

Engineering Control Cross-Sector

Research Agenda

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U.S. Department of Health and Human Services
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

National Occupational Research Agenda Engineering Control Cross Sector

Introduction

The National Institute for Occupational Safety and Health (NIOSH) is located in the Centers for Disease Control and Prevention, within the Department of Health and Human Services. NIOSH was established in 1970 by the Occupational Safety and Health Act at the same time that the Occupational Safety and Health Administration (OSHA) was established in the Department of Labor. The Act mandated NIOSH to conduct research and education programs separate from the standard-setting and enforcement functions conducted by OSHA. An important area of NIOSH research deals with methods for controlling occupational exposure to potential chemical, biological, radiological, and physical hazards.

The Engineering and Physical Hazards Branch (EPHB) of the Division of Applied Research and Technology (DART) has been given the lead within NIOSH to study and develop engineering controls and assess their impact on reducing occupational illness. Since 1976, EPHB (and its forerunner, the Engineering Control Technology Branch) has conducted a large number of studies to evaluate engineering control technology based upon industry, process, or control technique. The objective of each of these studies has been to develop, evaluate, and document the performance of control techniques in reducing potential health hazards in industry or for a specific process.

Although EPHB has been given the lead within NIOSH to study and develop engineering controls, other divisions within NIOSH also contain functions that conduct engineering control studies. For example, the Pittsburgh Research Lab (PRL) and Spokane Research Lab (SRL) have a long history of engineering research in the mineral extraction industries. Other divisions such as the Division of Safety Research (DSR) conduct engineering studies to protect workers from safety hazards in industry. The Division of

Respiratory Disease Studies (DRDS) has a Laboratory Research Branch (LRB) and Field Studies Branch (FSB) that conduct engineering research related to respiratory diseases.

In 2006, the Engineering Control Cross-Sector was created from the new decade of the National Occupational Research Agenda (NORA) under the new sector based approach. The new decade of NORA is organized into eight sectors and twenty-four cross-sectors. The primary purpose of the engineering control cross-sector is to guide engineering control research across all divisions within NIOSH and to interact with other NORA sector and cross-sector programs that have overlapping research interests. This strategic plan provides a description of the engineering control cross-sector program, economic factors, a list of our partners, and a detailed description of our program goals.

Program Description

The mission of the NIOSH research program for the engineering control cross-sector is to eliminate occupational diseases, injuries, and fatalities through a focused program of research and prevention. The program strives to fulfill its mission through:

- **High Quality Research:** NIOSH will continually strive for high quality research and prevention activities that will lead to reductions in occupational injuries and illnesses among workers through the reduction of exposures to hazardous substances and conditions.
- **Practical Solutions:** The NIOSH program for the engineering control cross-sector is committed to the development of practical solutions to the complex problems that cause occupational diseases, injuries, and fatalities.
- **Partnerships:** We recognize that collaborative efforts in partnership with labor, industry, government, and other stakeholders are usually the best means of achieving successful outcomes. Fostering these partnerships is a cornerstone of the NIOSH program for the engineering control cross-sector.

- **Research to Practice (r2p):** We believe that our research only realizes its true value when put into practice. Every research project within the NIOSH program for the engineering control cross-sector formulates a strategy to promote the transfer and translation of research findings into prevention practices and products that will be adopted in the workplace.

Controlling exposures to occupational hazards is the fundamental method of protecting workers. Traditionally, a hierarchy of controls has been used as a means of determining how to implement feasible and effective control solutions. One representation of this hierarchy can be summarized as follows:

- Elimination
- Substitution
- Engineering Controls
- Administrative Controls
- Personal Protective Equipment

NIOSH engineering control efforts include the following activities:

- Plan and conduct research on engineering control technology to prevent worker exposures to hazards.
- Promote the application of effective engineering control technology for safeguarding worker safety and health.
- Provide expertise in formulating effective and credible workplace standards.
- Provide consultation in the application of effective control solutions and techniques for hazard prevention.

Employing a hierarchy of controls, NIOSH scientists and engineers have worked collaboratively with companies, labor unions, trade associations, labor organizations, and local, State and Federal governments, both in the United States and around the world. This approach has allowed NIOSH and its partners to develop practical engineering controls in a cost-effective manner.

Economic Factors

Market forces, structural changes, and emerging threats may affect levels of resources available for occupational safety and health initiatives and impact priorities for research and translation within the engineering control cross-sector.

Control methods at the top of the control hierarchy presented in the previous section are potentially more effective and protective than those at the bottom. Following this hierarchy normally leads to the implementation of inherently safer systems, where the risk of illness or injury has been substantially reduced.

Short-term costs for implementing controls typically follow the order of the hierarchy, with elimination and substitution being sometimes impossible or cost prohibitive in an existing situation. Elimination and substitution of hazards may be less expensive and less complicated to implement at the design or development stage. Such prevention through design (PtD) solutions are a priority for NIOSH, and an area to which engineering controls can contribute significantly. Eliminating the presence of a hazardous substance or condition in the workplace obviously prevents illness and injury from that substance or condition. The substitution of a less hazardous substance or condition, likewise, reduces resulting illness or injury. Some economic factors that must be considered include the quality of the product, cost of substitute materials, return on investment, and speed and ease of production.

Long-term expenditures, on the other hand, tend to follow the hierarchy in reverse order with the use of personal protective equipment and the implementation of administrative controls incurring mounting expense with time. While not insignificant, the expense for developing and implementing these lower level controls typically is not as much as for the design and construction of an engineering control solution. Over time, however, the continued cost of supplies, medical monitoring, training, and other operational costs involved with administrative controls and personal protective equipment exceed the costs of maintenance and operation of an engineering control.

National Occupational Research Agenda (NORA)

The National Occupational Research Agenda is a partnership program to stimulate innovative research and improved workplace practices. Unveiled in 1996, NORA has become a framework for occupational safety and health research in the nation. Diverse parties collaborate to identify the most critical issues in workplace safety and health. Partners then work together to develop goals, objectives and an implementation plan for addressing these needs. In the ongoing efforts to improve NORA, the second decade of NORA was structured around sectors to more effectively serve our stakeholders.

Stakeholder Comments

Many stakeholders submitted comments in 2005 and 2006 outlining their top safety and health issues. The stakeholder comments can be searched, viewed and printed. These comments comprise one of the inputs considered by the NORA Sector Councils when drafting their strategic plans for the nation.

NORA Sector Councils

NORA Sector Councils develop and maintain sector-specific research agendas. In addition, a Cross-Sector Council coordinates priorities that affect multiple sectors and groups of workers. Representing all stakeholders, the councils use an open process to set goals, develop strategies, encourage partnerships, and promote improved workplace practices.

NIOSH Strategic Goals

The NIOSH Sectors are in the process of developing strategic goals to guide research and partnership efforts over the next decade.

NIOSH previously used priority topic areas (e.g., traumatic injury, hearing loss) to guide research efforts. Goals take this approach a step further by identifying specific outcomes that we want to target, intermediate goals to describe the necessary steps that need to be performed to accomplish the goal, and performance measures for evaluating progress in meeting the outcome goals. Setting goals is challenging because

- It forces us to focus on a subgroup of issues where we think NIOSH can make an impact—a long list would spread our resources too thin to accomplish the goals. Not every worthwhile topic can be included.
- It is difficult to develop performance measures. The ultimate goal is to reduce occupational injuries and illnesses, however, the available injury statistics have limitations, and exposure and health outcome measures are often not available.
- It is ambitious for NIOSH to set goals to achieve outcomes such as reductions in a national fatality rate. NIOSH is a research agency so we do not often directly influence outcomes—we must partner well and influence other groups to show results.

NIOSH Program Portfolio Approach

NIOSH has been organizing research, guidance, information, and service efforts into specific programs that can be readily communicated and strategically governed and evaluated. Eight NORA Sector Programs represent industrial sectors, and twenty-four Cross-Sector Programs organized around adverse health outcomes, statutory programs and global efforts.

The NORA Sector Programs intersect with Cross-Sector Programs in a matrix-like fashion. This approach allows multiple programs to work towards accomplishing intersecting goals.

Each of the 32 programs in the NIOSH Program Portfolio has a Manager and Coordinator. Each of the 8 NORA Sector Programs has a Research Council to engage external stakeholders in the process of developing sector program goals and methods to measure the short-term, intermediate, and long-term outcomes arising from those goals. Each cross-sector program will have a Steering Committee, which will also develop program goals and monitor outcome measures.

These planning efforts will position NIOSH to align with governmental approaches for evaluating program effectiveness. As part of our comprehensive approach to performance measurement, NIOSH has engaged the [National Academies](#) to independently evaluate some of our sector and cross-programs for relevance and impact.

Draft Program Goals

NIOSH is in the process of drafting strategic goals for the 32 program areas. As required by the Office of Management and Budget, these strategic goals will be organized by outcomes such as injuries and illnesses instead of more general topic areas such as reducing all occupational mortality in the transportation industry.

When draft goals for the NIOSH Programs are completed, they will be posted for review and comment. We will also use the [NIOSH eNews](#) to disseminate the draft goals and elicit feedback.

Engineering controls in general, and the NIOSH Cross-Sector of Engineering Control specifically, is an essential component within all of the NORA Sector and Cross-Sector programs.

Engineering Control Strategic Goals:

The Engineering Control Activity/Output goals were collected from other related NIOSH programs including the NIOSH Sector Strategic Plans, the NIOSH Hearing Loss Research Program Strategic Plan, and the Prevention through Design Strategic Plan. Please review these Strategic Plans for additional relevant information.

Strategic Goal 1: Reduce occupational illness through research on the advancement of new or retrofit engineering control technology.

Controlling exposures to occupational hazards is the fundamental method of protecting workers. Traditionally, a hierarchy of controls is used as a means of determining how to implement feasible and effective control solutions. One representation of this hierarchy can be summarized as follows:



Intermediate Goal 1.1: Reduce illnesses in the Services Sector with engineering controls

Activity/Output Goal 1.1.1: Conduct exposure assessments and controls evaluations for Security Equipment.

Activity/Output Goal 1.1.2: Provide engineering control recommendations that reduce radiation exposures in US Customs and Border Protection (CBP) personnel.

Activity/Output Goal 1.1.3: Control of carbon monoxide on houseboats and marine vessels.

Activity/Output Goal 1.1.4: Reduce exposures to dry cleaning solvents such as methylene chloride and 1-bromopropane through engineering control research.

Intermediate Goal 1.2: Reduce illnesses in Transportation, Warehousing, and Utilities Sectors with Engineering Controls

Activity/Output Goal 1.2.1: Use Computational Fluid Dynamics (CFD) techniques to design and evaluate engineering control technology for disease transmission on commercial aircraft.

Intermediate Goal 1.3: Reduce illnesses in the Manufacturing Sector with engineering controls

Activity/Output Goal 1.3.1: Conduct engineering controls research evaluations for diaceytl.

Activity/Output Goal 1.3.2: Reduce diaceytl exposures with the use of engineering controls.

Activity/Output Goal 1.3.3: Reduce exposures to engineered nanomaterials through development, adoption, and evaluation of engineering controls in workplaces.

Activity/Output Goal 1.3.4: Reduce worker exposures to metal working fluids with the use of engineering controls.

Intermediate Goal 1.4: Reduce illnesses in the Mining Sector with engineering controls

Activity/Output Goal 1.4.1: Develop control technologies, such as the canopy air curtain, to reduce the silica dust exposure of roof bolting machine operators.

Activity/Output Goal 1.4.2: Evaluate technologies that can be adapted for the development of an end-of-shift silica monitor.

Activity/Output Goal 1.4.3: Develop effective engineering noise controls to reduce roof bolting machine operators' noise exposure.

Activity/Output Goal 1.4.4: Develop effective engineering noise controls to reduce continuous mining machine operator's noise exposure.

Activity/Output Goal 1.4.5: Develop effective engineering noise controls to reduce noise levels by 10 dB(A) from vibrating screens used in Coal Prep Plants.

Activity/Output Goal 1.4.6: Identify existing engineering noise controls used in underground and surface mines and evaluate their effectiveness.

Activity/Output Goal 1.4.7: Assess the drill steel and mist system for roof bolting machines for noise control potential.

Activity/Output Goal 1.4.8: Assess noise controls for the bulldozer and front end loader machines.

Intermediate Goal 1.5: Reduce illnesses in the Construction Sector with Engineering Controls

Activity/Output Goal 1.5.1: Reduce construction workers' exposure to powered hand tool noise.

Activity/Output Goal 1.5.2: Reduce hearing loss among construction workers by increased use of noise reduction solutions, by the construction community.

Activity/Output Goal 1.5.3: Preventing silicosis in highway construction through a State-based Partnership. Work with the New Jersey silica Outreach and Research (NJSOAR) Alliance and promote the use of effective engineering controls by showcasing their effectiveness through the use of video exposure monitoring (VEM).

Activity/Output Goal 1.5.4: Develop and maintain a noise source/ worker exposure database for prioritizing noise control technologies for the construction and mining industries.

Activity/Output Goal 1.5.5: Define the relationship between sound power levels, impulsive sound levels, and noise exposure limits in conjunction with tool quality metrics, tool specifications, and information regarding other hazards (i.e. hand arm vibrations, dust, etc.).

Activity/Output Goal 1.5.6: Complete the field test (case study) on the cab in a mining/construction environment for insertion into the MSHA Program Information Bulletin (PIB).

Activity/Output Goal 1.5.7: Develop engineering controls for noise on at least 6 powered hand tools used in the construction industry.

Activity/Output Goal 1.5.8: Develop engineering controls for noise on large construction equipment.

Strategic Goal 2: Reduce occupational injuries through research on the advancement of new or retrofit engineering control technology.

Intermediate Goal 2.1: Reduce injuries in the Mining Sector with engineering controls

Activity/Output Goal 2.1.1: Reduce mine fire risks through the use of remote sealing and fire fighting technologies.

Activity/Output Goal 2.1.2: Reduce coal mine face explosions through improved face ventilation and methane monitoring technologies.

Activity/Output Goal 2.1.3: Develop technology to monitor the explosibility of coal mine dust in real time.

Activity/Output Goal 2.1.4: Develop and evaluate technologies for monitoring and extinguishing underground belt fires.

Activity/Output Goal 2.1.5: Develop new proximity warning technologies to reduce crushing/pinching type accidents/fatalities in underground mines.

Activity/Output Goal 2.1.6: Develop improved mine illumination systems, for both personnel and equipment, based on the new LED technologies now available.

Activity/Output Goal 2.1.7: Develop improved proximity warning systems based on the new LED technologies.

Activity/Output Goal 2.1.8: Conduct research to develop engineering control design criteria and effective installation practices for roof screen for roof control in coal mines.

Intermediate Goal 2.2: Reduce injuries in the Transportation, Warehousing, and Utilities Sectors

Activity/Output Goal 2.2.1: Conduct engineering control research on new and current technologies to prevent exposures to taxicab operators due to workplace violence.

Intermediate Goal 2.3: Reduce injuries in the Construction Sector

Activity/Output Goal 2.3.1: Conduct engineering control research to prevent exposures to workers using aerial work surfaces such as scissor lifts and/or boom lifts.

Activity/Output Goal 2.3.2: Conduct engineering control research to prevent exposures to workers using extension ladders.

Activity/Output Goal 2.3.3: Conduct engineering control research to provide better perimeter and edge protection to roofers to reduce the number of exposures caused by falls to a lower level.

Activity/Output Goal 2.3.4: Conduct engineering control research to provide better harnesses for workers to reduce exposures caused during a fall.

Activity/Output Goal 2.3.5: Conduct engineering control research to provide better anchor strategies to workers involved with roof construction.

Activity/Output Goal 2.3.6: Investigate ways to protect construction workers from electrocution hazards involving power line contact through hand-carried metallic objects and vehicle-related contacts.

Activity/Output Goal 2.3.7: Evaluate strategies and controls to reduce worker exposure to being run over by heavy construction vehicles and equipment: e.g., existing engineering control strategies such as Internal Traffic Control Plans and off-the-shelf Proximity Warning Systems or emerging technologies (HASARD – Hazardous Area Signaling and Ranging Device and RFID – Radio Frequency Identification Device).

Intermediate Goal 2.4: Reduce injuries in the Agriculture, Forestry, and Fishing Sector

Activity/Output Goal 2.4.1: Continue to develop the CROPS topic web page to promote the use of proven Rollover Protective Structure (ROPS) alternatives that can be used by farmers who do not currently have a ROPS installed on their tractor.

Intermediate Goal 2.5: Reduce injuries in the Services Sector

Activity/Output Goal 2.5.1: Conduct engineering control research to provide recommendations on the design of fire service vehicles to prevent exposures to fire fighters when responding to a call.

Strategic Goal 3: Reduce occupational illness and injuries by providing expert advice and consultation to our stakeholders (e.g., government regulatory agencies, consensus standard bodies, employers, unions, health and safety professionals, etc.) on the application of engineering controls for hazard prevention.

Intermediate Goal 3.1: Reduce exposures in the Construction Sector with Engineering Controls

Activity/Output Goal 3.1.1: Promote the use of engineering controls in the construction sector for noise and silica to regulatory agencies and consensus standard bodies.

Activity/Output Goal 3.1.2: Promote the understanding and use of Prevention through Design (PtD) concepts based on proven control technologies.

Activity/Output Goal 3.1.3: Evaluate the practicality and applicability of previously developed noise controls on bulldozer machines and front end loader machines.

Intermediate Goal 3.2: Reduce exposures in the Manufacturing and Services Sectors with Engineering Controls

Activity/Output Goal 3.2.1: Manage occupational Electric and Magnetic Fields (EMF) exposures to reduce the incidence of serious occupational illnesses and injuries by 70% within the telecommunications industry by 2012 (e.g., time, distance, shielding, barriers, warnings, and work practices).

Activity/Output Goal 3.2.2: Promote the use of engineering controls to control carbon monoxide emissions to regulatory agencies and consensus standard bodies.

Activity/Output Goal 3.2.3: Promote the use of engineering controls for diaceetyl and food flavorings that contain diaceetyl to regulatory agencies and consensus standard bodies.

Activity/Output Goal 3.2.4: Evaluate the practicality and applicability of new noise controls developed for the shipyard industry.

Intermediate Goal 3.3: Reduce exposures in the Mining Sector with Engineering Controls

Activity/Output Goal 3.3.1: Evaluate and transfer information to Mining Sector related to monitoring technology for sealed areas in coal mines.

Activity/Output Goal 3.3.2: Evaluate current mine belt fire monitoring and suppression systems for underground mines.

Activity/Output Goal 3.3.3: Evaluate emerging control technologies, such as wethead spray systems and wetting agents, for continuous miners.

Activity/Output Goal 3.3.4: Develop administrative control guidelines for reducing noise exposures to mine workers for transfer to industry.

Activity/Output Goal 3.3.5: Optimize roof support design strategies to allow engineering design of the roof support system based on specific ground and stress conditions.

Activity/Output Goal 3.3.6: Prove the practicality and applicability of new noise controls developed on continuous mining machine cutting systems.

Intermediate Goal 3.4: Reduce exposures in the Transportation, Warehousing, and Utilities Sectors with Engineering Controls

Activity/Output Goal 3.4.1: Use results gained from Computational Fluid Dynamics (CFD) to incorporate diseases transmission knowledge on commercial aircraft into ASHRA consensus standards.

Strategic Goal 4: Develop and increase recognition and awareness of occupational safety and health hazards and the means for controlling them by creating control

technology information that promotes technology transfer, as well as, the education and training of management, workers, health and safety professionals, and the media.

Intermediate Goal 4.1: Develop and build recognition and awareness of engineering controls in the Healthcare and Social Assistance Sector

Activity/Output Goal 4.1.1: Develop R2P assistance for the industry on engineering controls for hazardous drugs.

Activity/Output Goal 4.1.2: Translate engineering control research findings and guidance into public health prevention practices adopted within the workplace.

Intermediate Goal 4.2: Develop and build recognition and awareness of engineering controls in the Mining Sector

Activity/Output Goal 4.2.1: Transfer to industry information on new technologies for mine escape and rescue.

Activity/Output Goal 4.2.2: Evaluate dust control technologies used by Southern Appalachian Region mines to identify methods to reduce respirable dust exposures in these mines and transfer these results to industry.

Activity/Output Goal 4.2.3: Develop administrative controls "Best Practices" to reduce dust exposure related to worker positioning for the operation of continuous mining machines.

Activity/Output Goal 4.2.4: Develop "Best Practices" guidelines for respirable dust control in coal and metal/nonmetal mining operations and transfer the guidelines to industry.

Activity/Output Goal 4.2.5: Develop effective engineering control guidelines for escape and rescue in underground metal mines for transfer to industry.

Activity/Output Goal 4.2.6: Develop improved workstation designs for surface mining equipment for transfer to industry.

Activity/Output Goal 4.2.7: Disseminate the findings on the effectiveness of existing engineering noise controls used in underground and surface mines.

Intermediate Goal 4.3: Develop and build recognition and awareness of engineering controls in the Construction Sector.

Activity/Output Goal 4.3.1: Develop a Control Technology Database of the NIOSH Engineering and Physical Hazards Branch engineering control studies to create a direct method of transferring control technology research information to industry and health and safety professionals.

Activity/Output Goal 4.3.2: Translate engineering control research findings into public health prevention practices that are adopted in the workplace.

Activity/Output Goal 4.3.3: Develop workplace solutions for silica control in construction. Translate research on silica dust control in construction into easy-to-use documents offering advice on the selection and use of dust controls for construction tasks such as enclosed operator cabs, grinding concrete, scarifying concrete, and tuck-pointing masonry.

Activity/Output Goal 4.3.4: Increase the availability of engineering and work practice options for reducing silica exposures through innovative demonstration

projects to partner with tool manufacturers, tool rental and suppliers, and other groups to increase the availability of silica control tools and supplies

Activity/Output Goal 4.3.5: Disseminate the findings on the effectiveness of existing engineering noise controls used in construction and shipyard industries.

Activity/Output Goal 4.3.6: Disseminate the findings on the effectiveness of existing engineering noise controls used on bulldozers and front end loaders.

Activity/Output Goal 4.3.7: Develop NIOSH hazard alert on noise emissions from powered hand tools and disseminate to impacted stakeholders.

Intermediate Goal 4.4: Develop and build recognition and awareness of engineering controls in the Services Sector.

Activity/Output Goal 4.4.1: Promote the use of technologies to control carbon monoxide (CO) on houseboats and other vessels such as 1) a stack that reroutes generator emissions; and 2) electronic fuel injection and catalysts on engines that eliminate CO before it exits the exhaust.

Activity/Output Goal 4.4.2: Promote the use of technologies to control dry cleaning solvents (i.e., methylene chloride and 1- bromopropane).

Intermediate Goal 4.5: Develop and build recognition and awareness of engineering controls in the Manufacturing Sector.

Activity/Output Goal 4.5.1: Develop a consortium with leading universities and major manufacturers of machinery and equipment used in the construction and manufacturing industries conducting work in the area of the engineering control of noise.

Intermediate Goal 4.6: Implement control-focused strategies and promising approaches for addressing hazards and promoting safe work practices in all Sectors.

Activity/Output Goal 4.6.1: Explore control banding approaches for providing guidance to address specific hazardous workplace activities through a qualitative risk assessment and the application of control-focused solutions. Identify effective controls that support performance-based occupational exposure limit approaches such as control banding.

Activity/Output Goal 4.6.2: Identify effective controls to integrate as successful PtD processes, methods, tools and educational programs to be tailored for the small business environment.

Activity/Output Goal 4.6.3: Noise Control Compendium – Contract a revision, final review and formatting of NIOSH’s revised Noise Control Compendium for publication as a functional, interactive technical website on noise control materials, techniques, and case studies.

Strategic Goal 5: Provide the resources and information necessary to protect the health and safety of workers during public health emergencies and response activities.

Intermediate Goal 5.1: Develop Engineering Control resources and information during public health emergencies

Activity/Output Goal 5.1.1: Develop effective engineering controls for Expedient Airborne Isolation for Emergency Response Exercises.

Activity/Output Goal 5.1.2: Develop documents for engineering controls to protect buildings.

Activity/Output Goal 5.1.3: Develop engineering control documents to protect workers during a pan-flu incident.

Activity/Output Goal 5.1.4: Develop engineering controls to protect postal workers at mail processing facilities

Activity/Output Goal 5.1.5: Provide engineering control expertise during emergency response activities

Activity/Output Goal 5.1.6: Perform tracer gas studies of ventilation systems in buildings to assess vulnerabilities.

Activity/Output Goal 5.1.7: Participate and provide engineering control expertise during Commission Corps emergency response activities.

Intermediate Goal 5.2: Incorporate Engineering Control solutions into guidelines and regulations.

Activity/Output Goal 5.2.1: Conduct research and provide solutions to prevent carbon monoxide poisonings from portable generators during clean-up activities after natural disasters.

Activity/Output Goal 5.2.2: Disseminate engineering control research findings for controlling carbon monoxide from generators and motors in the marine industry to appropriate agencies and trade associations.

Emerging Issues

Engineering control of occupational hazards is a continually developing field due to both changes in the work place as well as evolution of the field itself. In recent years the emerging threat of terrorism has blurred the line between engineering control to protect workers (occupational safety and health) and engineering controls to protect the general population (public health). An example of this is the work done by the NIOSH Engineering and Physical Hazards Branch, in partnership with several other Federal agencies, to develop a document to provide building owners, managers, and maintenance personnel with [recommendations](#) to protect public, private, and government buildings from chemical, biological, or radiological attacks. This document will provide protection

to both employees and visitors in those buildings. Engineering controls designed to protect health care workers from contracting nosocomial infections will similarly result in protection of the general population from natural (e.g., avian flu) and man-made (e.g., bio-terror) threats.

Developments in science, engineering, and computer technology such as computational fluid dynamics and laser technology enable research in engineering control to propose more sophisticated controls for environmental hazards and to evaluate the effectiveness of those controls in much greater detail and more quickly than ever before possible. Developments in the field of engineering control, such as control banding, are enabling the application of appropriate control measures to previously unaddressed issues in a simpler and more expedient manner.

As the third of the triumvirate of principles underlying occupational safety and health—recognition, evaluation, and control—the field of environmental control in general and the NIOSH Cross-Sector area of engineering control specifically will emerge as essential component within all of the NORA Sector and Cross-Sector programs. Additionally, NIOSH funding of extramural research in control of occupational hazards will further lead to reduced workplace injury and illness.

Partnerships and Stakeholders

We recognize that collaborative efforts in partnership with labor, industry, government, and other stakeholders are usually the best means of achieving successful outcomes. Fostering these partnerships is a cornerstone of the NIOSH program for the engineering control cross-sector. Listed below are examples of partnerships that have been formed around specific engineering control projects. This list is in no way meant to be exhaustive, it is simply offered as an example of the extensive partnerships that have been formed in the Engineering Control cross-sector.

CBR Terrorism Control Technology

- Defense Advanced Research Projects Agency
- U.S. Army
- U.S. Navy Facilities Engineering Command
- U.S. Environmental Protection Agency
- U.S. Department of State
- Defense Threat Reduction Agency
- National Institute of Standards and Technology
- Lawrence Berkeley National Laboratory
- U.S. Department of Energy
- U.S. General Services Administration
- Army Corps of Engineers
- U.S. Department of Interior
- American Institute of Architects
- Federal Aviation Administration
- National Association of Realtors
- Institute for Real Estate Management
- AirCond Corporation
- Consolidated Engineering
- Air-Conditioning Contractors of America (ACCA)
- National Institute of Building Sciences
- Morse Association
- Gobbell Hays Partners, Inc.
- International Facility Management Association
- The Real Estate Roundtable
- National Association of State Facility Administrators
- Institute of Real Estate Management
- Building Owners and Managers Association, International
- International Council of Shopping Centers
- National Association of Real Estate Investment Trusts

- National Association of Realtors
- Real Estate Board of New York
- National Multi Housing Council
- National Apartment Association
- Sandia National Laboratories
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

Control of Carbon Monoxide on Houseboats and Marine Vessels

- U.S. Coast Guard
- National Center for Environmental Health
- Environmental Protection Agency
- American Boat and Yacht Council
- National Marine Manufacturers Association
- Forever Resorts
- Somerset Custom Houseboats
- Department of Interior
- Westerbeke Corp.
- Southwest Research Institute

Preventing Hearing Loss from Chemical and Noise Exposures

- University College London, United Kingdom
- Institut National de Recherche et de Sécurité (INRS), France
- National Institute for Working Life, Sweden
- National Institute of Occupational Health, Denmark
- Institute of Occupational Medicine and Environmental Health, Poland
- The NOFER Institute, Poland

Asphalt Milling: Engineering Controls and Best Practices

- National Asphalt Pavement Association
- Wirtgen
- Caterpillar
- Terex/Cedar Rapids/CMI
- Roadtec

- Payne and Dolan
- Midwest Paving/Delta Paving
- Northeast Asphalt
- L&L

Controlling Isocyanate Exposures in Spray-on Bed-liner Applicators

- Rhino Linings USA
- Line-X
- Washington State WISHA
- The Alliance for the Polyurethanes Industry (API)
- The Polyurea Development Association (PDA)

Comfort as a Predictor of Effective Hearing Protector Use

- Virginia Technical Institute
- General Motors
- James Anderson and Associates
- United Auto Workers
- Phonac Hearing Aid
- University of Cincinnati

Generation and Characterization of Nanoparticles

- RICE University
- University of Iowa
- University of Minnesota
- University of Rochester
- Woodrow Wilson Institute
- University of Cincinnati

Control of Styrene Exposure in Boat Manufacturing

- National Marine Manufacturers Association
- American Composite Manufacturers Association
- Grady-White Boats, Inc.
- Genmar Holdings, Inc.
- Sea Ray Boats, Inc.
- Century Boats, Inc.

- Island Packet Yachts, Inc.
- U.S. Marine, Inc.

Hearing Loss in Boat Manufacturing

- National Marine Manufacturers Association
- American Composite Manufacturers Association
- Grady-White Boats, Inc.
- Genmar Holdings, Inc.
- Sea Ray Boats, Inc.
- Century Boats, Inc.
- Island Packet Yachts, Inc.
- U.S. Marine, Inc.

Aircraft Cabin Airflows

- Federal Aviation Administration
- American Society of Heating Refrigerating, and Air-Conditioning Engineers

Expedient Patient Isolation for Bioterrorism and Epidemic Response

- University of Oklahoma, Health Sciences Center, OKC, Oklahoma
- Oklahoma State Department of Health, OKC, Oklahoma
- Oklahoma City Veteran's Administration Hospital, OKC, Oklahoma
- St. Joseph Memorial Hospital, Larned, Kansas
- Central KS Medical Center

Nonionizing radiation studies

- World Health Organization
- Electric Power Research Institute
- National Cancer Institute
- International Agency for Research on Cancer

Audiometry and Fit-Testing of Hearing Protection for Occupational Hearing Loss Prevention

- Bacou-Dalloz

New Methods for Evaluating Exposure to Impulsive Noise

- Larson-Davis Corporation
- University of Cincinnati

- National Association of Shooting Range
- OSHA Alliance

Hearing Loss Intervention for Carpenters

- United Brotherhood of Carpenters and Joiners of North America

Accommodation of Hearing-Impaired Workers

- General Motors
- United Automobile Workers of America (UAW)
- United Mine Workers of America (UMWA)

NORA Hearing Loss Team

- The Institute for Noise Control Engineering, USA
- National Hearing Conservation Association

Research for Worker Health

- American Society of Hospital Pharmacists
- United States OSHA
- Halogenated Solvents Industry Alliance (HSIA)
- Refractory Ceramic Fiber Coalition

Hearing Protector Testing Methods, Rating Algorithms, and Data-Collection Systems

- U.S. Environmental Protection Agency
- Aearo EAR Corporation
- U.S. Army Aeromedical Research Laboratories
- U.S. Air Force Research Laboratories
- Howard Leight Industries of Bacou Dalloz
- University of Florianopolis, Brazil

Applied Control Technology Studies

- U.S. Environmental Protection Agency
- Department of Labor/OSHA
- U.S. Coast Guard
- Internal Revenue Service (IRS)
- United States Postal Service (USPS)
- Small Businesses, trade associations, labor unions

- Center to Protect Worker's Rights

Computational Fluid Dynamics (CFD) in Control Technology

- Sandia National Labs
- University of Tennessee
- University of Illinois
- Boeing, Inc.

Hearing Loss Intervention for Shipyard Workers

- U.S. Naval Shipyard Puget Sound
- U.S. Navy
- University of Washington

Measurement and Control of Workplace Nanomaterials

- The UAW OHAB committee
- Altair Nanotechnologies

Model Program to Conduct Hearing Tests and Remotely Access Audiometric Data from Construction Workers

- United Brotherhood of Carpenters
- UBC Central Indiana Apprentice Training Center
- UBC Monroe Apprentice Training Center

Silica and Noise Exposure Control for Tile Roof Installers

- Center to Protect Workers Rights
- Petersendean Roofing Systems
- Aussieblue Roofing
- Uni-Glaze Coatings, Inc.
- Arizona Roofing Contractor Association
- United Union of Roofers, Waterproofers, and Allied Workers
- Roofers Local 135
- Arizona Roofing Industry JATC
- Associated Roofing Contractors
- Jim Brown and Sons Roofing
- Petersen Dean
- Tile Roofing Institute

- MonierLifeTile
- Western States Roofing Contractor Association
- Eagle Roofing Products
- National Roofing Contractors Association
- U.S. Department of Labor - OSHA
- Diversified Roofing
- Phoenix Building Trades
- Diversified Roofing

Coal Mining Diesel Partnership

- United Mine Workers of America
- Bituminous Coal Operators Association
- National Mining Association
- Utah Mining Association
- NIOSH

Metal/Nonmetal Mining Diesel Partnership

- United Steel Workers of America
- National Mining Association
- National Stone, Sand and Gravel Association
- Industrial Minerals Association-North America
- MARG Diesel Coalition
- NIOSH

Personal Dust Monitor Partnership

- United Mine Workers of America
- Bituminous Coal Operators Association
- National Mining Association
- Thermo Electron Corporation
- NIOSH

Coal Mine Noise Control Partnership

- United Mine Workers of America
- National Mining Association
- Bituminous Coal Operators Association

- Mine Safety and Health Administration
- Joy Mining Equipment
- Fletcher Corporation
- Consolidation Coal Company
- Peabody Coal Company
- NIOSH

Coal Rock Deflector Partnership

- United Mine Workers of America
- Bituminous Coal Operators Association
- National Mining Association
- Mine Safety and Health Administration
- NIOSH

Industry Partnership on Mine Emergency Communications

- United Mine Workers of America
- Bituminous Coal Operators Association
- National Mining Association
- Mine Safety and Health Administration
- State Governments
- Various Coal Mine Operators
- National Stone, Sand and Gravel Association
- Industrial Minerals Association-North America
- Various Communications Equipment Manufacturers

Stump Cutter Operator Presence System Partnership

- Vermeer Manufacturing Company

Engineering Controls related References & Websites:

Engineering Controls website – <http://www.cdc.gov/niosh/programs/eng/>

NAICS codes for Program - <http://www.census.gov/epcd/www/naics.html>

For more information regarding the ENG Guidance please contact:

Manager of NIOSH Engineering Controls

CAPT W. Gregory Lotz, Ph.D.
Director
Division of Applied Research and Technology,
National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226
TPN: 513-533-8462
FAX: 513-533-8510

Coordinator Engineering Controls

CDR Ronald M. Hall, MS, CIH
Deputy Branch Chief
Engineering and Physical Hazards Branch
CDC/NIOSH
4676 Columbia Parkway, MS R-5
Cincinnati, OH 45226
Phone: 513-841-4387
FAX: 513-841-4506

Co- Coordinator Engineering Controls

LCDR Duane R. Hammond, P.E.
Mechanical Engineer
Engineering and Physical Hazards Branch
CDC/NIOSH
4676 Columbia Parkway, MS R-5
Cincinnati, OH 45226
Phone: 513-841-4286
FAX: 513-841-4506

Engineering Controls Steering Committee Members:

<u>Name</u>	<u>Division</u>	<u>Phone Number</u>	<u>Role</u>
Thomas J. Lentz	EID	513.533.8260	EID representative
Stephen Martin	DRDS	304.285.6367	DRDS representative
Susan B. Board	OD	404.498.2512	Grants representative
John R. Powers	DSR	304.285.6219	DSR representative
Kim C. Gavel	NPPTL	412.386.5030	NPPTL representative
Edward D. Thimons	PRL	412.386.6683	PRL representative
Jurgen F. Brune	PRL	412.386.4922	PRL representative
Joseph B. Seymour	SRL	509.354.8019	SRL representative
Paul J. Middendorf	OD	513.533.8606	R2P Liaison