completed 12 key informant interviews with people from various sectors in the construction industry, public agencies, or academic institutions who were identified as experts in the field.

From these interviews and referrals made by the key informants, we gathered many examples of construction health and safety programs and educational/training materials that had merit and could be replicated or borrowed from. Some examples of efforts that we identified include: tailgate training and educational materials from the Construction Safety Association of Ontario; "Save Your Breath," a silicosis prevention video; the "Fall-Safe" safety audit program at West Virginia University; a "Guide to Safe Work Practices for Home Builders"; the "Smart Mark"

construction union-based training program; and health and safety training for day laborers in the San Francisco Bay and Los Angeles areas.

Choosing the Intervention Focus

The proposed intervention project options presented to the stakeholder advisory committees were:

- Conducting a program to improve tailgate safety training
- Developing a new ladder safety video;
- Implementing a day laborer safety training program; and
- Implementing a fall prevention program.

Overall, advisory committee participants (in both northern and southern California) identified training of contractors, foremen/supervisors, and union representatives who conduct tailgate trainings as the highest priority area. The proposed fall prevention project was ranked second, followed by development of a ladder safety video, and a safety training program for day laborers. The results of rankings by advisory group members are summarized in Table 22; the scale for ranking was constructed such that a low number indicates the highest priority. Table 22 also shows how rankings varied by constituent group (i.e., contractors, union representatives, or community-based organizations).

Table 22. Average Rankings of Construction Safety and Health Proposals, by Stakeholder Group

Group (n)	Tailgate Training	Ladder Video	Day Labor H&S	Fall-Safe
Contractors/ Contractor Orgs. (16)	**2.0**	2.3	3.1	**2.0**
Union reps (17)	2.3	2.5	2.9	**1.8**
Community-based Organizations (8)	2.0	3.3	**1.5**	3.5
Public Agencies (3)	**1.7**	3.3	2.0	3.0
Overall (44)	**2.1**	2.6	2.7	2.3

Carefully considering all available input, project staff made the final selection of improving the quality of tailgate safety training as the focus of the intervention. A letter was sent from OHB to a broad array of construction industry stakeholders reporting on the selection of the intervention topic. It stated that the key reasons for selecting this project were that it:

- Was most often ranked the #1 choice by advisory group members;
- Was designed to impact a large number of construction workers across the state through "train the trainer" seminars;

- Would provide participants with Cal/OSHA's Pocket Guide for the Construction Industry and simply written tailgate training materials in English and Spanish for multiple health and safety hazards; and
- Would allow OHB to work extensively with construction industry partners across the state.

Some additional factors supporting our conclusion that focusing on effective tailgate training would make a significant contribution include the following:

- Effective safety orientation leads to lasting employees, productive results, cost savings.
- For some contractors without a proactive health and safety program, focusing initially on tailgates might motivate them to begin to address health and safety more broadly.
- Having site-specific, short trainings enables contractors to comply with an important Cal/OSHA training regulation and enhances Injury and Illness Prevention Program activities.
- Tailgates, if done well, can be a powerful tool toward creating a safety culture.

We were particularly interested in focusing our training toward supervisors/foremen because:

- Episodic worker employment, changing work assignments/ site conditions, and multiple contractors on the jobsite are factors that make supervisors critical to jobsite safety.
- Training supervisors is just as important as training workers.
- Supervisors can provide one of the most significant encouraging or reinforcing factors on the jobsite.
- Most supervisors do not get training on how to train and to be a site safety leader.
- Having trained supervisors helps companies comply with Cal/OSHA regulations.
- For some workers, tailgate trainings from supervisors/contractors may be the only training they ever receive.
- Thousands of workers can potentially be reached if the frequency of effective tailgate trainings is increased.

Developing the Intervention Curriculum and Materials

The intervention project was titled "BuildSafe California: Conducting Effective Tailgate Trainings," and its overall goals were to:

- Improve the capacity of supervisors/competent persons/union representatives to deliver short, onsite safety trainings;
- Partner with organizations to reach contractors and workers;
- Determine whether participants improved the frequency and quality of their tailgate trainings leading to jobsite safety changes.

Our initial observations of tailgate trainings conducted at various jobsites and the results from our interviews of the trainers are summarized in Appendix 5D.

The final 4-hour training curriculum included these main components:

1. Welcome (OHB staff): Introduction to the purpose of the training
2. What issues do you face? (OHB staff): Activity where participants pair up and brainstorm the main problems they encounter in doing tailgate trainings

3. Learning from Other Contractors' Tailgates (OHB staff): Two videotapes shown of short tailgate trainings with group discussion of what participants consider good points and what could be improved
4. Elements of a Good Tailgate Training (OHB health educator): Presentation on effective adult learning techniques and the best practices of tailgate training
5. Cal/OSHA's Expectations (Cal/OSHA Consultation Service staff): Presentation on what Cal/OSHA looks for in a safety program; opportunity for questions and answers
6. How to Use the Safety Break Tailgate Materials (OHB staff): Distribution of resource folder, discussion of how Safety Break materials were designed to be used, review of other resources provided
7. Putting it All Together (OHB staff): Small group exercise where participants are given a jobsite scenario, asked to brainstorm topics for a tailgate training, go through the process of designing a tailgate training; results are discussed in the large group
8. Tailgate Trainings—Problems and Solutions (peer contractor): Contractor shares tips about how she/he organizes and carries out a tailgate training program, and elicits discussion from the group on solutions to the problems raised in the initial brainstorming activity
9. Wrap-up (OHB staff): Re-emphasizes the four main themes of effective tailgate training and distributes evaluation forms
10. Closing/Awarding certificates/Lunch and networking

To assist participants in the delivery of effective tailgate trainings, we produced a set of Safety Break cards in English and Spanish (Appendices 5E and 5F, also at www.dhs.ca.gov/ohb/buildsafe) which provides content information on 22 common construction health and safety topics and includes a template to develop tailgates on new topics and training documentation form.

The program folder of materials provided to each participant included: a training agenda; a handout on tailgate trainings and safety programs; a handout on the elements of a good tailgate training talk; overview of Cal/OSHA's expectations on safety and supervision in construction; Cal/OSHA's top 25 (i.e., most frequently cited) hazards in construction; Resources for Your In-Cab Safety Program Folder; a scenario used in a small group exercise; a Safety Break card template to use in the exercise; the four key questions to ask in assessing the effectiveness of your tailgates; a baseline evaluation questionnaire; and a training (formative) evaluation form.

Carrying Out the Intervention

Over a two and one-half year period of time we conducted 24 half-day trainings throughout the state, attended by over 1400 contractors, supervisors, foremen, managers and union representatives.

The locations of trainings included (some more than once): Oakland, San Francisco, Santa Rosa, Sacramento, Concord, Glendale, Santa Ana, Fresno, Bakersfield, Riverside, Oxnard, San Jose/Santa Clara, Monterey Park, San Diego, Chico, Redding, Eureka, Pasadena, Long Beach, and Los Angeles (Carson).

Based on job titles self-reported by attendees, we found that we were successful in reaching the types of personnel we sought, i.e., those that directly delivered tailgate trainings and/or those that were responsible for overseeing such a program and other health and safety issues. The breakdown of attendees (for the first 18 of the 24 trainings) by job title appears in Table 23.

Table 23. BuildSafe Seminar Attendees by Job Title

Job Title	Number	Percentage
Foreman	267	24
Owner/CEO/VP	187	17
Management/Admin	160	14
Superintendent	154	14
Safety Director	142	13
Project Manager	127	11
Other (includes union reps)	90	8
TOTAL	**1127**	**101%**

Table 24 shows the various types of construction or trades as self-reported by attendees (for the first 18 of the 24 trainings); over one-third were general building contractors.

Table 24. BuildSafe Attendees by Type of Construction or Trade

Type of Work	No.	Type of Work	No.
General	310	Tile	16
Painting	81	Remodeling	16
Electrical	66	Engineering	14
Public Works	53	Telecommunications	12
Roofing	38	Structural Steel	10
Concrete	37	Masonry	10
Landscape	34	Underground/Pipeline	10
Plumbing	31	Demolition	8
Drywall and Plastering	31	Glass	7
HVAC	29	Acoustical	7
Framing	26	Highway	6
Environmental	22	Unions	14
		TOTAL	**888**

Project accomplishments include:

- Obtained widespread support from key co-sponsors who contributed substantial resources, 15 contractor organizations and labor;
- Conducted 24 half-day trainings reaching over 1400 supervisors, foremen, contractors and union representatives; and
- Developed and posted the Safety Break cards in English and Spanish and other resources on the OHB Web site with other tailgate training resources to provide ongoing assistance.

Evaluating the Intervention

Formative and Process Evaluation: Training Program Quality

We analyzed formative evaluation data from the first 18 of the 24 trainings (1195 attendees) in order to get feedback from the participants on the training program and materials quality and for the purpose of continuous improvement of the curriculum.

Based on 972 valid responses, 86% (832) found the trainings very helpful; 14% (138) found the trainings somewhat helpful; and <1% (2) found the trainings not so helpful.

When asked, "What was the most useful thing you learned at the training?" the top 4 responses were:

- How to conduct a tailgate training (226);
- Resources provided (160);
- Regulations discussed (90);
- Importance of employee involvement in tailgate training (74).

When asked, "How could the training be improved?" the top 5 responses were:

- Do not change anything (110);
- Use more demonstration, visual aids, or real examples (64);
- Make the program longer (59);
- Give the Cal/OSHA speaker more time (54);
- Get more participation from the audience (41).

After each training, we read and discussed all suggestions for improvement and made the following changes over time:

- Introduced an exercise to get people to interact early on and find out their biggest issues/problems in doing tailgate trainings;
- Increased the time allotted for the Cal/OSHA speaker;
- Worked with speakers to improve presentations; and
- Included a new resource introduced by a Cal/OSHA speaker: In-Cab Safety Program Folder.

Impact/Outcome Evaluation

For the outcome evaluation we wanted to answer the question of whether, after a six-month period, the training had made a difference in the workplaces of attendees with regard to improvements in tailgate training efforts and overall safety culture.

Approximately one-third of eligible attendees provided valid responses to the six-month follow-up survey; 335 contractors responded for a response rate = 335/1053 = 32%. We were far more successful in obtaining responses through hard-copy mailings (211 responses; 63%) as compared to sending emails directing respondents to the Web-based survey (124 responses; 37%).

One of our most important concerns was determining how many contractors were meeting the requirement for doing a tailgate training at least every 10 days. When attendees were asked this question at the time of the training, they reported a very high level of compliance; 71% said they were doing trainings at least every 10 days. Our assessment of this finding is somewhat skeptical, as attendees were repeatedly told during the training that holding trainings every 10 days was a Cal/OSHA requirement, and attendees completing this questionnaire were asked to identify themselves (so we could contact them six months later). For those contractors that completed both a baseline (disclosing their identity) and a follow-up survey six months after

attending a training, 84 reported *not* being in compliance initially. Of these 84 contractors, 65 (77%) had increased the frequency of their training when we contacted them again.

Another question we asked was about the perceived effectiveness of attendees' tailgate trainings. The majority of contractors said their training effectiveness had either increased, or increased greatly after six months. Only a few contractors felt their training effectiveness had decreased. Some contractors either didn't know, or said their training effectiveness had stayed the same.

- Increased greatly: 15% (49)
- Increased 63% (209)
- Decreased <1% (1)
- Stayed the same 20% (66)
- Don't Know 3% (9)

We also wanted to know whether workers were raising safety concerns more often after their contractor/supervisor attended our training. A large proportion of contractors said workers were raising safety concerns just as often after the training as before. However, of those contractors who said that things were different six months later, most of them said that workers now raise safety concerns more often rather than less often.

- More often 38% (126)
- Less often 2% (8)
- The same 56% (186)
- Don't know 4% (14)

We also wanted to find out how worker attention to company safety rules might have changed since taking the training. Again, a fairly large group of contractors indicated that company safety rules were followed (or not followed) just as often. But of those who indicated that a change had occurred, the great majority of contractors said that worker attention to company safety rules had increased rather than decreased.

- Increased 54% (180)
- Decreased <1% (1)
- Stayed the same 41% (136)
- Don't know 5% (17)

A similar pattern was seen when we asked about whether workers' role in solving safety problems had changed since taking the training. Of those contractors who said that workers' role in solving problems had changed, again the vast majority said that their workers' role had increased, rather than decreased.

- Increased 55% (183)
- Decreased <1% (1)
- Stayed the same 40% (132)
- Don't know 5% (18)

We were also interested in learning about how helpful the materials were. At the six-month survey, we asked how useful the Safety Break cards were. Most contractors said the cards

were either very or somewhat useful. Only a few contractors thought the cards were not useful, although some contractors acknowledged they had not used the cards.

- Very useful 42% (140)
- Somewhat useful 41% (136)
- Not useful 4% (13)
- Did not use them 13% (44)

We asked participants whether the blank template card for creating new tailgate topics was useful. Although only about half of the contractors reported having used the blank Safety Break card, of those who did use it, most said that it was useful to them.

- Yes 42% (137)
- No 5% (18)
- Did not use 53% (175)

We wanted to know what other subjects might be addressed in Safety Break cards if we were to add more topics in the future. A large group of contractors mentioned various specific safety hazards and some specific health issues. Some examples are listed below:

- Safety:
  - Vehicle safety, including radio and cell phone use when driving
  - Air-activated tools
  - Aerial lifts
  - Lockout/tagout
  - Working with other trades
- Health topics: back pain, poison oak, hearing conservation, stress, cold

Other topics suggested by more than one contractor included:

- Trade-specific cards or job task-specific cards
- More cards in Spanish
- Group cards by type of work: residential, commercial, or industrial

We provided attendees with a resource list of Web sites that we determined had valuable and free tailgate training materials and other construction health and safety resources that attendees could use to prepare tailgate trainings. Only about half reported using the Web sites we provided. However, of those who used the sites, the vast majority found them somewhat or very useful.

- Very useful 17% (56)
- Somewhat useful 33% (110)
- Not useful <1% (2)
- Did not use 49% (165)

We asked an open-ended question regarding what other improvements attendees made as a result of attending the training. Sixty percent reported making other improvements. The top five improvements grouped by categories and mentioned (in order of frequency) included:

- Better and more frequent safety meetings; more demonstration; "better" topics; added Spanish language training;
- More safety awareness; employees are "looking out for each other"; more compliance with the safety program;
- More employee involvement: participation, talking, information sharing, and more employees are involved in conducting the trainings;
- Programmatic and structural changes; more organization; better documentation;
- Creation, update, or improvement of Injury and Illness Prevention Programs and/or Codes of Safe Practices.

We also asked a health and safety policy question regarding whether all contractors should be required to send someone to a basic health and safety training. We received a positive response described below:

- Yes 74% (256)
- No 14% (46)
- Don't Know 10% (32)

Upon completion of most of our trainings, we conducted further distribution of the BuildSafe tailgate training kit (including Safety Break tailgate cards) and other health and safety resources by posting them and the links on the OHB Web site. From the initial posting in February 2004, to the end of the grant period, September 30, 2005, we recorded the following Web site statistics: 2689 visits to the BuildSafe HTML page; 2742 visits to the construction health and safety links; and 45,917 downloads of the Safety Break tailgate cards. The downloads for the Safety Break topic cards indicate that the Spanish language cards are the most popular.

OHB has received numerous emails and letters complimenting us for conducting the training project and developing the materials and resources. Here are selected comments:

A small contractor who attended wrote to us, *"You and your team did an excellent job at the training, hitting on the important topics in a short period of time. Following your program we will move from going through the motions at tailgate meetings to implementing meetings that coincide with the tasks being performed at the time. I am going to tailor a six-month tailgate program that follows the sequence of events in the building work we do. Thanks for your efforts."*

Les Kanyuk of Anson Industries, Inc. (a large specialty contractor) sent an email: *"Thanks, I have been using your system for the past two years and it has been working very well. It has generated employee participation and more awareness to safety. All our Districts in the US are using the effective tailgate training topics."*

Reporting Back to Advisory Committee/Stakeholders and Others

At the conclusion of the project, we held meetings in northern and southern California to report back to the advisory committee members on the evaluation findings and to get their feedback on the project process, products, and outcomes. We asked stakeholders to provide feedback and comments on a number of questions including: how the project was useful to their organization; feedback on the Safety Break cards; how we could have done a better job of involving them; and proposals for how to continue the BuildSafe California type of work in the future (see Appendix 5G).

To reach stakeholders who could not attend these meetings, as well as a broader audience, we mailed out over 300 letters and packets to inform people and organizations about the project's findings and to thank them for their support and participation. We also wrote an article on the project's findings for the Contractors State License Board newsletter where we informed all licensed contractors in the state about the project's value and the availability of the project's tailgate training materials for their use via the OHB Web site.

5.5 Conclusions

The BuildSafe California: Conducting Effective Tailgate Trainings intervention project aimed to partner with other organizations to reach contractors and workers, and to improve the capacity of supervisors/competent persons/union representatives to deliver short, onsite safety trainings. Our evaluation of this effort was designed to determine whether participants had improved the frequency and quality of their tailgate trainings, leading to jobsite safety changes.

Our assessment is that we have met and in some cases exceeded the goals and the objectives of this project. We successfully recruited and engaged construction industry stakeholders in a project planning process which led them to become the strongest supporters of the project. From attendees and stakeholders we received a lot of immediate feedback on the project (process and formative evaluation) which provided opportunities to make various timely changes as described.

We successfully reached a difficult-to-reach target audience of foremen, supervisors, union representatives, owners of small construction companies, and others to improve their or their company's capacity to deliver effective tailgate trainings. Because of the popularity of the program and success in recruiting attendees at locations across the state, we conducted a number of additional trainings and exceeded the number of attendees we had originally targeted. In fact, since the end of the cooperative agreement period, we have continued to receive requests for trainings. Although we lack the resources to address most of these requests, we have now twice presented the program at a new annual statewide event, the Pacific Builders Safety Expo.

We created a new set of tailgate safety training materials, Safety Break cards, and other resources, including a listing of useful Internet-based materials, that continue to be available via our Web site despite the conclusion of the cooperative grant period. The feedback we have received about these resources has been very positive, and the number of Web hits counted for the Spanish language Safety Break cards indicates the need for and interest in conducting safety training in Spanish.

To the degree that we can have confidence in the validity of the evaluation responses, we can state that the training and materials appear to have generally improved the frequency and quality of attendees' tailgate trainings. Participants' self-assessment is that this has resulted in an improved safety culture at their jobsites. The very act of participating in the training caused many to be motivated toward making improvements in their existing tailgate training and safety programs, or it caused them to initiate whole new efforts in these areas.

This is a difficult industry, audience, and type of intervention project for which to conduct outcome evaluation. Some of the difficulties we encountered in obtaining responses to follow-up surveys were not unexpected considering that we were dealing with a very transient work population, who work in a very busy, production-driven environment. Since we did not have the

evaluation resources or capacity to measure reductions in morbidity and mortality attributable to the intervention or to follow up with workers subsequently participating in tailgate trainings conducted by attendees, we were limited to conducting a follow-up survey assessing intermediate measures such as attendees' perceptions of improvements in their trainings. We had some difficulties with the follow-up survey including the following:

- Comparison with initial responses was problematic due to possibly inflated self-reported assessments on the baseline survey.
- We obtained a relatively low (35%) response rate.
- Administering a survey via email was time-consuming for us but a less expensive data collection method.
- The limitations of self-reported data are well known.
- We found that many contractors (both small and larger) are irregular email users.
- The "digital divide" exists in the construction world, and thus there is still the need to reach contractors via hard copy as well as electronically.

We conclude that conducting effective tailgate trainings can be a powerful tool toward building a safety program and culture in an industry known for high rates of injuries, illnesses, and fatalities. Construction work is unique, with changing work assignments and site conditions, episodic employment patterns, many small contractors with limited safety resources, and multiple contractors all working under tight completion schedules. We believe that well-done tailgate trainings, having the characteristics we have described above, can contribute significantly in raising safety awareness and building a safe working environment in this industry. Contractors, supervisors, and lead workers need to be trained and skilled at conducting tailgate trainings as part of their site safety supervision responsibilities. Apparently, our participants agreed with this point of view, since a substantial number thought that completing this type of training should be mandatory. We recommend that more opportunities be created for improving skills in the delivery of tailgate safety trainings, and particularly to expand the capacity of tailgate trainers to provide Spanish-language safety training in a workforce increasingly comprised of Latino workers.

6. NEW COMMUNICATION METHOD: *"OCCUPATIONAL HEALTH WATCH"*

6.1 Background

OHB recognizes the importance of disseminating surveillance data, workplace investigation findings, and effective interventions to organizations across California, as well as nationally, so that this information can be used by others in their efforts to promote safe and healthy workplaces. We routinely use multiple communication methods including articles in lay and scientific publications; presentations at trainings, meetings, and conferences; and our Web site.

One stated objective of the Core Surveillance Model Program in California was to increase dissemination of surveillance data for multiple endpoints, findings of case investigations, and intervention results. To accomplish this objective, we decided to create a new method for communication of OHB work, an annual print publication designed for easy readability by key stakeholders for occupational safety and health in California, many of whom are not scientists or public health professionals. The purpose was to get information developed by OHB into the hands of people and organizations that are in a position to use it to positively impact worker health and safety. It would also serve as a useful tool for communicating what our organization

is doing and generally to raise awareness about important occupational health issues in California. To reach a wider audience, the publication would also be posted on the OHB Web site and sent via email to anyone who requests to be a recipient.

6.2 Specific Aims

This goal of this effort was to involve OHB staff that conduct surveillance and other prevention activities in the development and production of a new annual publication to disseminate surveillance and intervention findings to key stakeholders. The specific aims included:

- Develop and implement a process for involving OHB staff in contributing content and articles;
- Develop a design and format for the publication, as well as in-house capacity for layout;
- Enhance existing capacity for creating and maintaining a mailing list of constituents to receive printed copies of the publication;
- Produce and disseminate four annual issues of the publication (2002-2005); and
- Evaluate the usefulness of this new communication method.

6.3 Procedures/Methodology

This project was implemented using a team approach, with a lead person/editor (generally a health educator) each year taking the responsibility for creating a timeline, coordinating, and tracking the progress of the effort. Although many members of the OHB staff contributed articles, data, graphics, and photographs, the production team made final decisions about content, edited articles, did the layout, developed the mailing list, and coordinated printing and dissemination.

Initial discussions involved all interested OHB staff in discussing and agreeing on the purpose of the publication, the intended audience and reading level, the length and "look," and type of content.

A brief description of the process to produce each issue is as follows: An initial meeting was held with all interested staff and OHB program managers to discuss ideas for a specific focus and specific articles. The production team finalized the list of articles and set a deadline for each article to be written by a specific staff person. If needed, the editor wrote some articles based on discussions with the relevant program staff. Draft articles were read and edited by at least two members of the production team. Article authors had an opportunity to review final articles to ensure accuracy. Staff were asked to identify suitable photographs and graphics, with the goal of having at least one photograph or graphic on each page to break up the text. Articles were laid out using PageMaker and PhotoShop, and the team reviewed the layout to ensure that it was readable, attractive, and without typographical or formatting errors. The near-final version was sent for approval by California Department of Health Services upper management and then finalized. Staff worked on improving and updating the OHB constituent mailing list and adding new contacts based on the content of the specific issue. The publication was printed by a local union printer, mailed to the mailing list, and a PDF version put on the OHB Web site.

Each subsequent year, before beginning production of a new issue, the production team convened to discuss possible improvements to the previous one.

Although it is difficult to assess the impact of mailing out printed information to a wide audience, we attempted to compile some evaluation data on how this publication is perceived by readers. First, we convened one focus group of five construction industry stakeholders to review one issue of the publication that particularly focused on construction health and safety and provide feedback on how the publication might be useful to them as a source of information to support their health and safety efforts. Second, we have promoted to readers the idea of reprinting articles from our publication in issues of publications by their own organization, in order to expand the audience for our articles more widely. Success in this area provides anecdotal evidence that readers find our information useful enough to pass on to members of their organizations. Finally, OHB staff performed an internal assessment and thoughtfully considered the potential impact of the publication as an outreach tool, in order to determine whether to continue producing it after the end of the cooperative agreement period.

6.4 Results and Discussion

During initial meetings, OHB staff determined the basic parameters for the new publication. It would be a 12-page, two-color print publication disseminated annually to key stakeholders for occupational safety and health in California (primarily organizations rather than individuals), including trade associations, unions, community-based organizations, university research and teaching programs, occupational health clinics, health and safety professional organizations, and government agencies. The goals would be to provide information (i.e., interpretations of data, risk factors identified in case investigations, recommendations for prevention, announcements of available resources) that readers could use to further health and safety efforts within their own organizations, and also to increase awareness about OHB, its accomplishments, and resources.

We intended that, although the publication would contain statistics and surveillance data, the writing would be clear and non-technical, and each page would contain photographs or graphics. Each issue would include OHB contact information and announce new resources. We decided to feature articles about all types of OHB projects, rather than limit the publication to findings from our surveillance projects. We used a consultant graphic artist to design an attractive banner for the top of the first page, but developed the overall design, and layout in-house. It was helpful to review other state occupational health programs' newsletters to determine which design elements we preferred. As with all OHB materials, a union printer was used for production, including mass mailing.

The first issue of *Occupational Health Watch: Tracking California Workplace Injuries & Illnesses* was distributed to approximately 3500 contacts in Summer 2002 (Appendix 6A). This first issue explained what OHB is and why we created this new publication, and contained short articles with data from the OHB surveillance activities for acute pesticide illness, asthma, carpal tunnel syndrome (CTS), fatalities, lead poisoning, and sharps injuries. It provided case studies with prevention recommendations from investigations of pesticide illness caused by drift exposure, CTS in customer service representatives, a death due to backing vehicle, lead poisoning in industrial painting, mold-related illness among teachers, and hexane-induced nerve damage in auto mechanics. Because we were initiating an intervention in the construction industry, we also featured a focus on construction, presenting data from the U.S. Bureau of Labor Statistics. We also included information about workers' compensation expenditures in California, recommendations for achieving safer workplaces, and resources for more information (the OHB helplines and publications).

The second, third, and fourth issues of *Occupational Health Watch* (*OHW*) were disseminated, to approximately the same total number of recipients, in Spring 2003, Summer 2004, and Fall 2005. All issues appear on the OHB Web site (see "Materials Available for Other Investigators" for Web links), and additional printed copies of *OHW* were disseminated throughout the grant period at conferences and events attended by OHB staff.

For each subsequent issue of *OHW*, various changes were made based on staff evaluation of the previous issue. The improvements are described as follows:

- *Spring 2003 issue*: We decided to feature fewer surveillance projects so that longer, more comprehensive articles could be written. Epidemiology staff voiced a preference to report multi-year summaries rather than annual data, as they are more meaningful for drawing conclusions. We included more Web links for readers interested in obtaining more detailed data. This issue featured our work on CTS surveillance, and also an article explaining why and how OHB conducts surveillance of work-related injury and illness. (Appendix 6B)

- *Summer 2004 issue*: No major changes were made. We featured findings from 11 years of investigating work-related fatalities in Los Angeles County. This issue provided reports on work funded under the Core Surveillance cooperative agreement, including surveillance of construction falls and silicosis, and the BuildSafe California construction industry intervention project. (Appendix 6C)

- *Fall 2005 issue*: With several new staff on the production team for this issue, we made a number of changes. We decided to use a different color scheme for each issue, so that different issues of *OHW* were more distinguishable when put out on literature tables. Our graphic artist updated the design for the first-page banner, adding a farmworker to the graphic of several types of workers. We also changed the title to Occupational Health Watch: Preventing California Worker Injuries and Illnesses, in order to reflect that the content covers OHB projects that do not involve tracking. We used more photographs and graphics to break up large blocks of text, changed from a three-column to a two-column layout, and include boxes with "best practices." The case studies of workers who have experienced an injury or illness were given a new title of "True Story," on the rationale that "case study" is not a popular-language term; we also encouraged readers to consider using the "True Stories" with prevention recommendations as training tools. (Appendix 6D)

Evaluating the impact of an outreach publication that is mailed to several thousand readers can be very difficult and costly. For example, providing a phone or email contact for reader feedback, or a postage-stamped reader survey postcard, typically results in a very low response rate. We did not have adequate resources to conduct any type of in-depth evaluation of *OHW*.

However, we did hold one focus group that was arranged to coincide with a construction industry training program, where we invited participation from some attendees of that event. The previous issue of OHW had featured a number of articles pertinent to the construction industry. Five persons attended the focus group, representing trade associations, employers, and one union. The questions asked of participants included what they liked or did not like about *OHW*, how they did or could use it, and how it could be made more useful. Some examples of the responses are:

- They liked the "look" of the publication (i.e., photos, layout), that it covered a range of subjects and contained statistics, case studies, and the fact that articles were short and "to the point."
- After reading *OHW*, they were still not clear who OHB was and what our relationship was to Cal/OSHA.
- Some readers thought *OHW* was too long, and might prefer getting a shorter publication more frequently.
- Readers felt they could use *OHW* articles, particularly cases studies and factual information in trainings.
- Participants wanted to see coverage of positive solutions, new equipment, better ways of doing things, and more information on the costs of injury and illness.

The feedback from these readers encouraged us to promote the use of the "True Story" feature (i.e., case studies of actual injuries/illnesses with prevention recommendations) in training situations.

One way of assessing what readers find useful in *OHW* is by documenting the requests we have received for reprinting articles in other organizations' publications. Although we are missing data on reprints from the earlier issues, we can cite some examples of additional dissemination of *OHW* articles:

- Article on ladder safety from Summer 2004 *OHW* (findings from surveillance data and interviews of workers injured in a ladder fall, with prevention recommendations) was reprinted in the Golden State Builders Exchanges October 2004 statewide newsletter.
- Article on BuildSafe California: Conducting Effective Tailgate Trainings seminars from Summer 2004 *OHW* was reprinted in the Golden State Builders Exchanges October 2004 statewide newsletter.
- Article on construction falls surveillance findings (2.5 years of data) from Fall 2005 *OHW* was reprinted in the North Coast Builders Exchange newsletter, mailed to 1,600 building contractors.
- Article on OHB work to identify safer automotive cleaners and new educational materials for the automotive repair industry from Fall 2005 *OHW* was reprinted in the Automotive Service Councils of California newsletter, reaching a readership of 2,000 including 1,600 automotive shop owners.
- Article on the evaluation findings of BuildSafe California: Conducting Effective Tailgate Trainings seminars from Fall 2005 *OHW* was reprinted in *The California Painting & Decorating Contractor*, a newsletter of the statewide trade association for painting contractors.
- Article on the evaluation findings of BuildSafe California: Conducting Effective Tailgate Trainings seminars from Fall 2005 *OHW* was reprinted in *California Licensed Contractor*, the newsletter of the Contractor State License Board, which is sent to all licensed construction contractors.

Assessment by OHB staff of the usefulness of producing and disseminating *OHW* as an annual Branch newsletter determined the following:

- *OHW* is one mechanism that can serve to interest others in occupational health issues in general, because it is attractive, easy to read, and contains numerous short articles on a range of topics as well as useful information.

- Dissemination of *OHW* through the initial mailing and literature tables at events is an important way to communicate in an ongoing way to OHB stakeholders about what our program is doing.
- Especially when *OHW* articles are reprinted in other organizations' publications, we can reach large numbers of employers, workers, and others with information they can use to promote health and safety (e.g., data on high-risk industries/occupations and risk factors for injury and illness, stories to use in safety trainings, best practices, relevant Web links, OHB helplines and publications).
- Further low-cost dissemination of *OHW* can be accomplished through email subscriptions for those who request them.
- Producing *OHW* each year provides a structured incentive for periodically reviewing and updating our database of mailings, and seeking new organizations to add to the mailing list based on the content of the new issue.

6.5 Conclusions

It is important to continually seek new and effective ways to disseminate surveillance and intervention findings to those who are in a position to act on this information to improve safety and health in the workplace. It clearly is not adequate to report findings only through articles in scientific journals and presentations at meetings of safety and health professionals. The size of California and vast number of workplaces poses a unique challenge when it comes to effecting change in the workplace.

We conclude that periodically communicating with key stakeholders and sharing information developed through OHB work in a clear and non-technical way is valuable, and that *Occupational Health Watch* is a useful vehicle for achieving this goal. We have found that having *OHW* articles reprinted by other organizations in their newsletters is a low-cost and effective way to extend OHB efforts more broadly, particularly to the employer community; we intend to invest additional effort into encouraging other organizations to disseminate our information in this way. OHB plans to continue to produce future issues of *OHW* using resources provided by our current NIOSH cooperative agreement for surveillance and intervention. Ongoing and more in-depth evaluation of how readers use the information provided in *OHW* and what improvements they might recommend would help to maximize its effectiveness.

PUBLICATIONS

There are currently no published or in-press journal articles based on this work.

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APPENDICES

See enclosed compact disc.