California Occupational Safety and Health Surveillance, 2005-2010
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ABSTRACT

The Occupational Health Branch (OHB) of the California Department of Public Health (CDPH) conducted a *Fundamental Program* of public health activities that included the Occupational Health Indicators (OHI) supplemented by in-depth surveillance and intervention activities for three targeted areas (*work-related asthma (WRA), traumatic fatalities, and occupational pesticide illness (OPI)*). The aims of each of the four program areas were to 1) conduct *surveillance* of work-related injury and disease; 2) perform selected case-based *investigations*; 3) *collaborate* with a diverse range of stakeholders to develop and implement prevention strategies; 4) *disseminate* surveillance and case investigation findings to our target audiences; and 5) perform routine *evaluation* of our surveillance systems and program impact.

This project has had significant impact on the risk of work-related injuries and illnesses in a number of high-risk industries and occupations in California. These include:

- Increased awareness of the link between food flavoring chemicals and bronchiolitis obliterans, and enactment of the first national standard to protect workers against the risk of exposure to food flavorings.
- Elimination of chemicals in cleaning agents that cause work-related asthma, and increased use of safer alternative products and practices in hospitals and schools.
- Reduced exposure to silica during dry cutting of masonry materials, and enactment of the first OSHA process standard that requires wet methods or local exhaust ventilation.
- Use of alternative methods for pest control in agricultural and residential settings
- Increase in safe work practices to prevent heat-related illness in high-risk occupations, and enactment of first comprehensive OSHA standard.
- Reduction in health care worker exposure to aerosol transmissible diseases (ATDs), and enactment of the first comprehensive OSHA standard for health care employers.
- Improved safety programs in solar energy companies to prevent falls and electrocutions.

This program has demonstrated the value of establishing and implementing surveillance systems for work-related injuries and illnesses, followed by targeted investigations, outreach, and other dissemination efforts. The advent of electronic reporting systems has increased the efficiency and capture of work-related injury and illness data, although significant gaps remain for ascertaining chronic diseases. Findings from this project have been disseminated and used widely by a diverse audience.

HIGHLIGHTS AND SIGNIFICANT ACCOMPLISHMENTS

The Occupational Health Branch (OHB) of the California Department of Public Health (CDPH) conducted a *Fundamental Program* of public health activities that included the Occupational Health Indicators (OHI) supplemented by in-depth surveillance and intervention activities for three targeted areas (*work-related asthma (WRA), traumatic fatalities, and occupational pesticide illness (OPI)*). The aims of each of the four program areas are to 1) conduct *surveillance* of work-related injury and disease; 2) perform selected case-based *investigations*; 3) *collaborate* with a diverse range of stakeholders to develop and implement prevention strategies; 4) *disseminate* surveillance and case investigation findings to our target audiences; and 5) perform routine *evaluation* of our surveillance systems and program impact.

SURVEILLANCE OF WORK-RELATED INJURIES AND ILLNESSES

- Annually collected and analyzed California surveillance data for 19 Occupational Health Indicators (OHIs) and an Employment Demographics Profile.
- Analyzed injuries and illnesses in California for 2004-2006 using multiple data sets.
- Conducted a comprehensive analysis of workers' compensation data to describe the nature and extent of heat-related illness in California workers.
- Initiated industry-wide medical surveillance of respiratory health among diacetyl-exposed workers in the flavor manufacturing industry.
- Identified, with detailed demographic, industry, and occupational data: 5,791 potential cases of WRA over 17 years (annual average 361); 3,684 reports of suspected OPI over 10 years (annual average 335 cases); and 2,068 work-related fatalities in Los Angeles County over 17 years (annual average 122 cases).

CASE FOLLOW-UP AND WORKPLACE INTERVENTION

- Contributed surveillance data, investigation findings, and technical expertise to support groundbreaking Cal/OSHA standards (heat illness prevention, aerosol transmissible diseases, dust controls for dry-cutting of concrete or masonry, sensitizers, and diacetyl).
- Conducted targeted investigations for WRA including graffiti removal chemicals, wood dust, cleaning agents and disinfectants used in schools and hospitals, glutaraldehyde in heart valve manufacturing, and medical waste stream processing chemicals.
- Investigated 18 incidents of OPI related to air blast application of cyfluthrin, drift from aerial application of disulfoton, phosphine use in post-harvest fumigation, pyrethrin and pyrethroid use in structural pest control, sulfuryl fluoride fumigation post-clearance re-entry, dusting sulfur drift, metam-sodium drift after shank application, and conducted an assessment of safer alternatives to the use of cyfluthrin to control citrus pests.
- Investigated 52 fatalities (average of 10 per year), including residential, commercial, and highway construction worksites, a university laboratory, distribution warehouse, label and plastic manufacturing center, steel fabrication warehouse, and truck rental company.

COLLABORATION

- Pilot-tested with other states three new questions on workers' compensation utilization in the Behavioral Risk Factor Surveillance System (BRFSS).
- Convened the first two Western States Occupational Network (WESTON) meetings.
- Conducted stakeholder events related to OHB's Safer Chemicals Use Policies initiative.
- Developed and implemented a project to promote asthma-safe cleaning products and work practices in schools.
- Organized a conference at the University of California at Davis on "Safer Alternatives for Pest Control in Agriculture – Making the Public Health Case for Change."

DISSEMINATION, OUTREACH AND EDUCATION

- Produced and disseminated the OHB publication *Occupational Health Watch (OHW)* to over 3,500 stakeholders; in 2009, revised *OHW* into a quarterly e-newsletter format.
- Published the Health Hazard Alert: *Diacetyl (Butter Flavor Chemical) Use in Flavor Manufacturing Companies*; a guide for health care providers on how to conduct medical surveillance; 2 peer-reviewed journal articles on flavoring-related lung disease.
- Provided case-specific educational materials to nearly 2,000 WRA cases.
- Authored or co-authored six articles on WRA in the peer-reviewed literature.
- Ensured that WRA was addressed in other statewide publications (Plan for Asthma in California, The Burden of Asthma: A Surveillance Report, and County Asthma Profiles).
- Disseminated a report recommending safer alternatives for control of citrus pests.
- Authored or co-authored five articles on OPI in the peer-reviewed literature
- Made presentations on work-related fatalities at 27 industry and stakeholder meetings and 16 national conferences and FACE meetings.
- Translated all 20 FACE Fact sheets into Spanish and disseminated 17,030 statewide.
- Authored or co-authored two articles on workplace fatalities in the peer-reviewed literature, with FACE cases or fact sheets featured in 12 trade association publications.

EVALUATION

- Developed logic models for each of the four components of our program, examining planned or proposed activities in light of anticipated intermediate outcomes and impact, and using the models to guide program planning and evaluation.
- Conducted a capture-recapture analysis of our WRA cases that indicates the true number of cases that should be reported at 2,000 to 3,700 per year.
- Performed a comprehensive evaluation of our OPA surveillance system.
- Completed 39 employer interviews evaluating overall rating and workplace impact of the CA/FACE investigation reports.

TRANSLATION OF FINDINGS

This program has demonstrated the value of establishing and implementing surveillance systems for work-related injuries and illnesses, followed by targeted investigations, outreach, and other dissemination efforts. The advent of electronic reporting systems has increased the efficiency and capture of work-related injury and illness data, although significant gaps remain for ascertaining chronic diseases. Findings from this project have been disseminated and used widely by a diverse audience.

OUTCOMES, RELEVANCE, AND IMPACT

This project has had significant impact on the risk of work-related injuries and illnesses in a number of high-risk industries and occupations. Expected *intermediate outcomes* include:

- Increased awareness of the link between food flavoring chemicals and bronchiolitis obliterans, and enactment of first national standard to protect workers against the risk of exposure to food flavorings.
- Elimination of chemicals in cleaning agents that cause work-related asthma, and increased use of safer alternative products and practices in hospitals and schools.
- Reduced exposure to silica during dry cutting of masonry materials, and enactment of the first OSHA process standard that requires wet methods or local exhaust ventilation.
- Use of alternative methods for pest control in agricultural and residential settings
- Increase in safe work practices to prevent heat-related illness in high-risk occupations, and enactment of first comprehensive OSHA standard.
- Reduction in health care worker exposure to aerosol transmissible diseases (ATDs), and enactment of the first comprehensive OSHA standard for health care employers.
- Improved safety programs in solar energy companies to prevent falls and electrocutions.

SCIENTIFIC REPORT: FUNDAMENTAL PROGRAM

I BACKGROUND

The Occupational Health Branch (OHB) of the California Department of Public Health (CDPH) conducted a **Fundamental Program** of public health activities that included the Occupational Health Indicators (OHI) supplemented by in-depth surveillance and intervention activities for three targeted areas (work-related asthma, traumatic fatalities, and pesticide illness). The Fundamental Program has provided an important foundation for OHB surveillance and intervention activities by generating new information from available population-based surveillance data sources; coordinating across targeted projects on issues of dissemination, outreach, stakeholder input, and evaluation; further developing collaborations that will enhance program operation and impact; and evaluating progress with the aim of enhancing overall effectiveness.

II SPECIFIC AIMS

From 2005-2010, our specific objectives were to: 1) Collect and analyze on an annual basis surveillance data for 19 Occupational Health Indicators (OHIs) and an employment demographics profile; 2) Conduct in-depth analysis of selected OHIs to guide future program work; 3) Continue and expand our assessment of the Workers' Compensation Information System (WCIS) as a useful data source for occupational health surveillance; 4) Collaborate with state partners, local public health agencies, and other stakeholders to obtain input to guide our program and gain support to further program goals; 5) Collaborate with other state occupational health programs and NIOSH through participation in the Consortium of Occupational State-based Surveillance (COSS); 6) Disseminate our surveillance data, investigation findings, public health recommendations, and educational materials through an annual publication for stakeholders and an enhanced OHB website; and 7) Perform an annual performance review of the accomplishments and impact of our occupational health program with recommendations for improving effectiveness.

III METHODS

A SURVEILLANCE AND INTERVENTION

OHB has a long history beginning in 1987 of NIOSH-funded cooperative agreements and grants to conduct surveillance of priority occupational health conditions and related intervention and/or research activities. We have extensive experience in establishing new surveillance systems and in using multiple data sources data for case ascertainment including California's unique system of Doctor's First Reports of Work Injury or Illness (DFRs), which all physicians are legally required to complete after treating a suspected work-related injury or illness. Additional data sources include laboratory reports (blood lead and cholinesterase); hospital discharge, emergency room, and ambulatory surgery data; poison control center data; death certificates; and active reporting through specialists such as pulmonary specialists. We have expanded our use of the Workers' Compensation Information System (WCIS), an electronic data system containing all workers' compensation claims filed in California; OHB is authorized under state law to have access to WCIS. In addition, we have obtained and analyzed data from the Behavioral Risk Factor Surveillance System for several projects. OHB's access to data and physician reports enables us to identify emerging occupational health issues that require a public health response. Our ability to respond is enhanced through the use of trainees (e.g., CDC Epidemic Intelligence Service Officers (EISOs), CSTE epidemiology fellows, occupational medicine residents) supervised and mentored by our experienced multidisciplinary staff.

B COLLABORATION

Many organizations, including labor unions, employer groups, other state and local agencies, universities, occupational and environmental health advocacy groups, and health professional organizations, broadly support the prevention activities of OHB and have a long history of collaborating with us. Recognizing the need to obtain program input and create/enhance relationships with key stakeholders statewide, we critically evaluated the use of advisory groups by conducting a survey of other state occupational health programs in 2006. Based on this information, OHB decided that a fixed advisory group would be problematic in our large state and not fit our program needs. Instead, OHB uses a variety of methods (e.g., small or large group meetings on specific topics, one-on-one meetings, involvement in specific activities sponsored by other organizations such as attending their events and serving on their advisory groups) to engage our stakeholders and develop new relationships. We involved all OHB staff in a process to identify key stakeholders for OHB and specific projects, consider which were most important and why, and which relationships required further development. This provided the basis for a work plan of activities to enhance stakeholder relationships.

In addition to collaboration with state partners, OHB sustains active collaboration with our counterparts in other state occupational public health programs and with NIOSH intramural staff.

C DISSEMINATION, EDUCATION, AND OUTREACH

We routinely notify our target audiences of the results of significant surveillance findings and site-specific investigations; publicize the consequences of unrecognized or uncontrolled exposure to workplace hazards; and promote effective measures to prevent exposures, injury, and illness to others who can implement change. OHB maintains a Contacts Database of over 99,000 organizations and individuals, and is continually updating and adding new listings.

Our target audiences and major objectives for dissemination, education, and outreach efforts include workers, unions, and worker advocacy group; employers and industry-wide organizations; medical and public health professionals; federal, state, and local governmental agencies; and environmental and other community-based organizations. We disseminate information in a wide variety of formats, including: written materials for workers about prevention of illness and injury, workers' compensation procedures, and other workplace legal rights; fact sheets and hazard advisories; worksite-specific letters with detailed recommendations; scientific reports and peer-reviewed publications; presentations at worker, medical, public health, and industry conferences; presentations to health care providers in clinics and hospitals; written recommendations to regulatory agencies on proposed and existing regulations; written analyses of proposed legislation; participation on interagency, advisory, and other work groups; posting materials and publications on our OHB website (www.cdph.ca.gov/programs/ohb); and data and reports sent to NIOSH for inclusion in national surveillance databases.

D EVALUATION

With relatively limited resources devoted to occupational health and safety in a state as large as California, we must ensure that we operate in an effective manner, identify areas where improvements can be made, and learn from our experiences. In addition, our activities must be designed to maximize the positive impact on workplace health and safety conditions statewide. We continue to use a variety of methods to evaluate our surveillance systems; public health investigations; dissemination, outreach and educational activities; stakeholder relationships and collaborations; internal program operations; and the impact of our efforts including intermediate outcomes. We have found it most effective to use different processes over time, each one yielding new and different information.

IV RESULTS

A SURVEILLANCE AND INTERVENTION

Occupational Health Indicators

OHB has calculated California data for the 19 OHIs and employment demographics profile annually since the year 2000 and provided these data to CSTE for posting on the CSTE website. OHB participates with other states and CSTE to share responsibility for updating the CSTE document with OHI definitions and "How To" guides; California is responsible for Indicators 11 (pesticide poisonings) and 13 (elevated blood lead levels (BLLs)). In recognition of new scientific information on health effects of lead at lower BLLs, California proposed updating Indicator 13 to include numbers and rates of adults with BLLs $\geq$ 10 ug/dL (in addition to those exceeding 25 and 40 ug/dL); this proposal was adopted by the CSTE Work Group, effective beginning with OHI data for the year 2006. The proposed CSTE Indicator for low back pain was pilot tested using our workers' compensation data, and detailed comments provided on the proposed case definition, exclusion criteria, and procedure and diagnostic codes.

Analysis of work-related injury and illness data in California

With the availability of several electronic data sources for routine surveillance, we completed an analysis of work-related injuries and illnesses for the years 2004-2006. Hospital discharge and ED data sets were selected based on primary payer (workers' compensation) for specific diagnoses (ICD-9-CM), median and total charges, and major mechanism of injury (Principal E-code). Numbers and rates of hospitalizations were analyzed by major diagnostic category by gender, ethnicity, race, and age. Work-related hospitalizations for low back surgery, pneumoconiosis, and respiratory diseases were also described. The WCIS data set was analyzed by occupation and industry, region within California, cause, nature, and body part. Subsets of the data sets were analyzed for young workers (age 14-17), and provided to the Labor Occupational Health Program Young Worker Health and Safety project.

The results of our analysis have been incorporated with publicly available Bureau of Labor Statistics (BLS) and Census of Fatal Occupational Injuries (CFOI) data to describe several key findings of importance to prevention and intervention efforts. These findings will be published in the report "Staying Safe and Healthy at Work in California: Fact Finding for Prevention."

Flavoring-related lung disease

In 2004, OHB received a physician report of a flavor-manufacturing worker diagnosed with bronchiolitis obliterans (BO). As OHB and the California Division of Occupational Safety and Health (Cal/OSHA) began planning for an industry-wide investigation, a second BO case was identified at a second flavoring plant. California requested technical assistance from NIOSH to conduct employee medical screening of respiratory health in this plant. OHB posted case reports on our website, identified 29 flavoring companies statewide by using marketing databases and a telephone survey, issued a Diacetyl Health Hazard Alert, organized a late-breaking session at the annual CSTE meeting (June 2006) to share the information with other states, and completed the publication of a MMWR article. OHB, Cal/OSHA, and NIOSH then collaboratively implemented industry-wide medical surveillance of several hundred California flavor manufacturing workers, based on company-sponsored spirometry and respiratory questionnaires performed every six months. OHB worked with NIOSH and pulmonary experts to develop guidelines for company medical providers on how to conduct quality surveillance for flavoring-related lung disease. OHB collected and reviewed these data, and a cross-sectional epidemiologic analysis was conducted by a CDC EISO assigned to OHB, with assistance from NIOSH and OHB staff. Cal/OSHA Consultation Service conducted industrial hygiene field work in each plant, issuing a report detailing necessary control measures including a respiratory protection program, and putting companies on a timeline for implementation of engineering controls. The cross-sectional analysis was published in a peer-reviewed journal in 2010, and in

September 2010 California OSHA passed the first occupational standard for diacetyl in the country, effective December 2, 2010.

Heat-related illness

In California in 2005-2006, 20 workers died from heat-related illness (HRI) during the summer months, all but one an outdoor worker. OHB medical staff assisted Cal/OSHA with many of the fatality investigations and summarized our findings and recommendations in a report that was instrumental in providing the scientific rationale for a unique workplace protection standard. In 2006, California promulgated the first OSHA regulation in the country specifically designed to prevent HRI among outdoor workers (Title 8 CCR 3395).

As only limited data are available regarding the risk factors for occupational HRI, we undertook a comprehensive analysis of electronic workers' compensation data to describe the nature and extent of HRI in California (Kathleen Fitzsimmons, CTSE Epidemiology Fellow). A total of 5,081 claims of HRI were obtained from WCIS for 2000-2007. A surveillance case definition for HRI was developed, and industry and occupation were coded according to the NAICS and Census Occupation Code (COC) classifications. Hispanic ethnicity was designated based on the 1990 Census Bureau Spanish Surname list. Overall rates, and specific rates by occupation, industry, county, gender, ethnicity, and age were calculated using denominator data from California labor market surveys, the U.S. Census 2000, and the Current Population Surveys. A manuscript will be submitted shortly for peer-review publication.

B COLLABORATION

Partnership between occupational and environmental health

In 2006 we conducted a strategic planning process that considered several thematic areas for potential as a unifying programmatic focus for a several-year initiative. We selected the emphasis, "Achieving Safer Chemicals Use Policies: A Partnership between Occupational and Environmental Health." We convened an Initiative Coordinating Group (ICG) with representation from all programs within OHB to coordinate existing and new activities that fall under this theme. The ICG has planned activities to promote awareness of OHB work among stakeholders and to pursue new collaborations, including identifying potential environmental health partners with whom to develop relationships and initiating one-on-one or small group meetings; inviting guest speakers from these organizations to OHB staff meetings to learn about their work; attending and/or making presentations about OHB work at events held by these groups; holding a stakeholder event (May 26, 2009) to celebrate the 30th anniversary of the establishment of OHB and featuring our work on safer alternatives to toxic chemicals; providing input on behalf of CDPH to the Green Chemistry Initiative; convening a meeting (June 3, 2009) with 30 invited occupational and environmental advocates to discuss how to ensure that worker health and safety is included in chemicals policy efforts; and supporting the publication of a document on the health and environmental benefits of implementing safer alternatives to toxic substances in the workplace.

Integrating occupational health into mainstream public health

We increased our efforts to raise the profile of occupational health within our own department (and with local health departments), by initiating and/or taking advantage of opportunities to work with our colleagues in other programs. Examples include 1) communicable disease prevention: joint worksite investigations of selected infectious disease outbreaks (e.g., coccidioidomycosis in construction workers), and response to novel H1H1 influenza, including protection of health care workers and guidance to employers/employees; 2) environmental health and emergency preparedness: guidance to public health officers on controlling exposure to wildland fire smoke, response to chemical releases and disasters, and health effects and mitigation measures related to climate change; and 2) chronic disease prevention: worksite-

based wellness, healthy built environments, asthma statewide strategic plan, and skin cancer prevention for outdoor workers.

Input to new and improved Cal/OSHA standards

OHB contributed technical expertise to numerous Cal/OSHA standards, including: 1) the first-in-the-nation Aerosol Transmissible Diseases standard (Title 8 CCR 5199) and Aerosol Transmissible Diseases-Zoonotic standard (Title 8 CCR 5199.1), which became effective August 5, 2009; 2) Standard for control of employee exposure from dust-generating operations conducted on concrete or masonry materials (Title 7 CCR 1530.1), effective October 22, 2008. OHB staff provided silicosis surveillance data and medical and technical input, and an OHIP summer intern project with the Bricklayers Local union assessing exposure during tile cutting helped to build important stakeholder support. 3) The first-in-the-nation standard for Heat Illness Prevention (Title 8 CCR 3395), effective July 27, 2006.

Collaborations on a national level

During the past five years OHB staff have: 1) Participated in all CSTE Work Group and COSS meetings, and provided numerous presentations at the occupational health sessions at all annual CSTE meetings; 2) Contributed to publication of the NIOSH/CSTE document, "Guidelines for Minimum and Comprehensive State-based Public Health Activities in Occupational Safety and Health"; 3) Collaborated with nine other states to pilot and analyze data for three new questions on workers' compensation utilization in the Behavioral Risk Factor Surveillance System (BRFSS); 4) Contributed to the development of CSTE position statements to make elevated blood lead levels, silicosis, and pesticide illness nationally notifiable conditions; 5) Represented CSTE on the NIOSH Surveillance Coordination Group during monthly conference calls and annual face-to-face meetings; 6) Served on the NIOSH NORA Sector Research Councils for the Services Sector and Healthcare Sector; 7) Assisted NIOSH and CSTE to hold the Western States Occupational Network (WESTON) meetings in Denver, CO in September 2008 and 2009; 8) Contributed items to NIOSH e-News (flavoring-related lung disease, flu vaccine distributed without engineered safety needles); 9) Provided peer technical review of several NIOSH publications; 10) Provided testimony at a NORA town hall meeting; and 11) Contributed to the National Academy of Sciences reviews of the NIOSH HHE program (testimony) and Traumatic Fatalities program (report review).

C DISSEMINATION, EDUCATION, AND OUTREACH

Occupational Health Watch Newsletter and email blasts

We had previously created a publication to communicate with our stakeholders who can use our surveillance and case investigation findings and recommendations to make changes in the workplace. This publication, *Occupational Health Watch (OHW): Tracking California Workplace Injuries and Illnesses*, was mailed annually to over 3,500 individuals and organizations statewide. Fall 2005 and Spring 2007 issues were published during the current grant period. As the *OHW* format required significant staff resources to design and produce and could only be produced annually, we then developed a new e-newsletter format for *OHW* that focused on one short topic per issue with resources and links to more information. The new electronic *OHW* (first issue on lead poisoning) will continue to be produced at least quarterly, allowing our stakeholders to hear from us more regularly. A significant effort was conducted to obtain email addresses for our *OHW* recipients and most frequent contacts, now totaling 5,572; this has enabled us to disseminate information electronically when possible and reduce mailing costs. This capacity enables us to send out "email blasts" on topical areas to selected stakeholders such as a nationwide alert on flu vaccine distributed without engineered safety needles.

Enhanced OHB website

OHB completed a major renovation and update of our website with reworking the format and content for over 150 web pages and converting over 500 publications in order to comply with a

new CPDH format and guidelines to assure accessibility for people with visual impairment. The new format also involves adding "metadata" to facilitate access using the CDPH internal search engine. OHB also worked to significantly expand its links that included adding a special section for Spanish-speaking workers. We launched and continue to update "What's New" sections on the OHB home page and within each of our four major program section home pages; this enables us to promote new publications and alerts and announce upcoming events. In addition, we have created new topic pages for specific projects, such as Occupational Health Indicators, flavoring-related lung disease, a new California Safe Cosmetics Program, and respiratory protection.

D EVALUATION

Specific tools and processes that we have used for overall program evaluation during the last five years include: 1) a program review conducted using the NIOSH/CSTE *Guidelines for Minimum and Comprehensive State-Based Public Health Initiatives in Occupational Safety and Health* as the "gold standard." Over a series of meetings held in Spring 2009 and involving key project staff, we conducted an extensive review of our program by assessing current activities as compared to the Guidelines. This process helped to identify a number of areas for program improvements and developed plans for future efforts with the aim of meeting the comprehensive activities where possible. 2) Development and use of logic models to track the impact of our activities and identify areas to improve our program. Using the NIOSH logic model as a guide, we worked with a consultant facilitator and developed logic models for the Fundamental Program and our three other priority health condition projects. 3) "360 evaluations" of our program leadership; and 4) ongoing tracking of program accomplishments.

V CONCLUSIONS

Over the last 5 years, the Fundamental Program has successfully conducted a comprehensive program of public health activities that included the Occupational Health Indicators (OHI) supplemented by in-depth surveillance and intervention activities. We have used public health investigations, collaboration with other organizations, and dissemination of our findings to implement prevention strategies for a variety of work-related injuries and diseases. These approaches will be continued in our next five years of the NIOSH-funded OHI Component, including an emphasis on identifying and responding to emerging occupational health issues.

PUBLICATIONS

In the last five years, some of the products that fall under the Fundamental Program and have been authored or co-authored by our staff include:

- Kosnett MJ, Wedeen RP, Rothenberg SJ, Hipkins KL, Materna BL, Schwartz BS, Hu H, Woolf A. 2007. Recommendations for medical management of adult lead exposure. Environ Health Perspect 115(3):463-471.
- MMWR Morbidity and Mortality Weekly Report. 2007a, Fixed obstructive lung disease among workers in the flavor-manufacturing industry – California, 2004-2007. MMWR, April 27, 2007; 56(16);389-393. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5616a2.htm
- Prudhomme J, Neidhardt A. 2007. Cal/OSHA investigations of heat-related illnesses 2006. State of California. 10/18/2007.
- Stanbury M, Anderson H, Bonauto D, Davis L, Materna B, Rosenman K. 2008. Guidelines for minimum and comprehensive state-based public health activities in occupational safety and health. Occupational Health Surveillance Workgroup, CSTE. Cincinnati, OH: US DHHS, CDC, NIOSH. DHHS (NIOSH) Publication No. 2008-148. September 2008.

- Kim TJ, Materna BL, Prudhomme JC, Fedan KB, Enright PL, Sahakian NM, Windham GC, and Kreiss K. 2010. Industry-wide medical surveillance of California flavor manufacturing workers: Cross-sectional results. Am J Ind Med 53:857-865.
- Lichterman J, Brown-Williams H, Delp L, Quint J. Preventing Toxic Exposures: Workplace Lessons in Safer Alternatives. July 2010. Health Research for Action, University of California: Berkeley, CA. Available at: http://healthresearchforaction.org/perspectives/preventing-toxic-exposures.pdf

SCIENTIFIC REPORT: WORK-RELATED ASTHMA

I BACKGROUND

Since 1993, the Occupational Health Branch (OHB) of the California Department of Public Health (CDPH) has maintained a NIOSH-funded program to conduct ongoing surveillance and a wide variety of intervention activities for **work-related asthma (WRA).** The WRA Prevention Program (WRAPP) utilizes multi-source surveillance data to characterize the nature and extent of WRA and to target workplace investigations in order to generate and promote practical prevention/intervention strategies that can reduce the risk of WRA statewide.

II SPECIFIC AIMS

From 2005-2010, we maintained our existing model for the surveillance of WRA, and implemented new activities that enhanced our previous work. The overall goal during this last funding cycle was to maintain and enhance the California program for the prevention of WRA. Specific objectives were to: 1) Expand case ascertainment using multiple data sources; 2) Perform case-based field investigations and develop prevention strategies; 3) Collaborate with local and state agencies; 4) Disseminate results generated from project activities; and 5) Evaluate surveillance activities on an ongoing basis.

III METHODS

A SURVEILLANCE

Over the past 17 years, WRAPP has modified the original sentinel provider-based reporting system to include multiple sources of case ascertainment. We elected to initially utilize an existing statewide physician reporting system (Doctors' First Reports of Occupational Injury and Illness, DFR) and, over the last five years, we have added emergency department, patient discharge, and workers' compensation data as routine data sources for reporting. All potential cases of WRA undergo a telephone interview to confirm the diagnosis and obtain data for case classification. This questionnaire includes core information collected by all NIOSH-funded WRA surveillance states and we use the WRA case definition and case classification criteria established by NIOSH. Medical records may also be used for case confirmation and classification. The study protocol has been approved by the California Health and Human Services Agency Committee for the Protection of Human Subjects. Data are thoroughly cleaned and edited, duplicates are eliminated, and data are transferred to NIOSH annually. Since each of the four data sources identifies many unique cases of WRA, capture-recapture analysis is regularly conducted to better estimate the true number of WRA cases in California. In addition to case-based surveillance, population-based data on WRA in California have been obtained and analyzed from the Behavioral Risk Factor Surveillance System on a regular basis since 2001.

B CASE FOLLOW UP AND WORKPLACE INTERVENTION

WRAPP performs workplace field investigations for selected cases to gather in-depth data about the worksite, work processes, and risk factors for WRA. The data provided by our investigations link the illness identified in the surveillance system with the context in which the hazardous exposures occurred. In this way, our field investigations enhance our capacity to formulate, evaluate, and disseminate effective prevention strategies. WRA reports are selected for follow-up based on the magnitude of the public health impact represented by the incident report(s): (1) incidents involving a large number of workers, or an exposure that is common to a large population of workers; (2) a large number or rate of illness reports related to a single agent, industry, or task; (3) illness severity (i.e., long-term disability, hospitalizations, and deaths); and (4) "sentinel events", which are reports that may represent a new or emerging hazard, a failure of recognized control measures or regulations to effectively control exposures, or an opportunity for prevention. OHB has statutory authority to gain access to the workplace for

the purpose of conducting investigations of work-related morbidity and mortality (California Health and Safety Code Sections 105175-105180). Site visits are conducted according to our written Field Investigations Policy and Procedures manual, and may include the following methods: on-site industrial hygiene assessment of the workplace and work processes; interviews with employers, employees, and other individuals involved in the incident, and other key informants; symptom surveys of workers; review of written policy and procedures, medical records, and regulatory investigations; and analysis of the relevant scientific literature.

C COLLABORATION

Collaboration with relevant state and local agencies, advocacy groups, and other interested parties have allowed us to expand our reach and increase our efficacy. By integrating our results and messages into mainstream public health and existing community asthma prevention activities, our work supports the efforts of others who can utilize our data and technical expertise to implement prevention strategies that will affect both worker and community asthma prevention. Our collaborative approach also strives to support more primary prevention-based activities by focusing on promoting safer alternatives to a wide range of audiences and constituencies.

D DISSEMINATION, EDUCATION AND OUTREACH

We conduct outreach and disseminate the findings and recommendations from our WRA program to notify our collaborators and target audiences of the results of significant surveillance findings and site-specific investigations; publicize the consequences of unrecognized or uncontrolled exposure to WRA agents in the workplace; and promote effective measures to prevent exposures and illness to all parties who can implement change. In addition to our WRA dissemination database of over 2,700 health care providers, we utilize a mailing list of over 100,000 organizations and individuals maintained by the OHB. We disseminate information in a variety of formats, including materials for workers about prevention of WRA and workplace legal rights; worksite specific letters with findings and recommendations; scientific publications; conference presentations; grand rounds, and other presentations to health care providers; written comments to regulatory agencies and voluntary standard-setting organizations on proposed and existing regulations and guidelines; written analyses of proposed legislation; participation on interagency, advisory, and other work groups; posting on our website; and data and reports sent to NIOSH for inclusion in national surveillance databases.

E EVALUATION

We recognize the important role that evaluation plays in ensuring that our surveillance system is effective in tracking and preventing work-related asthma. We have been using a logic model during the last 5 years to track our objectives, outputs, and outcomes. This allows us to quantify outputs and evaluate if they have had any impact. Over the past 17 years, we have conducted ongoing evaluation using the CDC Guidelines for Evaluating Surveillance Systems. We have also reviewed past evaluations of the SENSOR program and incorporated recommendations for both surveillance and interventions. We have taken many steps to assess the different components of our system, including surveillance, worksite investigations, and information dissemination.

IV RESULTS AND DISCUSSION

A SURVEILLANCE

From 1993-2008, WRAPP identified 5,791 potential cases of WRA (annual average 361) and has confirmed 4,425 cases. The overall rate of occupational asthma for all industries over 15 years is 1.9 per 100,000 employed in California. The recent addition of three new statewide data sources has significantly increased the caseload, and the rate for 2007 has increased to 2.7 per 100,000 employed. Industries with particularly high rates include local transit, hospitals, logging, museum and recreational sites, lumber and wood product manufacturing, utilities, social

assistance, electrical equipment manufacturing, telecommunications, and heavy construction. Occupations with particularly high rates include firefighters, technicians, telephone operators, gluing machine operators, medical assistants, respiratory therapists, correctional officers, chemical machine operators, welfare eligibility clerks, and material movers**.** Using DFR data reported directly to the WRA program from an HMO to evaluate case capture through the standard DFR system, we determined that only about one-third of DFRs are captured through the standard system of physician reports to workers' compensation insurers. This finding suggests that the overall rate of WRA asthma in California for 2007 is actually closer to 9.0 per 100,000 workers.

Of the 4,425 confirmed cases with WRA from 1993-2008, 54% could be classified after interview and/or review of medical records. Of these, 7% were classified as Reactive Airways Dysfunction Syndrome, 10% as new onset asthma associated with a known asthma inducer, 41% as new onset cases associated with an unknown asthma inducer, and 43% as work-aggravated asthma. The agents most commonly associated with the ten occupations with the highest rate of WRA during this time period are presented below**.**

Occupation	Exposures Identified
Firefighters	Smoke (75%), diesel exhaust, chemicals, dust
Miscellaneous Technicians	Chemicals, NOS, glues, paint,many other
Telephone Operators	Dust, carpet dust, perfume, paint
Gluing Machine Operators	Epoxy, glue, solvents
Medical Assistants	Cleaning chemicals, glutaraldehyde, indoor air pollutants
Respiratory Therapists	Latex, pharmaceuticals, cleaning chemicals
Correctional Officers	Smoke, pepper spray, indoor air pollutants
Chemical Machine Operators	Many different chemicals
Govt Program Eligibility Workers	Roofing tar, paint, indoor air pollutants
Miscellaneous Material Movers	Many different chemicals

B CASE FOLLOW-UP AND WORKPLACE INTERVENTION

From 2005-2010, WRAPP staff conducted focused follow-up investigations of exposures in four industries related to agents associated with WRA. The findings of selected investigations illustrate how our approach to case follow-up investigations ensures that the results of the surveillance system are linked to illness prevention.

Cleaning Agents used in Schools - Surveillance data demonstrated that WRA among school staff related to cleaning agents is an important, preventable problem. We investigated school janitorial chemicals and found that many products used to clean or disinfect contain known asthmagens. We investigated cleaning work practices and the use of cleaning agents at several school districts and participated in the revision of Green Seal Environmental Standard for Industrial and Institutional Cleaners, GS-37. We collaborated with three school districts, a statewide charter school, and other organizations to switch to using asthma-safe cleaning products and work practices in their schools. This project will inform the development of guidelines to assist all schools and similar organizations in switching to preferable chemicals.

Glutaraldehyde Exposure in the Manufacture of Bioprosthetic Heart Valves - We investigated WRA among workers exposed to glutaraldehyde at two facilities that manufacture 90% of all the bioprosthetic heart valves used in the world. Our study findings were an important basis for the California Division of Occupational Safety and Health (Cal/OSHA) lowering of the glutaraldehyde Permissible Exposure Limit from 0.2 ppm to 0.05 ppm TWA. After the glutaraldehyde PEL was lowered, Cal/OSHA initiated rulemaking to amend the complete set of airborne contaminant standards to add a sensitizer designation and require medical surveillance for all asthmagens. Additionally, cases from these manufacturers are specifically tracked to help determine the adequacy of the new standard and/or their exposure controls.

Medical Waste Stream Workers - We collaborated with Health Care Without Harm on the prevention of WRA among medical waste treatment workers exposed to multiple asthma-causing agents. This project, in addition to improving health and safety for the workers at the individual worksite, demonstrated the importance of integrating occupational health with environmental health decision-making.

C COLLABORATION

WRAPP has collaborated with federal, state, and local agencies, health care professionals, industries, trade associations, labor organizations, asthma advocacy groups, and community-based organizations in our ongoing program activities. We have participated on numerous interagency, advisory, and other work-groups addressing asthma, such as the National Disinfection Workgroup, Toxics Use Reduction Institute, Greenseal and Ecologo certification committees, California Asthma Strategic Planning steering committee, and the California Schools Environmental Health and Asthma Collaborative (SEHAC).

D DISSEMINATION, EDUCATION AND OUTREACH

Our program has made dozens of presentations over the last five years, including talks to public health professionals, health care providers, workers, employers, unions, and non-governmental and community-based organizations. WRAPP has provided written educational materials to over 5,000 workers and health care providers, and published our findings in newsletters, bulletins, reports, and publications of other organizations. By including WRA data and findings in more general asthma publications, we reach a much wider audience with a limited understanding of WRA. We have reported our findings of WRA investigations in booklets for workers and in multiple reports and journal articles. Findings from the WRA project have been distributed in our California WRA program newsletter to over 2,000 health care providers and three issues of the Branch publication *Occupational Health Watch*, reaching 3,400 readers per issue. We also participated in a media event to provide information on the hazards of cleaning chemicals and on asthma-safe cleaning products to a collaborative of ethnic news media serving low-wage, immigrant, and hard-to-reach communities of workers.

In addition to the many presentations and written materials cited above, our program has also provided written comments on proposed or existing regulations to Cal/OSHA and NIOSH; submitted written comments to third-party certification organizations developing standard criteria for cleaning; provided WRA data to Cal/OSHA to assist in their assessment of several standards, as well as for consideration of sensitizer notations; provided data to local health departments for their jurisdictions and to other organizations on specific exposures or industries; and analyzed proposed legislation addressing the use of asthma-safe green cleaning chemicals in schools. An analysis of activity on our WRA program website over the last year documents 1,200 downloads of our medical waste report, and between 300-400 downloads each for our many other WRA materials.

E EVALUATION

Surveillance

We continually conduct evaluation of our surveillance efforts. The overall capture of our surveillance system has continued to grow with the addition of several new data sources. A capture-recapture analysis was done to evaluate the overlap of each data source and estimate the total number of WRA cases in the population. This showed that, since there is little overlap between data sources, all are necessary, and the true number of cases that should be reported is estimated to be 2,000 to 3,700 per year. The *timeliness* of our surveillance system is adequate for case follow-up, with a median of 20 days between physician diagnosis and receipt of DFR by the WRA program. Hospital-based reports (ED and PDD) are less timely, as annual data are not available until Fall of the subsequent year. In evaluating *case classification*, our evaluation of WRA data shows an overall confirmation rate of 83%, with 1/3 of cases

successfully interviewed and 20% of those reached refusing the interview. The *sensitivity* of the DFR reporting system in detecting WRA cases is relatively poor. A prior evaluation showed that 70% of cases may be missed using this source. The *predictive value positive* (PVP) of our surveillance of WRA is excellent, with 90% of WRA cases receiving interviews subsequently confirmed as true cases.

Workplace follow-up and interventions

To evaluate our WRA field investigations, we assess the capacity to respond to case reports in a timely manner; the quality of our investigations; and the public health impact of our efforts. We have evaluated each step in our field investigations to identify procedures that maximize our ability to gain access to the worksite, while minimizing the potential negative impacts of our investigations on the well-being of vulnerable workers. This evaluation has been formalized in our *Policy and Procedures for Field Investigations*, which provides the legal and ethical framework for our investigations and a practical step-by-step methodology for site visits. All investigations initiated by the WRA program resulted in the development and wide dissemination of comprehensive written recommendations for prevention and the development of incident summaries that were transmitted to NIOSH. In worksites without a union, we identified the need to emphasize collaboration with environmental, community-based, and other non-governmental organizations with access to, and the trust of workers. Participation rates for on-site worker interviews have been excellent, ranging from 60 to 70%. Our selection criteria for follow-up investigations have been very successful in identifying incidents with broad public health significance. The results of investigations have provided useful information regarding the adequacy of existing regulations. Recommendations and findings from our investigations over the past five years have had important effects on policy and standards, including ensuring that several third-party certification organizations include asthma as a factor in their standards for cleaning products, lowering of the glutaraldehyde standard in California, and development of a proposed requirement for medical surveillance for workplace exposure to sensitizing agents.

Dissemination of information

The *quantity* of education materials distributed, the types of audiences to whom materials were disseminated, the number of talks or training provided, and the number of participants who have attended are evaluated continuously. The *quality* of our dissemination efforts is evaluated by whether our approaches are consistent with the language and literacy needs of the target audiences, and if they are presented in a culturally appropriate manner. For example, to guide the design of our worker-focused WRA materials, we have collaborated with the UC Berkeley Labor Occupational Health Program to convene worker focus groups to assess the efficacy of our written materials and provide guidance on how to improve them. The findings and recommendations of our field investigations are summarized in simple language and also translated into Spanish. In light of our limited resources and the diversity of the workforce, we do not have the capacity to conduct extensive outreach to individual workers beyond the worksite being investigated and individual case follow-up efforts. Rather, we conduct outreach and foster collaborative working relationships with non-governmental organizations. These organizations in turn disseminate the findings and recommendations of our project to their constituents.

V CONCLUSIONS

Over the last 5 years of the cooperative agreement, WRAPP has successfully maintained and significantly expanded the surveillance of work-related asthma in California. We have used targeted case investigations, collaboration with other organizations, and dissemination of our findings to implement prevention strategies for work-related asthma statewide. By focusing on primary prevention activities and coordinating our efforts with other asthma prevention programs, we have been able to maximize our impact. These approaches will be continued in our next five years of WRA surveillance and prevention activities.

PUBLICATIONS

In the last five years, we have authored or co-authored six articles on WRA in the peer-reviewed literature:

- Work-Related Asthma among Health Care Workers: Surveillance Data from California, Massachusetts, Michigan and New Jersey, 1993-1997. Am J Ind Med, 47(3): 265-275, 2005.
- The Proportion of Self-reported Asthma Associated with Work in Three States—California, Massachusetts, and Michigan, 2001. J of Asthma, 43:213–218, 2006.
- Glutaraldehyde Exposures Among Workers Making Bioprosthetic Heart Valves. Journal of Occupational and Environmental Hygiene. J Occup Environ Hyg. May;4(5):311-20, 2007.
- Work-related Asthma in the Educational Services Industry—California, Massachusetts, Michigan and New Jersey, 1993-2000. Am J Ind Med. Jan;51(1):47-59, 2008.
- Primary Prevention of Occupational Asthma: Identifying and Controlling Exposures to Asthma-causing Agents. Am J Ind Med. Jul;51(7):477-91, 2008.
- Letter in response to “Efficacy of ‘Green’ Cleaning Products with Respect to Common Respiratory Viruses and Mold Growth, J Environ Health, May 2009” Letter.J Environ Health. 2009; 72:58.

SCIENTIFIC REPORT: PESTICIDE-RELATED ILLNESS

I BACKGROUND

The Occupational Health Branch (OHB) of the California Department of Public Health (CDPH) has worked to prevent **work-related pesticide illness** through our NIOSH-funded Occupational Pesticide Illness Prevention Program (OPIPP) from 1987-1992 and from 1997 to the present. The purpose of the OPIPP is to collect and analyze data on the health effects of occupational exposure to pesticides for purposes of prevention. We have access to detailed medical information on the pesticide-related illness and conduct targeted in-depth investigations in order to generalize our recommendations to all affected employers and employees.

II SPECIFIC AIMS

From 2005-2010, we maintained our existing SENSOR model for the surveillance of OPI and implemented several activities that enhanced our previous work. The overall goal during this last funding cycle was to maintain and enhance the California SENSOR program for the prevention of OPI. Specific aims were to: 1) Expand case ascertainment using multiple data sources; 2) Perform case-based field investigations and developing prevention strategies; 3) Collaborate with local and state agencies; 4) Disseminate results generated from project activities; and 5) Evaluate surveillance activities on an ongoing basis.

III METHODS

A SURVEILLANCE

OPIPP has developed a multi-source surveillance system for efficient and timely case reporting. Cases are identified from several data sources and include reporting from physicians, local health departments, poison control, local agricultural commissioners, hospital data, and workers' compensation data. Once cases are identified, medical records are requested, NIOSH surveillance case definitions are applied, industry and occupation coding is conducted, and final case classification is performed utilizing the established NIOSH case classification system. Data are thoroughly cleaned and edited, duplicates are eliminated, and data are transferred to NIOSH on an annual basis.

B CASE INVESTIGATIONS

We perform workplace investigations for selected cases to gather in-depth information about the worksite, work processes, and risk factors for OPI. OPI reports are selected for follow-up based on the magnitude of the public health impact: (1) incidents involving a large number of workers, or involving an exposure that is common to a large population of workers or is deemed to be of public health importance; (2) a large number or rate of illness reports related to a single agent, industry, or task; (3) illness severity (i.e., long-term disability, hospitalizations, and deaths); and (4) "sentinel events," reports that may represent a new or emerging hazard, or a failure of recognized control measures or regulations to effectively control exposures. CDPH-OHB has the authority to gain access to the workplace for the purpose of conducting investigations of work-related morbidity and mortality (California Health and Safety Code Sections 105175-105180). Workplace investigations may include the following methods: on-site industrial hygiene assessment of the workplace and work processes; interviews with employers, employees, and/or other individuals involved in the incident, and other key informants; symptom surveys of workers; reviews of written policies and procedures, employee training records, monitoring data, medical records, and regulatory investigations; and analysis of the relevant scientific literature.

C COLLABORATION

We leverage our efforts by collaborating with others who can use our data and technical expertise to implement strategies that will improve worker and community health. Our collaborative approach strives to support primary prevention-based activities by educating a

wide-range of audiences about the occupational health implications of pesticide use and by identifying strategies to improve worker health and safety through alternative methods for pest control.

D DISSEMINATION, EDUCATION, AND OUTREACH

We conduct outreach and disseminate our findings and recommendations to collaborators and stakeholders; publicize the importance of recognizing and reporting OPI; and promote effective measures to prevent exposures and illness to parties who can implement change. In addition to our OPI contacts database of over 2,000 health care providers, we have access to a mailing list of over 100,000 organizations and individuals maintained by OHB. We conduct outreach to employees, employer and industry organizations, medical and public health professionals, federal, state and local agencies, and environmental and community-based organizations. We disseminate information in a variety of formats, including materials for workers about prevention of OPI and workplace legal rights; worksite specific letters with findings and recommendations; scientific publications; conference presentations; grand rounds, and other presentations to health care providers; written comments to regulatory agencies and voluntary standard-setting organizations on proposed and existing regulations and guidelines; written analyses of proposed legislation; participation on interagency, advisory, and other work groups; posting on our website; and data and reports sent to NIOSH for inclusion in national surveillance databases.

E EVALUATION

We recognize the important role that evaluation plays in ensuring that our surveillance system is effective in tracking and preventing work-related pesticide illness. We have been using a logic model during the 5-year project period to track our objectives, outputs, and outcomes. In 2006, a CDC Epidemic Intelligence Service Officer completed an evaluation of the OPIPP system using the CDC updated guidelines for evaluating public health surveillance systems. All tasks outlined in the guidelines document were completed. The findings and conclusions of the evaluation were presented in Atlanta in 2006.

IV RESULTS

A SURVEILLANCE

From 1998 to 2008, the OPIPP program received a total of 3,684 unique case reports of suspected OPI. An average of 335 cases were reported annually. A total of 47% of reports were classified as definite, probable, or possible cases of OPI. A majority of the cases (67%) were male, and the mean age of cases was 36. The youngest worker was 13 at time of exposure and the oldest 77 at time of exposure. Only 22% of cases reported that they were actively applying pesticides at time of exposure, while 60% of cases reported that they were doing their usual work activities (non-application) when exposed. The most common pesticide agents reported were organophosphates, inorganics, and pyrethroids. Headache, nausea, eye irritation, and upper respiratory irritation were the most common health effects reported. The overall annual rate of OPI for all industries is 1.2 cases per 100,000 workers, with the highest rates seen in the agricultural, utilities, and educational services industries.

In 2007, the OPIPP program began to include disinfectant cases in the dataset. There were 280 reports involving disinfectants received from 2007 to 2008. The majority of these reports have been classified as probable or possible cases (70%), and 37% of these cases were classified as high or moderate severity cases. Cases were split evenly between males (52%) females (48%). The mean age of disinfectant cases was 37 with a minimum age of 16 and a maximum age of 68 at time of exposure. Bleach, chlorine, and glutaraldehyde were the most common disinfectants reported. Production, building cleaning, healthcare, and food preparation occupations were most commonly associated with cases involving disinfectants.

In 2010, OPIPP began requesting medical records for cases identified through the Workers' Compensation Information System (WCIS). In 2009, 116 cases that were not previously captured by the program have been identified and medical records have been requested.

B CASE INVESTIGATIONS

From mid-2005 to mid-2010, OPIPP staff conducted follow-up investigations for 18 incidents related to agents associated with OPI (average of 3-4 investigations per year). Investigations were conducted in a variety of workplaces including farms, warehouses, offices, hospitals, residences, manufacturing, and post-harvest food processing. Two examples of these investigations are briefly described below:

2007-2008: Workers in an almond processing plant became ill following fumigation of the facility using phosphine gas. Our investigation found that the major contributing factors to this incident were: the unanticipated leakage into adjacent rooms, not providing non-applicator employees with hazard communication training, lack of knowledge regarding the toxicity of the pesticide, inadequate clearance monitoring, insufficient ventilation, and the absence of a requirement to obtain a permit for its use or to notify the county agricultural commissioner of the intent to apply it.

2009: Eight workers in an office building experienced symptoms two days after application of a pyrethrin and pyrethroid pesticide products. Three of the workers were sent to the hospital. Although the pest control operator was cited for not ventilating the area and for improper notification, OPIPP felt that better knowledge and implementation of integrated pest management methods in this and other office settings would have been a better way to prevent OPI.

C COLLABORATION

The OPIPP program has collaborated with federal, state, and local agencies, health care professionals, industries, trade associations, labor organizations, sustainable agriculture organizations, and community-based organizations in our ongoing program activities. We have participated on numerous interagency, advisory, and other work-groups addressing pesticide illness, such as the California Office of Binational Border Health, Toxics Use Reduction Institute, and the CDPR Pesticide Registration and Evaluation Committee.

D DISSEMINATION, EDUCATION, AND OUTREACH

From 2005 to 2010, OPIPP staff made approximately 25 presentations at trainings and conferences, together reaching over 1000 individuals in our target audiences**.** We have also analyzed proposed legislation addressing laboratory reporting of cholinesterase results; provided written comments on proposed or existing regulations to CDPH and the California Department of Pesticide Regulation (CDPR), e.g., regarding expanding pesticide application notification requirements to neighboring properties and adding phosphine as a state-restricted material. Findings from OPIPP were distributed in the Fall 2005 edition of the Branch publication *Occupational Health Watch*, reaching 3,400 readers per issue. We have also authored or co-authored five articles describing our findings in the peer-reviewed literature. Several specific activities are described below:

- To explore the public health impacts of pesticides and to develop strategies to promote the use of safer pest management alternatives, we initiated and co-sponsored a conference on May 28, 2009, at the University of California at Davis entitled "Safer Alternatives for Pest Control in Agriculture – Making the Public Health Case for Change." Attendees and speakers encompassed a diverse group of stakeholders. Our collaborators were the Western Center for Agricultural Health and Safety, Center for Occupational and Environmental Health, and UC Statewide IPM program. The presentations from this conference are posted on the OHB website.

- To expand the reporting of pesticide illness among a vulnerable population at the US/Mexico border, we collaborated with the California Office of Binational Border Health, CDPR, Imperial County, and a worker advocacy group to produce, disseminate, and evaluate farm worker educational materials.
- We are collaborating with the San Francisco Department of Public Health and other organizations on a project to decrease the use of bleach in child care centers and, as part of a national collaboration, we are developing a School Disinfection Handbook for the Toxics Use Reduction Institute.

E EVALUATION

Surveillance

The total number of reports of OPI have fluctuated between 1998 and 2008, with a high of 592 in 1998 and a low of 193 in 2006. The timeliness of our surveillance system is adequate for case follow-up, with a median of 4.9 days elapsed between OPI onset and physician diagnosis, and a median of 43 days between physician diagnosis and receipt of report by OPIPP. The average time lag from the date of medical records request to the date of receipt is 41 days. There was insufficient information to classify 40% of reports. Of these, 82% were not classifiable because they lacked information about a pesticide, and 26% documented only one health effect. There is poor overlap between some of our reporting methods; for instance, only 10% of the cases identified in WCIS overlap with our doctor-based reporting system. The positive predictive value of our surveillance of OPI is relatively good; 56% of OPI cases for which medical records are received are subsequently confirmed as true cases.

Case investigations

We evaluated each step in our field investigations to identify procedures that maximize our ability to gain access to the worksite, while minimizing the potential negative impacts of our investigations on the well-being of vulnerable workers. This evaluation has been formalized in our Policy and Procedures for Field Investigations. We initiate our investigations in a timely manner and are able to gain access to worksites for purposes of conducting incident investigations. One important measure of the quality of field investigations is our ability to gather sufficient information to develop meaningful recommendations for prevention. Participation rates for on-site and telephone interviews has been excellent, with over 70% completion during OPI investigations. Our interview questionnaire has been evaluated and revised to include more open-ended questions to allow workers to provide more of their ideas. A key finding of our evaluation is that high-quality investigations require substantial resources (personnel, time, a diversity of scientific and technical expertise, and communication skills). Due to resource limitations, we cannot follow up all eligible OPI cases. Therefore, collaboration with outside agencies and groups is a key evaluation tool to help pinpoint the most pressing public health issues for follow-up. Our investigations have provided useful information regarding the adequacy of existing regulations. Our recommendations are directed towards the parties with the authority to implement changes—usually employers, trade associations, and regulatory agencies.

Dissemination, Education, and Outreach

The quantity of education materials distributed, the types of audiences to whom materials were disseminated, the number of talks or trainings provided, and the number of participants who have attended are evaluated continuously. To increase the impact of our outreach and education, we have successfully collaborated with various organizations. The quality of our dissemination efforts is evaluated by whether our approaches are consistent with the language and literacy needs of the target audiences, and if they are presented in a culturally appropriate manner. In light of our limited resources and the diversity of the workforce, we do not have the capacity to conduct extensive outreach to individual workers beyond the worksite being

investigated and individual case follow-up efforts. Rather, we conduct outreach and foster collaborative working relationships with outside organizations. These organizations, in turn, may disseminate the findings and recommendations of our project to their constituents.

V CONCLUSIONS

Over the 5 years of our grant, we have successfully maintained and enhanced our surveillance of occupational pesticide illnesses in California. We have used targeted case investigations, collaboration with others, and dissemination of our findings in order to prevent work-related pesticide illness. As we have received funding from NIOSH for an additional 5 years of OPIPP, in these coming years we plan to build on our previous work and expand our collection of disinfectant cases, continue to explore the use of Workers' Compensation reports in our database, and expand our collaborations with the California Department of Pesticide Regulation and others in order to expand the reach of our Program.

PUBLICATIONS

In the last five years, we have authored or co-authored five articles on OPI in the peer-reviewed literature:

- Application of the Industrial Hygiene Hierarchy of Controls to Prioritize and Promote Safer Methods of Pest Control: A Case Study. Public Health Rep 2009; 124(Suppl 1):53-62.
- Acute pesticide poisoning among agricultural workers in the United States. Am J Ind Med 2008; 51:883-898.
- Acute Pesticide Poisoning in the U.S. Retail Industry, 1998-2004. Public Health Rep 2007; 122:232-244.
- Pesticide Illness Among Flight Attendants Due to Aircraft Disinsection. Am J Ind Med 2007; 50:345-356.
- Worker Illness Related to Ground Application of Pesticide – Kern County, California, 2005. 5/5/06. MMWR 55(17):486-488.

SCIENTIFIC REPORT: WORK-RELATED INJURY FATALITIES

I BACKGROUND

The Occupational Health Branch (OHB) of the California Department of Public Health (CDPH) has worked to prevent **work-related injury fatalities (WRIF)** through our NIOSH-funded California Fatality Assessment and Control Evaluation (CA/FACE) program from 1992 to the present. Through an in-depth analysis of data on interactions of the worker, the work environment, and work processes, the ultimate purpose of the California FACE program is to reduce the burden in California of work-related injury fatalities through the development of effective prevention measures. We have access to multi-source fatality reporting documents and conduct targeted in-depth investigations in order to generalize our recommendations to workers and employers.

II SPECIFIC AIMS

From 2005-2010, we maintained our existing model for the surveillance of WRIF and implemented several activities that enhanced our previous work. The overall goal during this last funding cycle was to maintain and enhance the CA/FACE program for the prevention of WRIF. Specific aims were to: 1) Expand case ascertainment using multiple data sources; 2) Perform case-based field investigations and develop prevention strategies; 3) Collaborate with local and state agencies; 4) Disseminate results generated from project activities; and 5) Evaluate surveillance activities on an ongoing basis.

III METHODS

A SURVEILLANCE

CA/FACE has developed a multi-source surveillance system for efficient and timely case reporting. Cases are identified from multiple data sources, including the Los Angeles Department of Coroner (LACCO), Division of Occupational Safety and Health (Cal/OSHA), Census of Fatal Occupational Injuries (CFOI), news websites, newspaper clips, television, and radio reports. Once cases are identified, death and coroner reports are requested, NIOSH surveillance case definitions are applied, industry and occupation coding is conducted, and final case classification is performed utilizing the established NIOSH case classification system. Data are thoroughly cleaned and edited, duplicates are eliminated, and data are analyzed on a yearly basis.

B CASE INVESTIGATIONS

We perform workplace investigations for selected cases to gather in-depth information about the worksite, work processes, and risk factors that led to the work-related injury fatality. Over the past 5 years, the CA/FACE program targeted work-related fatalities for investigation based on guidance from the NIOSH FACE scientific staff in consultation with the state FACE programs, and included the following priority conditions: machine-related, highway/roadway construction-related, youth, and Hispanic workers.

OHB has the authority to gain access to the workplace for the purpose of conducting investigations of work-related morbidity and mortality (California Health and Safety Code Sections 105175-105180). Workplace investigations may include the following methods: on-site fatality investigator assessment of the workplace and work processes; interviews with employers, employees, and/or other individuals involved in the incident; review of written policies and procedures, employer's safety training program, and documentation that is pertinent to the decedent and the work that was being performed at the time of the fatal incident. Information regarding the employer's years in business, number of employees, incident history, employee training records, and analysis of the relevant scientific literature are collected. The CA/FACE investigator interviews any witnesses to the incident as well as immediate supervisors

and union stewards. Also obtained are pictures and other investigative information from Cal/OSHA, the coroner's report from the Los Angeles Department of the Coroner, and the death certificate.

C COLLABORATION

We leverage our efforts by collaborating with others who can use our data and prevention recommendations to implement strategies that will improve worker and community health. Our collaborative approach strives to support primary prevention-based activities by educating a wide-range of audiences about the occupational health implications of workplace hazards and by identifying strategies to improve worker health and safety by identifying safer work practices and engineering controls.

D DISSEMINATION, EDUCATION, AND OUTREACH

We conduct outreach and disseminate our findings and recommendations to collaborators, stakeholders, and target audiences of the results of significant surveillance findings and site-specific investigations; publicize the consequences of unrecognized or uncontrolled exposure to workplace hazards; and promote effective measures to prevent exposures, injury, and illness to all parties who can implement change; publicize the importance of workplace safety; and promote effective prevention measures to parties who can implement change. The CA/FACE program and the OHB maintain a mailing list of over 100,000 organizations and individuals. We conduct outreach to workers, employer and industry organizations, medical and public health professionals, federal, state and local agencies, and environmental and community-based organizations. We disseminate information in a variety of formats, including materials for workers about prevention of WRIF; worksite specific letters with findings and recommendations; scientific publications; conference presentations; grand rounds, and other presentations to health care providers; written comments to regulatory agencies and voluntary standard-setting organizations on proposed and existing regulations and guidelines; written analyses of proposed legislation; participation on interagency, advisory, and other work groups; posting on our website; and data and reports sent to NIOSH for inclusion in national surveillance databases.

E EVALUATION

We recognize the important role that evaluation plays in ensuring that our surveillance system is effective in tracking and preventing WRIF. Objectives, outputs and outcomes have been tracked using a logic model, which allows us to quantify outputs and evaluate if they have had an impact. We have assessed the different components of our system, including surveillance, worksite investigations, and information dissemination. We have conducted ongoing evaluation using the CDC Guidelines for Evaluating Surveillance Systems. The employer Action Evaluation Form has been used over the past 5 years to evaluate how the CA/FACE fatality investigation report was perceived by the employer, and whether the recommendations resulted in changes in the workplace. An Online Publication Evaluation Form has been posted on our CA/FACE website, and this online questionnaire form allows web visitors to instantly evaluate any one of our publications. Finally, all Spanish and English fact sheets are printed in both a 'short form' (without evaluation) and a 'long form' (with evaluation attached to the bottom of the fact sheet). The fact sheet evaluation includes overall rating of the fact sheet, if recommendations can be used at their workplace, and their intended use of the fact sheet.

IV RESULTS

A SURVEILLANCE

From 1992 to 2008, the FACE program confirmed a total of 2,068 fatalities in Los Angeles County. This is an average of 122 cases annually. A majority of the cases (93%) were male and the mean age of cases was 40 years. The youngest worker was 12 and the oldest 90 at time of death. Both the number and rate of WRIF in Los Angeles County has declined during

the 17-year period (1992-2008), paralleling the overall trend in California and nationwide. The number of work-related fatalities in Los Angeles County declined from 152 in 1992 to 101 in 2008, with the fatality rate also decreasing from 4.0 in 1992 to 2.5 in 2008. Homicide is the leading cause of work-related fatalities (31%), followed by transportation (19%), falls (13%) and machine-related (8%).

B CASE INVESTIGATIONS

From July 2005 to June 2010, FACE staff completed 52 fatality investigations (average of 10 per year). Investigations were conducted in a variety of locations including residential and commercial construction worksites, a university laboratory, distribution warehouse, label and plastic manufacturing center, steel fabrication warehouse, truck rental company, and highway construction worksite. Two examples of these investigations are briefly described below:

2008: A worker in a plastic bottle recycling facility was supervising a bale breaker machine as it separated the bottles from each other so they could be further processed. On the day of the incident the 41-year-old victim and a co-worker were standing on the catwalk and noticed a bale that was not properly feeding into the blades. The victim broke the company's standard procedure (use automated controls to reverse the conveyor) and instead, he entered the conveyor belt area through the access gate while the machine was still running. He used his foot to kick the stuck bale into the blades but his foot was caught in the rotating blades and pulled into the machine. CA/FACE prevention recommendations include installing physical barriers and safety interlocks that could prevent or shut down the machine in case a worker entered an unsafe area.

2010: A 30-year-old solar installer died when he fell off a 40 degree pitched roof. The job involved installing solar panels on the roofs of a multi-family housing development with several 3-story apartment buildings. On the day of the incident, the victim was checking the alignment of solar panel brackets and backed up to get a better view, when he stepped off the roof and fell 45 feet to the ground below. A safety meeting was held by the project manager on the first day of the job and he had informed all work crews that fall protection was required. However, work crews were not supervised by this project manager once the job began, and they were left alone to do the work. Neither the victim nor his co-workers were wearing fall protection, and they were not tied off. CA/FACE prevention recommendations include that employers should ensure both fall protection is worn and worksite safety plans are implemented.

C COLLABORATION

The FACE program has collaborated with federal, state, and local agencies, health care professionals, industries, trade associations, labor organizations, sustainable agriculture organizations, and community-based organizations in our ongoing program activities. We have participated on numerous interagency, advisory, and other work-groups addressing workplace safety, such as the Mexican and Ecuadorian Consulates, UCLA Labor Occupational Safety and Health (LOSH) program, trade associations such as the California Solar Energy Industries Associations, and Tree Care Industry Association, Cal/OSHA Standards Board, and ASTM International.

D DISSEMINATION, EDUCATION, AND OUTREACH

From 2005 to 2010, FACE staff made presentations at 27 industry and stakeholder meetings and 16 national conferences and FACE meetings, together reaching over 2,000 individuals in our target audiences. All 20 fact sheets were translated into Spanish, and 17,030 fact sheets were disseminated to employers, safety professionals, and workers at safety trainings, the Mexican and Ecuadorian consulates, health and job fairs, labor centers, national conferences and professional meetings, union trainings, and Worker Memorial Day events.

We have analyzed proposed changes to the California Code of Regulations and Federal OSHA Proposed Rules. We wrote a letter of support to the California Occupational Safety and Health Standards Board regarding the proposed changes involving seatbelt use in powered industrial trucks (it should be required), and to Federal OSHA in support of requiring seatbelt use while cranes are in operation (mechanics' trucks). Finally, FACE summary data provided to the Los Angeles Taxi Workers' Alliance prompted them to launch a campaign requiring a more rapid response to driver's distress signals.

Findings from FACE were distributed in the fall 2005 and 2007 editions of OHB's publication *Occupational Health Watch*, reaching 4,000 readers per issue. We co-authored two articles in the peer-reviewed literature, and had our FACE cases or fact sheets featured in 13 trade association publications. Specific dissemination activities are described below:

- We investigated two cases involving cars or trucks that shifted on jack stands or truck lifts and fell on workers that were underneath the vehicles. The 'Falling Vehicles' fact sheet was disseminated widely and was featured on trade association websites and e-newsletters and was included in a training module for 1,750 vocational schools, reaching approximately 150,000 students.
- Solar fatality investigations resulted in three fact sheets (fall off roof, electrocution, and fall through skylight), and one FACE Flash (how to safely lift solar panels to the roof), which were mailed to 1,000 solar installation companies. Feedback from the companies was that the FACE materials prompted them to adopt safer work practices and purchase the alternative lifting devices that were highlighted.

E EVALUATION

Surveillance

The total number of WRIF in Los Angeles has fluctuated between 1992 and 2008, with a high of 167 in 1994 and a low of 94 in 2003. Our evaluation of temporal reporting trends shows a decrease in the number of WRIF from 152 in 1992 to 101 in 2008. This decrease parallels the reduction in cases reported from the CFOI program, both in Los Angeles County and in California. We believe the case count decrease reflects a true decline in overall cases (rather than due to reporting problems). Most of the decline in fatality case counts is due to decreases in work-related homicides, which may reflect a combination of decreased criminal activity or improvement in workplace prevention strategies. The timeliness of our surveillance system is adequate for case follow-up, with a median of 8 days elapsed between work-related fatal incident and investigator notification. In evaluating case classification, out of a total of 2,404 cases reported from Los Angeles County as possibly work-related, 2,068 (86%) met the NIOSH definition for work-relatedness.

Case investigations

We evaluated each step in our field investigations to identify procedures that maximize our ability to gain access to the work site, while minimizing the potential negative impacts of our investigations on the well-being of workers. To evaluate our CA/FACE fatality investigations, we assess the capacity to respond to case reports in a timely manner; the quality of our investigations (were they conducted according to the standards set forth in our policy and procedures); and the public health impact of our investigations (did the investigations produce public health based recommendations for prevention and were the recommendations implemented). This evaluation has been formalized in our *Policy and Procedures for Field Investigations*. We initiate our investigations in a timely manner (usually within two weeks after we receive notification of an incident) and are able to gain access to worksites for purposes of conducting fatality investigations. One important measure of the quality of field investigations is our ability to gather sufficient information to develop meaningful recommendations for prevention. The Employer Action Evaluation Form has been used since 2004 to evaluate how

the CA/FACE fatality investigation report was perceived by the employer, and whether the recommendations resulted in changes in the workplace. During 2005 – 2010, we sent all 54 investigated employers the fatality investigation report, and conducted a telephone interview with 47 (seven companies were no longer in business) using the Employer Action Evaluation form. FACE staff found that 92% of employers rated the investigation report 'Good' or 'Excellent'; 92% of respondents rated the individual FACE recommendations 'Good' or 'Excellent'; at the time of interview (3 weeks after they received the report), 92% of interviewed employers had implemented at least one of the FACE recommendations at their worksite; and 85% had discussed the report with their employees, or planned to in the near future.

Participation rates for on-site investigations have been excellent. In only one case between 2005 and 2010 have we been unable to gain access to a worksite for purposes of conducting incident investigations, and this was due to employer legal counsel opposing our right of access. Participation rates for on-site interviews of victim co-workers have ranged from 60-70%. One reason for the decreased participation rate was the language barrier between the CA/FACE investigator and Spanish-speaking co-workers or employers. Since 2006, we have used a Spanish translator who accompanies the investigator to the worksite and conducts any follow-up calls. All investigations initiated by the CA/FACE program resulted in the development and wide dissemination of comprehensive written recommendations for prevention and the development of incident summaries that were transmitted to NIOSH. A key finding of our evaluation is that high-quality investigations require substantial resources (personnel, time, a diversity of scientific and technical expertise, and communication skills). Due to resource limitations, we cannot follow up all eligible WRIF cases. Recommendations and findings from our investigations have had important effects on policy and standards. The recommendations in our investigation reports are directed towards the parties with the authority to implement changes – usually employers, trade associations, and regulatory agencies.

Dissemination, Education, and Outreach

The quantity of education materials distributed, the types of audiences to whom materials were disseminated, the number of talks or trainings provided, and the number of participants who have attended are evaluated continuously. To increase the impact of our outreach and education, we have successfully collaborated with various organizations. To reach Hispanic workers, we have collaborated with the UCLA Labor Occupational Safety and Health (LOSH) program, for translation and dissemination of our CA/FACE materials at bilingual worker trainings and community events. The quality of our dissemination efforts is evaluated by whether our approaches are consistent with the language and literacy needs of the target audiences, and if they are presented in a culturally appropriate manner. The findings and recommendations of our field investigations are summarized in simple language (5^{th} grade reading level) and translated into Spanish. From February 2009 to June 2010, CA/FACE received 292 fact sheet evaluations from workers (90% Hispanic) taking part in LOSH worker trainings at the Mexican Consulate. Respondents rated the fact sheet excellent or good (96%); thought it was easy to understand (97%); are more aware of workplace safety after reading the fact sheet (98%); and believe the recommendations can be implemented where they work (99%).

V CONCLUSIONS

Over the 5 years of our grant, we have successfully maintained and enhanced our surveillance of work-related injury fatalities in California. We have used targeted case investigations, collaboration with others, and dissemination of our findings in order to prevent occupational fatalities. As we have received funding from NIOSH for an additional 5 years of FACE, in these coming years we plan to perform 10 to 12 investigations of select work-related injury fatalities, adding two additional priority conditions: falls among Hispanics in residential construction, and renewable energy production (special emphasis on solar installation); publish at least two fact

sheets and 3 worker fatality alerts per year; publish surveillance and fatality investigation findings in the OHB newsletter *Occupational Health Watch*; post a year-end summary data report on the CA/FACE website; publish articles in trade association newsletters; evaluate our surveillance system, field investigations, and information dissemination; and maintain and enhance ongoing collaborations with state and local agencies, unions, trade association, and other stakeholders.

PUBLICATIONS

In the last five years, we have authored or co-authored the following:

Peer Reviewed

- *Work-Related Injury Deaths Among Hispanics – United States, 1992-2006*. MMWR June 6, 2008 / 57(22);597-600.
- T.J. Lentz, Paul Moore, Hank Cierpich, Robert Harrison, Laura Styles, James Rogge. Sustainable Energy and Worker Safety - Aiming for New Heights. *MetalMag* October 2009 / 10 (8): 56-61.

Trade Association Publications Featuring CA/FACE Cases or Interviews

- The Professional Landcare Network (PLANET)'s *Safety Solutions*, July 2005, "Tree Care Work Presents Fatal Hazards" p. 1.
- The Tree Care Industry Association (TCIA), *Tree Care Industry Magazine*, July 2005, "FACE Program Prevents Workplace Fatalities" p. 40-41.
- The Professional Landcare Network (PLANET), *Safety Solutions*, April 2006, "Do Your Hispanic Workers Understand You?" p. 1.
- The Tree Care Industry Association (TCIA), *Tree Care Industry Magazine*, May 2006, "Are Your Hispanic Workers Safe?" Includes '10 tips from a Fatality Investigator', p. 44-50.
- *Electrical Construction & Maintenance (EC & M) Magazine* – Forensic Casebook, August 2006, "The Case of the Shipyard Electrocution: Journeyman electrician is killed while performing maintenance on high-voltage transformer." Highlights CA/FACE case #92CA016. p. 16-18.
- UCLA Labor Occupational Safety and Health *WOSH Bulletin*, April 2008.
- National Safety Council's *Safety & Health Magazine* – FACE Value, July 2008, "Laborer Crushed by Falling Paper Bales" p. 57. Highlights CA/FACE case #07CA002.
- National Safety Council's *Safety & Health Magazine – FACE Value*, April 2009, "Driver Dies after Falling from Top of Tanker Truck". Highlights CA/FACE case #08CA002. p. 57.
- *VidaNuevo* (Spanish language magazine) "UCLA Desarrolla Programa de Seguridad Para Trabajadores", Mayo de 2009.
- *Electrical Construction & Maintenance (EC & M) Magazine* – From the Forensic Files of NIOSH, May 15, 2009. Highlights CA/FACE case #06CA007.
- National Safety Council's *Safety & Health Magazine* – FACE Value, July 2009, "Boat Repairman Killed When Battery Explodes." p. 53. Highlights CA/FACE case #07CA004.
- National Safety Council's *Safety & Health Magazine* – FACE Value, August 2009, "Maintenance Worker Killed in Roof Fall" Highlights CA/FACE case #08CA001.