HIGHLIGHTS 2006

THE CENTER TO PROTECT WORKERS' RIGHTS

CPWR

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NEA – The Association of Union Constructors

Mechanical Contractors Association

National Association of Construction Boilermaker Employers

National Electrical Contractors Association

North American Contractors Association

Sheet Metal and Air Conditioning Contractors National Association

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U.S. Department of Energy

U.S. Department of Labor

Environmental Protection Agency

National Institute for Occupational Safety and Health, CDC

National Institute of Environmental Health Sciences, NIH

Several State Departments of Health

Zenith Administrators, Seattle, Washington

FOREWORD

For fifteen years, the Center to Protect Workers' Rights has been focusing on construction safety and health and we want you to know what we're accomplishing with a nationwide consortium of university researchers, corporations (project owners, construction contractors, and insurers), nonprofit organizations, government agencies, and — most important — construction workers.

Founded in 1979 by the Building and Construction Trades Department, CPWR in 1990 began working closely with the National Institute for Occupational Safety and Health, part of the CDC, under a series of competitive grants. In recent years, we've joined also with the National Institute of Environmental Health Sciences, part of the National Institutes of Health, to deliver safety-and-health training in partnership with 11 unions. And, with support from the Department of Labor and Department of Energy, we work with local Building and Construction Trades Councils and local unions to serve former construction workers in the nation's nuclear defense programs.

We use this three-pronged approach — research, training, and service — to save lives. Because of the large numbers employed and excessive injury rates, more workers are killed by injuries in construction than in any other industry in the United States — 1,268 reported in 2004, or 5 per workday. Construction workers are 7 percent of the workforce, but suffer 22 percent of the deaths from injuries on the job. For a mix of reasons, we can't count the number of deaths from occupational illnesses, but we do know that construction workers suffer high rates of cancers and respiratory diseases that can be life threatening. More than 150,000 construction workers require time off each year to recover from work-related injuries or illnesses, some of which force them to leave the trades.

More, CPWR and its research consortium seek to improve the quality of life for workers and their families; for instance, by helping to prevent chronic, painful musculoskeletal disorders that result from day-in, day-out heavy lifting and the awkward postures and repetition required for some jobs.

Our efforts can improve productivity and cost-effectiveness for an industry that employs more than 10 million men and women. Healthier workers are, of course, more productive. Ill or disabled workers can cost the industry and society in medical bills, workers' compensation, social programs, and lost wages.

Thus, for instance, we are working to prevent falls, which cause 30 percent of the deaths from injuries in our industry, with four dedicated projects: statistical and applied research on ladder injuries, a statewide publicity campaign to promote basic ladder safety, a fall prevention training program for residential construction, and a video to promote a new fall protection system for ironworkers who literally are working on the edge — installing decking, the support for floors in high-rise construction.

As new needs arise, we address them. A rapidly increasing Hispanic workforce brings demands for new understanding and training to the workplace. We've been identifying the problems and working to produce programs that address those workers' needs. (Since 1996, we've been producing materials in Spanish.) Disasters, such as the 9/11 attack on the World Trade Center and the devastation wrought by Hurricane Katrina in August 2005, call for specially trained construction workers. After 9/11, we developed and provided basic safety training for 1,800 construction workers who assisted in recovery at the World Trade Center. More recently, we have been in the Gulf states providing safety training for workers facing exposure to toxic substances and other hazards. Also, we've translated to Spanish the Power Point presentations produced by the National Institute of Environmental Health Sciences to orient new cleanup workers on safety.

We define and identify the problems, work in the field to develop practical, evidence-based solutions, and spread the word — through such means as newsletters, conferences, technical reports, pocket cards for workers, videos, and the Internet. In addition to our own website, at www.cpwr.com, we coordinate the Electronic Library of Construction Safety and Health (www.elcosh.org). Our staff and colleagues are developing two new electronic programs, to detail Construction Solutions to ergonomic/safety problems and to help managers build safety into project scheduling (*see* www.saluslink.com).

CPWR staff reflect a broad range of technical knowledge and experience, but we couldn't do our work, of course, without our collaborators in academia, government, and the industry. We hope you find our work worthwhile. Updates are provided on our website. Or, if you have questions about our programs, call us at 301-578-8500.

Edward C. Sullivan, President,
Building and Construction Trades Department, AFL-CIO,
and The Center to Protect Workers' Rights
March 2006

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STATISTICAL RESEARCH

CPWR and cooperating researchers use statistics to pinpoint safety-and-health trends and analyze the economics of the industry, particularly the costs of safety-and-health programs. Data Center staff respond to requests for data from government policymakers, unions, and other industry stakeholders. The director, Xiuwen (Sue) Dong, has addressed problems with construction industry data in presentations to the Bureau of Labor Statistics and the National Academy of Sciences.

Injury and Illness Surveillance

The Data Center analyzes statistics from the Bureau of Labor Statistics, the Census Bureau, the National Institute for Occupational Safety and Health, the National Center for Health Statistics, and workers' compensation programs, among others.

An outgrowth of this continuing research, ***The Construction Chartbook: The Construction Industry and Its Workers,*** first published in 1997 and now in its third edition, is the leading reference of its kind for the industry. With more than 150 charts covering the industry's demographics, economics, and safety and health, the book describes findings, but also data sources and limitations of the data. The fourth edition is slated for 2008.

CPWR produced the construction section of the *NIOSH Worker Health Chartbook, 2004,* and a 2005 report, *Work-Related Fatal and Nonfatal Injuries among U.S Construction Workers, 1992-2003,* which tracked trends for 14 occupations on 52 charts. Other studies submitted to scientific journals look at ties between reported injuries and both safety training and overtime work.

Hispanic Construction Workers

Continuing research covers demographics, the rate of work-related injuries and illnesses, health insurance coverage, and health services and related costs compared with the industry overall. The goal is to highlight problems among this group, which is a rapidly growing portion of the construction workforce (*see* page 11: Hispanic day laborers).

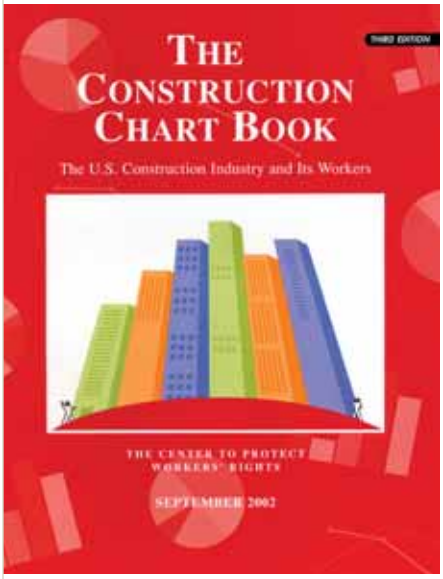
Economics of Safety and Health

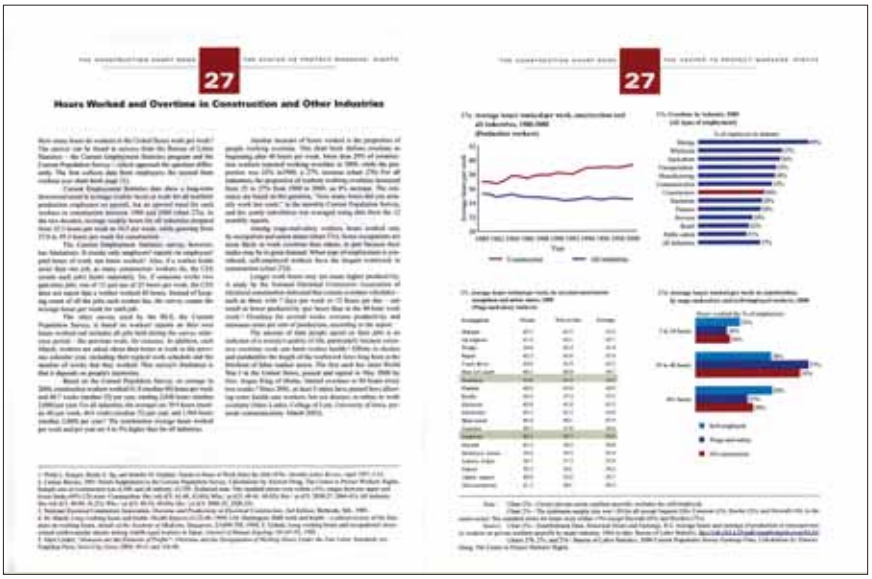
Costs of occupational injuries in construction

Data Center staff are working with the Pacific Institute for Research & Evaluation to develop a model of the costs of injuries and illnesses in construction.

Construction Economics Research Network

The Economics Research Network, originated by CPWR in 1994 with former secretary of labor John W. Dunlop, meets twice yearly. The network, now chaired by David Weil, PhD, of the Kennedy School of Government and Boston University, draws 20 labor and health researchers from universities, government, and the private sector to examine economic effects on construction worker safety and health. Dale Belman, PhD, Michigan State University, coordinates the meetings.





TRAUMATIC-INJURIES RESEARCH

Injuries at work killed more than 1,260 construction workers in 2004; for at least a decade, falls have caused about 30 percent of the deaths.

Falls

Prevention of falls from ladders

Melissa Perry of the Harvard School of Public Health and Gordon Smith of the Liberty Mutual Research Institute for Safety have been analyzing data from the Bureau of Labor Statistics, the CDC, and other federal agencies to zero in on the causes of falls from ladders. Although ladders are one of the oldest and most common tools in construction, they're still a major injury hazard. Perry and Smith have used the government data to develop a detailed questionnaire to interview workers who are injured using ladders. The goal is to work with union leaders, safety engineers, and others to reduce ladder-related hazards through both supervisor training and task redesign or task substitution.

ANALYSES

CPWR is analyzing causes of injuries involving heavy equipment in excavations, injuries involving dump trucks, and fires and explosions on construction sites.

Ladder-safety campaign: "Don't Fall for It"

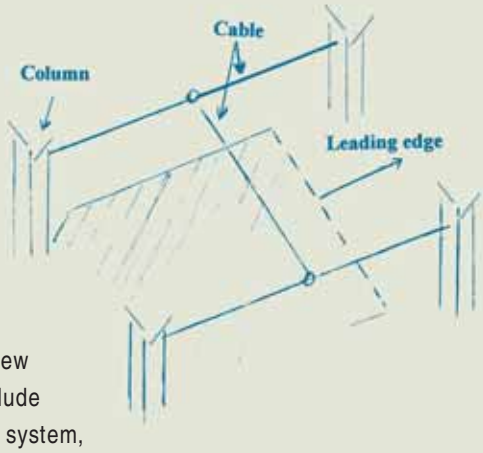
Since 2003, CPWR has been developing materials for a pilot research and marketing campaign to help reduce injuries in construction; such an effort has proved successful in Great Britain. In the United States, about 400 workers are killed in falls from ladders each year. To stop those deaths and an unknown number of injuries, Janie Gittleman of CPWR, working with the New Jersey Building and Construction Trades Council and the New Jersey Department of Health and Senior Services, has developed a video and 4 tip sheets about ladder safety for construction workers. The 10-minute video, *Don't Fall for It,* mixes interviews with survivors of falls (or victims' survivors) and information about safe procedures. Employees of members of the Building Contractors Association of New Jersey were given a short pretest on their knowledge and attitudes about ladder safety partly to provide input for program materials. Then they were shown the video and given a short post-test, along with the tip sheets to take with them. To measure effectiveness of the approach and the materials, researchers are following up with the 350 workers three months later and monitoring fall-incident data — near-misses and injuries — in the state. In late 2006, the findings will be evaluated to decide whether to expand the program.

Nail Guns

In recent years, researchers in Washington state and at Duke University have documented a growing number of injuries caused by the use of pneumatic nail guns in wood-frame residential construction. The tools are easy to use and are often given to relatively unskilled workers, placing apprentice carpenters at particularly high risk. Hester Lipscomb, of Duke University, is approaching the problem in several ways. She is working with the

LEADING-EDGE DECKING FALL PROTECTION

Michael McCann, CPWR director of safety research, is working with the Ironworkers Union and contractors to produce a video and workbook on a new fall protection system for ironworkers installing decking. Ironworkers have been reluctant to use personal fall-arrest systems when installing a deck, the support for a floor, for fear that harness lanyards attached to an anchor below shoulder level could get tangled and cause their own safety problems. And, with anchors below shoulder level, there was the chance a worker would hit the deck below in a fall. In pilot studies, the new system, which attaches to cables 7 feet above the decking, has stopped falls and ironworkers were able to rescue themselves. The researchers will evaluate how well the new training materials enable a steel erection contractor to implement the system. Partners include NEA – The Association of Union Constructors, Bovis Lend Lease, and the developers of the system, Capco Steel Inc. and Innovative Safety, a consulting firm.



FALL PREVENTION TRAINING FOR RESIDENTIAL CARPENTERS

In another approach to the persistent problem of falls, researchers at Washington University School of Medicine, with the St. Louis Carpenters Joint Apprenticeship Training Program, are assessing fall-protection training in the 4-year apprenticeship program. The researchers are analyzing injury data and, with apprenticeship instructors, are reviewing the curriculum. Based on results from focus groups of apprentices, Bradley Evanoff, MD, MPH, and the others are developing questionnaires for a worksite survey on knowledge, attitudes, and barriers to fall-prevention on the job. In addition, experienced carpenters are auditing safety practices on worksites. The findings, with input from contractors, will be used to direct changes in training. After any changes are implemented, the effects on attitudes and behavior will be assessed. Other participants in the project are the Carpenters District Council of Greater St. Louis and Vicinity; Hester Lipscomb, Duke University Medical Center; and Roz Sherman Voellinger, a labor educator at the University of Missouri St. Louis.

Carpenters District Council of Greater St. Louis and Vicinity, homebuilders associations in St. Louis and S. Illinois, and two affiliated training schools. Information is being collected from apprentices on their use of nail guns, plus their training and any injuries. James Nolan, Local 2119, and Dennis Patterson, Local 1310, collect questionnaire data and interview injured apprentices in detail. In addition, the project is assessing the effects of a May 2003 voluntary industry standard (American National Standards Institute) — it calls for shipping framing nailers with safer sequential triggers — by monitoring the types of tools carpenters use, contractors' purchasing decisions and policies, and injury rates. Preliminary findings show that injury rates among apprentices are higher than previously thought; nearly half of apprentices have at least one nail-gun injury before completing the 4-year training program. Workers with the least carpentry experience and no training are at greatest risk; injury rates are twice as high with use of the more common contact-trip trigger, even after taking into account training and experience. The data will be used to provide feedback to the International Staple Nail and Tool Association about safety materials included in tool packaging. At the same time, the research team is comparing the productivity of the two types of triggers when used by experienced journeymen.

Safety Training and Safety Campaigns across Three Regions

The Plumbers and Pipefitters Union (UA) is helping Peter Chen, PhD, and John Rosecrance, PhD, of Colorado State University to find new ways to improve construction safety and then spread the word. First, Chen, a psychologist, and Rosecrance, a physical therapist and expert in ergonomics, and their team are identifying key barriers to safety and implementing new training to address them. With UA locals 208 (in Colorado), 420 (Pennsylvania), and 290 (Oregon), contractor associations, and insurers, the researchers identified barriers that are organizational and psychological, involving workers and management. The barriers include a lack of a safety climate, poor leadership skills, a lack of recognition of employees' ability to contribute safety solutions, poor safety communication techniques, and conflict between the pressures of work and family. Focusing on the barriers, the researchers have developed training modules for management and workers, which are being presented in the spring of 2006. At the same time, the research team is developing strategies to spread findings on psychological safety research and best practices throughout the construction industry. Using those strategies, the team later will develop, implement, and evaluate the effectiveness of a new communications campaign. The intent is to benefit researchers, contractors, insurers, managers, and workers and their families in all parts of the industry. Partners include Pinnacol Assurance, the largest workers' compensation insurer in Colorado; Liberty Mutual Research Center for Safety; Associated General Contractors of Colorado; and the Mechanical Contractors Association of Colorado, Oregon, and Eastern Pennsylvania.

HEAVY EQUIPMENT

Rollover protective structures (ROPSs). With the International Union of Operating Engineers, CPWR is helping to draft an OSHA safety standard for ROPS and seatbelt use on compactors/rollers. The union and the Association of Equipment Manufacturers in 2005 presented results of a CPWR small study to OSHA's Advisory Committee on Construction Occupational Safety and Health, ACCSH agreed to set up a workgroup on the issues (*see* page 7).

Slips, trips, and falls. At the request of the Teamsters Union, CPWR has been interviewing Ready Mixed concrete truck drivers about the hazards, in order to develop recommendations for improvements in procedures and truck designs.

DISEASE MONITORING AND PREVENTION RESEARCH

Work-related disease is clearly a hazard in construction, where workers are exposed to dusts containing asbestos, silica, and other life-threatening toxins; cadmium, lead, and other heavy metals; solvents; and biological agents ranging from bacteria to molds to viruses. Large-scale statistical studies based on death reports show some trades at high risk for lung and other diseases.

Yet, the occurrence of work-related illness is difficult to gauge in the industry. One reason is that it is difficult to document construction workers' exposures; for instance, a bricklayer could be exposed to welding fumes as a bystander. Another factor is the lag between many exposures and the diagnoses of diseases, including cancers and nervous system disorders.

Lung Disease in Sheet Metal Workers

CPWR, with Duke University Medical Center and the Sheet Metal Occupational Health Institute, is using medical screenings and work histories of more than 16,900 union members to study risk factors — on and off the job — for work-related lung disease, particularly chronic obstructive pulmonary disease. The researchers are analyzing responses to questionnaires and screening results to identify ways to prevent respiratory diseases.

Task-Based Controls

Pam Susi of CPWR has for a decade been working with university and government researchers and with unions to find ways to measure and reduce worker exposures to health hazards on the job, such as dusts, fumes — and noise (*see* page 6). Estimation or measurement of exposures for various tasks is difficult for many reasons, such as that the worksite changes constantly. A *CPWR-NIOSH Engineering and Work Practices Controls Work Group* has met since 1994 to develop methods to accurately measure the hazards/exposures and to evaluate potential protections for workers. Engineering protections, such as ventilation, or changes in work practices are preferable to workers' wearing respirators or other personal protective equipment.

Data analysis

CPWR continues to work with the Harvard School of Public Health, Hunter College, and the Bricklayers and the Plumbers and Pipefitters Unions to measure possible worker exposures to silica dusts, welding fumes, manganese, and hexavalent chromium, while further refining survey/research methods. Researchers at the University of North Carolina are using those exposure data to determine the extent to which workers are exposed to hazardous agents and the effects engineering controls have on reducing exposures. To assess controls for manganese and total fume, CPWR, with the Ohio Building and Construction Trades Foundation and the Plumbers and Pipefitters Union, has been comparing exposures with and without local-exhaust ventilation and two types of protective hoods. CPWR is working, as well, with the University of Massachusetts Lowell, to measure exposures to silica, noise, diesel exhaust, dust, and welding fumes associated with the tasks performed by Pile Drivers, Operating Engineers (who drive heavy equipment), and other construction workers. UMass Lowell researchers are testing the effectiveness of silica and dust controls such as local-exhaust ventilation on power hand tools — in the lab, at the Laborers Training Center, and at worksites around Massachusetts. Silica, in rock and concrete, can cause silicosis, an incurable lung disease.

Tools and programs for improving occupational health conditions in construction (TAPS)

With Hunter College (in New York City), the Harvard School of Public Health, the Ohio Building and Construction Trades Council, and the International Masonry Institute, CPWR is testing tools for controlling exposure to welding fumes and silica dust, while also addressing hexavalent chromium exposure among tile and terrazzo workers. The team has collected cement samples from throughout the United States to measure the range of hexavalent chromium in Portland cement, which is often used during terrazzo work. Hexavalent chromium is associated with lung cancer, occupational asthma, and skin problems so severe that some workers are forced to leave the trades.

Barriers to reducing bricklayers' silica exposures

Once controls are developed, researchers must work with contractors and workers to overcome any barriers to their use. As part of the TAPS project, researchers at Hunter College are working with CPWR, the Bricklayers Union, International Masonry Institute, and Masonry Contractors of New Jersey to find ways to encourage contractors to use engineering controls (such as ventilation) to protect workers from silica. One approach is a planned certification program for contractors who agree to use engineering controls as part of a comprehensive silica control program.

MUSCULOSKELETAL DISORDERS AND ERGONOMICS RESEARCH

The physically demanding nature of construction work, including lifting of heavy materials, the need to work in awkward and static postures, and tasks that require repetitive motion, helps explain why musculoskeletal disorders – strains and sprains – are the most common type of work-related injury in the industry. MSDs account for one-quarter of injuries and illnesses requiring time off to recover.

Masonry Ergonomics

Masons and mason tenders (assistants), who lift as much as 6,000 pounds of block in a day, suffer a high rate of work-related musculoskeletal disorders (MSDs), especially low-back pain. Those injuries, in turn, can cause long absences from work. Medical and safety researchers at CPWR and universities in California, Iowa, Oregon, and West Virginia are identifying tools, materials, and work practices that could reduce the risks for MSDs in masonry. The research involves documenting how effective some approaches are and how decisions are made by contractors and workers whether to use them; later, the project will circulate information about possible improvements and judge how effective is the information campaign. Focus groups with masons from the northwestern, north-central, and eastern U.S. identified best practices, but showed that their use varies by type of work, by region and climate, and even by collective-bargaining agreement. The researchers are meeting with masons in Washington, DC, West Virginia, Iowa, Portland (Oregon), and Seattle to pursue the questions before compiling a list of best practices to promote. At the same time, the University of Iowa biomechanics lab is developing a model to predict back injury from manual materials handling, which will be used to show changes in back movements with the use of such aids as scaffolding and material platforms, which alter the height of mortar and block and reduce the need for lifting and bending. (The University of California, Davis is providing research instruments and the University of Oregon is providing technical assistance.) The goal is to develop training materials for the selected best practices, while assessing productivity and workers' knowledge and attitudes about the chosen approaches.

New Methods for Overhead Drilling

Drilling overhead into concrete can take a toll on workers' shoulders, necks, and lower backs because of the heavy weight that must be supported and the awkward posture required for long periods. David Rempel, MD, Demetra Dalamagas, and Billy Gibbons of the University of California, San Francisco surveyed proposed and existing designs, including some built by construction workers. Two designs were chosen to manufacture for field trials, an inverted drill press and a foot-lever drill press. The researchers are working with electrical, mechanical, and sheet metal contractors, an architect, and project owner, plus members of the Electrical Workers and Sheet Metal Workers Unions in Oregon and Washington. Workers have been trying the devices and making suggestions for improvements, in terms of usability, fatigue levels, and basic design. Based on feedback from workers, new designs are being built and studied to compare body posture, muscle fatigue, hand vibration, and productivity between use of the new drill presses and conventional overhead drilling.

ENCOURAGING ERGONOMIC CHANGE

Steven Hecker, Marc Weinstein, PhD, and Jennifer Hess, PhD, at the University of Oregon's Labor Education and Research Center, are developing a model communications strategy to promote the use of ergonomic innovations in construction. The project, known as ICE (Improving Construction Ergonomics), has been working with tool vendors, contractors, and members of building trades unions in Oregon and southern Washington to identify tools, materials, and work practices that can be introduced easily on worksites to reduce the risks of sprains and strains. In the first year, the group chose an extended-handle screw gun, a tool that allows carpenters to work on decking, subflooring, and construction of forms for pouring concrete while standing, instead of bent over. In 2006, the researchers are expanding their work to develop ways to promote the use of ergonomic improvements in masonry and concrete work. The team is tracking the effectiveness of these efforts. In addition to the Willamette Carpenters Training Center, project partners include the Construction Ergonomics Initiative, the Greater Portland Construction Partnership, and the Laborers-AGC Education and Training Fund.

HEARING CONSERVATION RESEARCH

By age 50, more than half the construction workforce has experienced work-related hearing loss. Hearing loss impairs quality of life (and health) on and off the job. It can also increase the risk of injuries; for instance, when a worker can't hear approaching vehicles or warning signals. OSHA's standard for construction is not protective enough, allowing noise levels that are dangerously high, so labor and management must cooperate to protect workers.

Hearing Conservation Program

Workers' hearing can be protected only through a comprehensive, regional effort, given construction workers' movement between employers and jobs. Using the slogan, "Block it, move it, reduce it," Build It Smart is implementing a hearing conservation program that is intended to serve as a model for the industry. Researchers, including construction workers, have been monitoring noise levels on work sites and experimenting with noise barriers and noise perimeters to limit worker exposures. Sometimes work processes are being changed to reduce noise, such as replacing pile driving with boring. Equipment maintenance, modifications, and replacement with quieter models are being evaluated; for instance noise-reducing saw blades can cut noise levels in half. Training for workers and supervisors shows proper use of personal hearing protection and increases awareness of noise levels on the job; on site, heavy equipment is labeled with stickers showing whether special hearing protection is needed. In addition, Build It Smart, the Labor-Management Organization of Washington State, and its partners at the University of Washington, Duwamish Technical School (Seattle), and the International Laborers Training Center (Kingston), members of the Washington Associated General Contractors, and other contractors have been testing workers' hearing and noise levels of tasks to establish a centralized database.

Hearing Loss Prevention in Road Construction

One attempt to prevent construction workers' hearing loss is a "noise in road construction" initiative of the Washington State OSHA program, known as WISHA. The initiative, begun in spring 2004, calls for inspections and consultations on how to reduce noise and protect workers' hearing. William Daniell, MD, MPH, of the University of Washington, and others developed a form that has been distributed to WISHA inspectors to use for their noise-related inspections. The form helps inspectors summarize findings about noise monitoring, controls, training, use of hearing protection, hearing tests, and the type of work done on the site. The UW researchers have been analyzing the completed forms and other WISHA records to summarize findings of the state initiative. Then, starting in the spring of 2006, the UW team will be visiting road construction sites run by previously inspected companies to learn how well hearing conservation efforts are going one to two years after the WISHA inspections. The researchers will measure noise levels, monitor use of hearing protection, and talk with workers and managers.

Noise Control in Concrete Cutting

The University of Massachusetts Lowell is working with several unions to evaluate noise controls for small powered tools, such as portable concrete (chop) saws and jackhammers, and on heavy equipment, such as rock crushers — with and without controls for silica exposures (*see* TAPS, page 4).

NOISE LEVELS (IN DECIBELS) OF 4" ANGLE GRINDER
(103 decibels) with & w/out barriers, measured at various distances from the grinder

Without barrier				With plywood barrier				Raised plywood barrier			
5'	10'	20'	40'	5'	10'	20'	40'	5'	10'	20'	40'
100	95	90	84	80	74	70	64	84	80	74	70

Note: Background noise from about 200 yds: highway traffic at 64 to 75 decibels. Decibels are measured on a logarithmic scale; 73 decibels is twice as loud as 70, the normal level for conversation.
Source: Build It Smart

PILOT RESEARCH GRANTS: SMALL STUDIES

With funding from the National Institute for Occupational Safety and Health (NIOSH), CPWR since 1993 has provided more than 50 grants of up to $20,000 each. The goal has been to help define problems and point up needed policy changes or potential interventions. Some of these studies determine whether a large-scale investigation is warranted. Awards are determined after reviews by CPWR staff and outside experts, including members of CPWR's Technical Advisory Board and NIOSH researchers.

Examples of completed studies

William English, a safety engineer, and William Marletta, PhD, in 1995 produced one of the first small studies, *An Investigation of Surface Slip Resistance On Structural Steel.* A debate had begun on whether OSHA should issue a rule for slip-resistance on coated surfaces to protect ironworkers and others from falls during steel erection. The authors worked with ironworkers to show that commercially available slip-resistant paints could meet a minimum specification, while commercially available portable slipmeters could objectively measure compliance.

Nancy Clark and other researchers at Mount Sinai School of Medicine and Hunter College, in New York City, in 1997 looked at ways to reduce exposures to flammable and toxic strippers and lacquers, particularly among elevator maintenance staff, who work in confined spaces. The researchers measured exposures using solvent- and water-based materials, in *An Assessment of Metal Maintenance Workers' Solvent Exposures.*

Christine Oliver, MD, MS, and Heidi Miracle-McMahill, analyzed responses to questionnaires used on Boston's Big Dig in *Asthma in Heavy and Highway Construction Workers Exposed to Silica.* The report in 2003 found that, of 300 construction workers believed to be exposed to silica on the massive project, more than 25% reported symptoms consistent with asthma. Yet the workers' responses suggested the asthma had gone largely undiagnosed and untreated.

Paul Becker, PhD, Mark Fullen, and Brandon Takacs, used video, observation, and questionnaires to identify safety hazards unique to workers on modular home construction. The report, in 2003, addressed an overlooked but expanding branch of construction with serious and as-yet unaddressed hazards, particularly falls and crushing. A video was posted at www.elcosh.org. The researchers at West Virginia University afterward received funding from other sources to develop training for installers.

Melvin L. Myers in 2004 analyzed OSHA reports of overturn-related deaths of operators of compactors (steamrollers) in 1986-2002 to learn whether a lack of rollover protective structures (ROPSs) combined with failure to use seatbelts contributed to the deaths. The report recommended changes, beginning with operator training requirements and promulgation of an OSHA standard for compactors requiring the use of ROPSs and seatbelts in construction. After a joint presentation about the report to the OSHA Advisory Committee on Construction Occupational Safety and Health by the International Union of Operating Engineers and the Association of Equipment Manufacturers, ACCSH formed a work group to further explore the issue.

William Heitbrink, PhD, and Scott Collingwood, in 2005 reported their preliminary recommendations for a set-up to protect tuckpointers from silica dust, which can cause deadly disease. Tuckpointers, who remove old mortar from masonry, are exposed to huge amounts of such dust. The authors attached an industrial vacuum cleaner, hose, and shroud to a grinder. While their research continued, they thought the findings were important enough to circulate early, as *Protecting Tuckpointing Workers from Silica Dust: Draft Recommendations for a Ventilated Grinder.*

SELECTED SMALL STUDIES, 1993-2005

- *Immunocytochemical Analysis of Oncoproteins and Growth Factors in Human Malignant Mesothelioma.* Mount Sinai Medical Center, New York, NY
- *Lyme Disease Prevalence among Construction Workers on Long Island, New York.* State University of New York at Stony Brook; Building and Construction Trades Council, Nassau and Suffolk Counties, NY
- *The Effects of the Repeal of Various State Prevailing Wage Laws on the Incidence and Severity of Worker Injuries in the Construction Industry.* University of Utah
- *Airborne Exposures and Ambulatory Peak Expiratory Flow Among Drywall Finishers.* Duke University Medical Center, Durham, NC
- *Reducing Sprains and Strains in Construction through Worker Participation* (focusing on scaffold erection). NIA TNO, The Netherlands
- *Unsound Conditions: Work-Related Hearing Loss in Construction, 1960-75.* University of Utah
- *Ready Mixed Concrete Truck Drivers: Work-Related Hazards and Recommendations for Controls.* Mount Sinai School of Medicine, NY
- *Investigation of the Viability of Designing for Safety.* Oregon State University
- *Inherently Safer Design Principles for Construction.* Hazard Information Foundation, Sierra Vista, Arizona.

Small-study findings such as these are published as CPWR reports, reported in the trade and scientific press, posted on the Internet, and presented at scientific and industry meetings.

Proposals are sought for studies that encourage innovation, develop interventions, use and improve data sets, evaluate effectiveness of interventions, and show better ways to disseminate information about construction safety and health.

KEY RESEARCH, TRAINING, AND SCREENING LOCATIONS, 2006

The Center to Protect Workers' Rights and Collaborators


Weldon Springs, MO (S)
Mallinckrodt, MO (S)
St. Louis, MO (R & T)
Saint Paul, MN
New Brighton, MN
Fernald, OH
Columbus, OH
Portsmouth, OH
Mound, OH
Taylor, MI
Ann Arbor, MI
Elk Grove Village, IL
Iowa City, IA
Chicago, IL
Pekin, IL
KS
Kansas City, MO
S. Illinois
Morgantown, WV
Paducah, KY (S & T)
Alcoa, TN
Knoxville, TN
Oak Ridge, TN
Durham, NC
Savannah River, SC
New Orleans, LA
Gainesville, FL
Pinellas Plant, FL
Miami, Florida
Lowell, MA
Boston, MA
Providence, RI (R & T)
Brewster, NY (T)
Brookhaven, NY (S)
New York City, NY
Springfield, NJ (T)
The State of New Jersey
Philadelphia, PA
Baltimore, MD (T)
Columbia, MD (T)
Linthicum, MD (T)
Laurel, MD (T)
Silver Spring, MD (R & T)
Washington, DC (T)
Annapolis, MD (R)
Alexandria, VA (R)
KEY:
Research
Training
Screening

TRAINING AND DISASTER RESPONSE

Training is a key to improved safety and health on the job — letting workers, trainers, and supervisors know of best practices, including research findings from the CPWR consortium. Courses, many of them hands-on, are delivered to thousands of building trades trainers and workers throughout the United States annually by trainers from CPWR and building trades unions. Development, delivery, and evaluation of training are funded through the National Institute of Environmental Health Sciences and the National Institute for Occupational Safety and Health.

Disaster Response Training for Construction Workers

After September 11, 2001, CPWR worked with the New York City Building Trades Council to protect recovery workers at the World Trade Center site. CPWR worked with Bechtel Corporation to develop the site safety plan in the early days following the disaster. Based on this plan, CPWR developed a 3-hour hazard awareness training program for site workers. CPWR sent staff to New York City to coordinate worker training efforts. Once the 1,800 construction workers on site had received the training, CPWR evaluated the training to determine where best to use limited resources to prepare safety-and-health training for future disasters.

The DVD and a Network of Trainers

CPWR developed a training program to distribute to instructors nationwide to enable them to immediately begin providing effective safety-and-health training to skilled support personnel in the event of another disaster – be it a gas explosion, a series of tornadoes, or anything else. The interactive training program on DVD, *CPWR Disaster Response Safety and Health Training for Construction Workers,* covers hazard recognition, personal protective equipment, decontamination, and the incident command system. The program has been developed and implemented in partnership with OSHA and its Office of Training and Education, NIOSH, the International Association of Fire Fighters and its HazMat Training and Education Department, and NIEHS. Building Trades Master Instructors have trained more than 2,300 Outreach Instructors who are prepared to train local workers.

Follow-up to Hurricane Katrina

The day after Hurricane Katrina struck the Gulf Coast on August 29, 2005 and devastated much of the region, CPWR staff were contacting trainers to help arrange for safety-and-health training for building trades workers in cleanup and recovery operations. By September 1, after the Building and Construction Trades Department agreed to coordinate worker training in the area for some contractors, training sites had been identified in Baton Rouge, New Orleans, and elsewhere. At the request of the National Institute of Environmental Health Sciences, CPWR sent training staff to Louisiana to coordinate training through that state's federal response center. CPWR plans to conduct some 250 worker training courses in Louisiana reaching more than 3,700 workers by September 2006.

CPWR has translated to Spanish training presentations and booklets developed by the National Institute of Environmental Health Sciences, which are being distributed and are posted at www.wetp.org and www.cpwr.com

Minority Worker Training in the Gulf States

At the same time, CPWR has been developing minority worker training in Alabama, Louisiana, and Mississippi for residents of the areas devastated by Hurricane Katrina. Working with the Building and Construction Trades Department, CPWR is providing a condensed version of its minority worker curriculum at a building trades center in each state. The goal is to bring 100 trained apprentices into the building trades in the region by September 2006. In addition to basic construction skills, the course covers job readiness/life skills, hazardous waste worker, and disaster preparedness.

MINORITY WORKER TRAINING

CPWR has trained more than 1,000 members of minority groups since 1999 under two programs.

Minority worker training

CPWR trains workers in targeted areas in life skills, basic construction skills, and environmental worker courses (asbestos abatement, lead abatement, confined space, and hazardous waste worker). Partners include Building and Construction Trades Councils, the Carpenters Union, plus community colleges and community-based organizations in Baltimore, New Orleans, and Oakland.

EPA brownfields worker training

CPWR prepares residents of federally designated Brownfields Communities to clean up contaminated land and blighted buildings. As part of the preparation, students receive training in life skills, basic construction skills, technologies, and environmental worker training (asbestos abatement, lead abatement, and hazardous waste worker). Also, students receive assistance with job placement. Partners in this activity are Building and Construction Trades Councils, the Carpenters Union, plus community colleges and community-based organizations in Boston, East Palo Alto, Los Angeles, and Saint Paul.

Hispanic day laborers

Hispanic day laborers in construction are at high risk for work-related injuries for a mix of reasons, one of which is a lack of safety-and-health training. Michele Ochsner, PhD, at the Rutgers University Occupational Training and Education Consortium, is working with trainers and safety-and-health experts at the Laborers' Union and New Labor, a nonprofit organization. The goal is to develop and evaluate a construction safety training program in Spanish especially for these workers. Although construction is hazardous for all workers, day laborers may not know what type of work they're expected to do until they arrive at a job site, and they may have difficulty understanding supervisors' instructions in English, both of which can compound the hazards. Thus, project staff are adapting Smart Mark, the 10-hour OSHA-approved course developed by the construction unions and CPWR (*see* page 13), to the needs of Hispanic day laborers in residential construction. The project has trained a group Hispanic immigrant workers as "peer researchers," who have conducted interviews and led focus groups in central and northern New Jersey to learn about any special curriculum needs, among other things. Formal training was to begin in early 2006 and includes a train-the-trainer program to enable Hispanic day laborers to teach their peers. Partners in the Laborers' Union include the New Jersey Laborers' Health and Safety Fund and Local 1030, in North Bergen.

ENVIRONMENTAL TRAINING

Since 1999, CPWR has been working with most building trades unions to provide safety-and-health training to thousands of workers annually to ensure that a trained workforce is available at high-hazard Department of Energy and EPA Superfund sites.

The programs are funded by the Department of Energy and the Environmental Protection Agency, but administered by the National Institute of Environmental Health Sciences, a part of the National Institutes of Health. The courses stress hands-on learning — wearing full-body level A suits, using respirators correctly, entering confined spaces safely, using a fall-protection harness. Construction workers and apprentices learn how to recognize hazards and to work safely in environments where there might be asbestos, heavy metals, solvents, or other hazardous materials. Feedback from trainers suggests that the program helps improve training generally throughout the building trades.

The participating unions are the Asbestos Workers, Boilermakers, Bricklayers, Carpenters, Cement Masons, Electrical Workers, Ironworkers, Painters, Plumbers and Pipefitters, Roofers, and Sheet Metal Workers.

DOE Training

CPWR and its union partners train about 3,500 workers and apprentices yearly in hazardous waste worker and annual refresher, lead worker and annual refresher, confined space, asbestos worker and annual refresher, OSHA 10- and 30-hour (safety and health), and train the trainer. Much of the training is provided at the Hanford reservation in eastern Washington.

EPA Training

To help prepare about 3,500 construction workers each year for work at Superfund sites, training is provided in hazardous waste cleanup, confined-space safety, and train the trainer.

TRAINER ENHANCEMENTS

Trainers have been meeting annually since 1999 for lectures and workshops to consider new ways to conduct training in the asbestos, lead, and hazardous-waste remediation courses, some of which must be repeated yearly (to maintain worker certification). At the same time, the enhancements are used to update trainers on new construction techniques and any changes in regulatory requirements. In July 2005, CPWR conducted an enhancement in San Diego and Tijuana, Mexico, for 80 trainers focusing on Spanish-speaking immigrant workers — why they come to the United States, the workplace "safety" conditions they've left behind, and any cultural differences that might impede communications on the job site. In addition to attending workshops, the trainers heard from a historian of Mexican labor unions, Mexican contractors, and an official of Mexico's OSHA, the Secretaría del Trabajo y Previsión Social, among others.

Electrical safety inspections

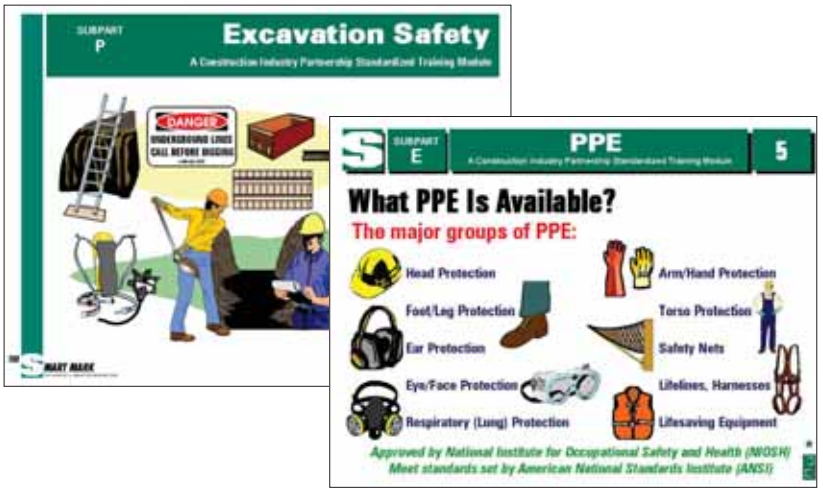
In an attempt to enlist workers to improve safety (and cut costs), a union electrician has been trained to conduct electrical safety inspections twice weekly on a Bovis Lend Lease site in New York City for 6 months through mid-2006. The inspection findings are being used by subcontractor foremen who certify in writing when and how any hazards are corrected. The correction of hazards is verified in writing by the site superintendent or a representative. This program grew out of a CPWR study which found that inspections by a safety professional with careful follow-up can reduce the number of electrical hazards on a construction site. The earlier study found a problem, however, in the cost of having a safety professional conduct so many inspections. For this new approach, West Virginia University's Safety and Health Extension developed a checklist that is entered into a hand-held electronic device and loaded onto a computer. CPWR is working with the Electrical Workers Union and the New York City Joint Board of the Electrical Industry, as well as Bovis Lend Lease. The data are to be analyzed in terms of types of hazards found, how often each type of hazard is identified, and how long it takes to fix each one.

Smart Mark

More than 200,000 building trades workers since 1998 have completed this standardized version of the OSHA 10-hour hazard-awareness curriculum for construction workers. The course was developed by CPWR, with construction employers and affiliate unions of the Building and Construction Trades Department. The 13 one-hour modules allow instructors flexibility, depending on the students' needs, as to which topics to cover. Modules include confined spaces, ergonomics, materials handling, and stairways and ladders. OSHA-authorized building trades outreach instructors deliver the course nationwide — in English or Spanish.

SMART MARK TRAINING EVALUATION

The University of Illinois-Chicago is developing a survey questionnaire in English and Spanish to assess Smart Mark trainees' attitudes and work practices, and what they know about workplace safety and health before and after training. Rosemary Sokas, MD, and her team are working with about 175 journeymen and apprentices in Roofers local 11 and Plumber and Pipefitters local 597, both in Chicago. The goal is to design a large-scale evaluation of Smart Mark's effects on workplace practices and injury outcomes.



National Resource Center for OSHA Training (OSHA Region III Education Center).

The National Resource Center is a U.S. Department of Labor OSHA Training Institute Education Center based at the National Labor College, Silver Spring, Maryland. The program trains safety-and-health professionals and workers in Delaware, Maryland, Pennsylvania, Virginia, and West Virginia — and trains union instructors and members nationally. The goal, since the National Resource Center's founding in 1994, has been to ensure that construction unions have enough safety-and-health trainers. Construction-related courses cover a wide range of topics, including OSHA 500, confined-space entry, and trenching and excavation. Since 2000, the National Resource Center has trained about 6,700 building trades instructors, who are employed by local joint labor-management trusts. The instructors, in turn, train an estimated 120,000 workers annually. Partners include the Building and Construction Trades Department, AFL-CIO (as represented by CPWR), and the Safety and Health Extension, West Virginia University.

Train the Trainer

About 5,000 construction union trainers nationwide have completed the OSHA 500 instructor course on construction safety-and-health regulations. The trainers, who have extensive experience in construction, in turn provide OSHA 10- and 30-hour construction hazard awareness training to workers. In July 2005, for the first time, CPWR conducted a train-the trainer course specifically for Spanish-speaking instructors. For more information on construction union instructor training, contact Chris Trahan, ctrahan@cpwr.com.

SERVICE

CPWR experts serve on technical, consensus, and advisory boards affecting the construction industry. CPWR staff join with local building trades leaders to provide access to construction workers and sites for researchers. In addition, staff provide requested technical advice, facilitate and review the results of medical screenings, and help provide employment verification for former workers eligible for government compensation.

Screenings for Former Department of Energy Construction Workers

Starting in 1996, CPWR began coordinating a national program that provides free medical screenings for the more than 700,000 building trades workers whose service to their country's nuclear weapons programs in World War II and afterward put them at risk for life-threatening ailments. The Building Trades National Medical Screening Program — http://btmed.org — opened its first outreach office in Hanford, Washington, in March 1998. With Department of Energy funding mandated by Congress, the program has grown to 14 sites nationwide. More than 12,000 former workers have been screened (*see* map, pages 8-9).

Local building trades unions reach out to inform current and former members about the program. Each participant first completes a work history interview, which is conducted by a building trades worker who has received special training. The participant is then offered a free medical screening examination with tests for any exposures identified in the interview. Some participants are referred for further medical attention. Former construction or maintenance workers in the weapons program who may have had significant exposures to asbestos, beryllium, cadmium, chromium, lead, mercury, noise, radiation, silica, solvents or other health hazards are eligible.

So far, the screenings have:

- Determined that construction workers are at significant risk for illnesses as a result of having been exposed to health hazards in DOE facilities. (This program was the first to document that construction workers are at risk for beryllium disease.) As a result, the Department of Energy is emphasizing health protection during such work.
- Identified medical problems that were untreated or poorly treated and, as a result, has enabled hundreds of workers to get better medical care. As the largest medical study ever of older construction workers in the United States, the screenings have highlighted the need for better medical care for workers who perform maintenance, repair, renovation, and demolition.
- Provided part of the evidence that led Congress to enact the Energy Employees Occupational Illness Compensation Program Act in 2000, and, in particular, to include construction and maintenance workers in this program.
- Provided valuable work-history and site information to NIOSH on how to improve radiation dose reconstructions for construction workers on DOE sites.

SCREENING SITES

Hanford, in Washington; Oak Ridge, Tennessee; Savannah River, in South Carolina; Amchitka, Alaska; the Pinellas Plant, in Florida; INEEL, in Idaho; Paducah, Kentucky; Kansas City, Mallinckrodt, and Weldon Springs, in Missouri; Brookhaven, in New York; and Fernald, Mound, and Portsmouth, in Ohio.

PARTICIPATING ORGANIZATIONS

CPWR; Augusta, Central Washington, Dayton, Florida Gulf Coast, Greater Cincinnati, Greater Kansas City (Missouri), Idaho, Knoxville/Oak Ridge, Nassau and Suffolk Counties (New York), Tri-State (Kentucky, Ohio, West Virginia), Western Kentucky, and various state Building and Construction Trades Councils; Duke University Medical Center; University of Cincinnati Medical Center; Zenith Administrators.

Employment Verification and Compensation

Since 2001, the Energy Employees Occupational Illness Compensation Program Act has compensated 13,000 Department of Energy workers or their survivors for wage loss and medical care. The program is administered by the U.S. Department of Labor. About one-third of the claimants are construction or maintenance workers who were employed intermittently by subcontractors. Because the Department of Energy doesn't have work records for many of those employees, the Department of Labor was having difficulties approving the claims. Thus, the Department of Labor asked CPWR to work with local building trades unions to obtain records from union and union-employer trust funds — for instance, dispatch cards or health and welfare or pension contribution receipts — to help with employment verification.

Since 2003, CPWR has assisted with more than 4,200 verifications. Most of the verifications were completed in less than 30 days and enabled the Department of Labor to complete decisionmaking in more than 80 percent of the cases. An estimated 18 to 33 percent of the building trades workers who worked in the nuclear program might be eligible for compensation. Claimants can receive cash benefits and all medical costs related to a covered illness from the time a claim is filed.

OUTREACH

In addition to providing safety-and-health training and technical assistance for the industry and government, CPWR produces videos/DVDs and two websites (including www.cpwr.com), and participates in or organizes conferences/exhibits at the regional, national, and international levels. Publications range from a newsletter *(Impact)* to technical reports, such as *The Construction Chart Book* (*see* page 1), to magazine and journal articles, and hazard alert pocket cards for workers. The hazard alerts, in English and Spanish, cover more than 25 topics, from *Aerial lift safety* (or *Seguridad en los elevadores de obra*) to *Welding fumes and gases* (*El trabajo de soldadura*), and may be downloaded from CPWR's website and eLCOSH. Nearly 1 million of the pocket cards have been printed since 1996.

Electronic Library of Construction Safety and Health (eLCOSH)

Since 2000, a website at www.eLCOSH.org coordinated by CPWR has provided user-friendly safety-and-health information for construction workers and others from a wide range of sources — in English and Spanish. Some 800 documents and videos, more than 140 of them in Spanish, are posted using English and Spanish site maps. Contributors include the Government of Spain, the U.S. Army Corps of Engineers, NIOSH, state agencies, private-sector authors, university researchers, trade magazines, and building trades safety-and-health programs. A few short documents are written for eLCOSH, such as, *When you need fall protection* and *Which respirator filter do I need?* CPWR/eLCOSH has translated many of the Spanish documents from English. More than 50 annotated site links are provided. eLCOSH was nominated in 2001 for a NOVA award from the Construction Innovation Forum for improving quality and reducing costs.

SalusLink

For commercial and heavy construction projects, scheduling software is used to plan and manage most aspects of construction. Unfortunately, schedules typically do not address safety despite a high level of interest in promoting safety on construction sites. To remedy this, CPWR has developed a new software application, SalusLink. It enables safety managers to link safety activities to individual line items in Primavera P3 or Primavera SureTrak schedules. SalusLink is being field-tested. (*See* www.saluslink.com.)

Construction Solutions

CPWR is developing an on-line databank of practical ways to improve construction safety and health, including ergonomics. Starting in spring 2006, workers and others will be able to look up hazards for various trades and tasks, then learn in detail about potential solutions. For instance, a masonry contractor who is looking for ways to reduce workers' compensation costs will be able to read about hazards associated with mixing mortar and find ideas for eliminating heavy lifting from this task. CPWR's partners in the project are Conceptual Arts Inc. and the University of Iowa; the project will be parallel to a NIOSH Workplace Solutions database for general industry, also under development.

International Activities

In 1992, CPWR helped organize an International Roundtable of labor, management, and government experts on construction safety and health in Germany, Japan, the Netherlands, the United Kingdom, and other countries, which meets yearly to exchange ideas. CPWR staff have also been participating in international technical meetings to exchange policy and program information and develop evidence-based best-practice guidelines.

National Conference

CPWR, with the National Institute for Occupational Safety and Health and other co-sponsors, plans to convene stakeholders to exchange information and ideas in 2007. This will be the fourth national conference organized by the Center to Protect Workers' Rights since 1993. The most recent conference and exhibition, chaired with the Construction Safety Council and held outside Chicago, *Power through Partnerships,* drew 1,200 participants from the United States and abroad in 2002.

SELECTED RECENT CPWR-SUPPORTED PUBLICATIONS

CPWR PUBLICATIONS*

Dong, Xiuwen, Yurong Men, and Elizabeth Haile. *Work-Related Fatal and Nonfatal Injuries among U.S. Construction Workers,* 1992-2003. 2005.

Journeyman Technical Information Paper 2. *Protection from Electric Shock and Arc Flash.* 2003.

McCann, Michael. *Deaths and Injuries involving Elevators or Escalators,* Revised. 2004.

McCann, Michael. *Explosion and Asphyxiation Deaths among Contract Employees in Industrial Plants.* 2003.

Model Specifications for the Protection of Workers from Lead on Steel Structures. Updated, 2002.

Ruttenberg, Ruth, and Maria Lazo. *Spanish-Speaking Construction Workers Discuss Their Safety Needs and Experiences.* 2004.

Weil, David. *Making OSHA Inspections More Effective: Alternatives for Improved Inspection Targeting in the Construction Industry,* June 2004.

VIDEO

Welding: A Control Technology, 2000.

JOURNAL ARTICLES AND BOOKS

Burkart M, McCann M, Paine DM. *Elevated Work Platforms and Scaffolding.* McGraw-Hill, New York, 2004.

Dement, John, Ph.D., Knut Ringen Dr. P.H., Laura Welch, M.D., Eula Bingham Ph.D., Patricia Quinn. Surveillance Of Hearing Loss Among Older Construction And Trade Workers At Department Of Energy Nuclear Sites. *American Journal of Industrial Medicine,* 48:348-58, 2005.

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Dong X, Entzel P, Men Y, Chowdhury R, Schneider S. Effects of Safety and Health Training on Work-Related Injuries among Construction Laborers, *Journal of Occupational and Environmental Medicine,* 46(12): 1222-28, Dec. 2004.

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Halperin K, McCann M. An evaluation of scaffold safety on construction sites. *Journal of Safety Research.* 35:141-50, 2004.

Hecker, S., Gambatese, J., and Weinstein, M. Designing for Worker Safety: Moving the Construction Safety Process Upstream. *Professional Safety,* 50(9): 32-44, 2005

McCann M. Deaths in construction related to personnel lifts, 1992-99. *Journal of Safety Research.* 2003:34: 507-14.

CPWR and the CONSTRUCTION LITERATURE

Changes in construction research. A comparison of research in the early 1990s to recent years shows a growing emphasis on studies of specific hazards in construction, and to targeted studies of exposure and controls. CPWR supported 50% of the studies on ergonomic hazards and controls and 17% of the studies on health hazards and controls. As expected from CPWR's emphasis on identification and control of respiratory hazards, 38% of studies on silica were CPWR-sponsored. CPWR supported 50% of the studies reporting on development of interventions or exposure assessment methods.

Peer review. In the five years 1999-2004, CPWR-sponsored research accounted for one-quarter of all peer-reviewed publications in construction safety and health, and half of those dealing with interventions or exposure assessment methods.

McCann M, Hunting KL, Murawski J, Chowdhury R, Welch L. Causes of electrical deaths and injuries among construction workers. *American Journal of Industrial Medicine,* 43:398-406, 2003.

Meeker JD, Susi P, Pellegrino A. Exposure to Silica and Metals Among Painters Using Specular Hematite Abrasive (column). *Journal of Occupational and Environmental Hygiene,* 2:D60-64, 2005.

Paine DM, McCann M. Evaluation of a decking fall protection system. *Professional Safety.* 2004:49(6): 40-43.

Rappaport M S, Goldberg M, Susi P, Herrick RF. Excessive Exposure to Silica in the US Construction Industry. *Annals of Occupational Hygiene,* 47(2): 111-22, 2003.

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Susi P. Principles of Exposure Assessment – Application and Experience with a Task-Based Approach. In: R. Coble, ed., *The Management of Construction Safety and Health.* A.A. Balkema, Rotterdam. 2000.

Weinstein, M., Gambatese, J., and Hecker, S. Can Design Improve Construction Safety: Assessing the Impact of a Collaborative Safety-in-Design Process. *Journal of Construction Engineering and Management,* ASCE, 131(10): 1125-34, 2005.

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**Also see* small studies, page 7

Strategic Goals

CPWR is working with the National Institute for Occupational Safety and Health, NIOSH, to define 8 strategic goals for research in construction. The work, begun in early 2005, should affect NIOSH and industry research priorities for the next decade. Although priority areas, such as traumatic injury and hearing loss, have previously been identified and have guided research, the proposed goals go further by identifying performance measures and intermediate and longer-term outcomes to target, such as numbers of injuries and illnesses. CPWR has provided input for a document to present the content and rationale for the proposed goals, which include reducing falls to a lower level and improving surveillance. A new NIOSH NORA Construction Sector Research Council in spring 2006 is expected to use the document as a starting point to develop national construction goals.

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