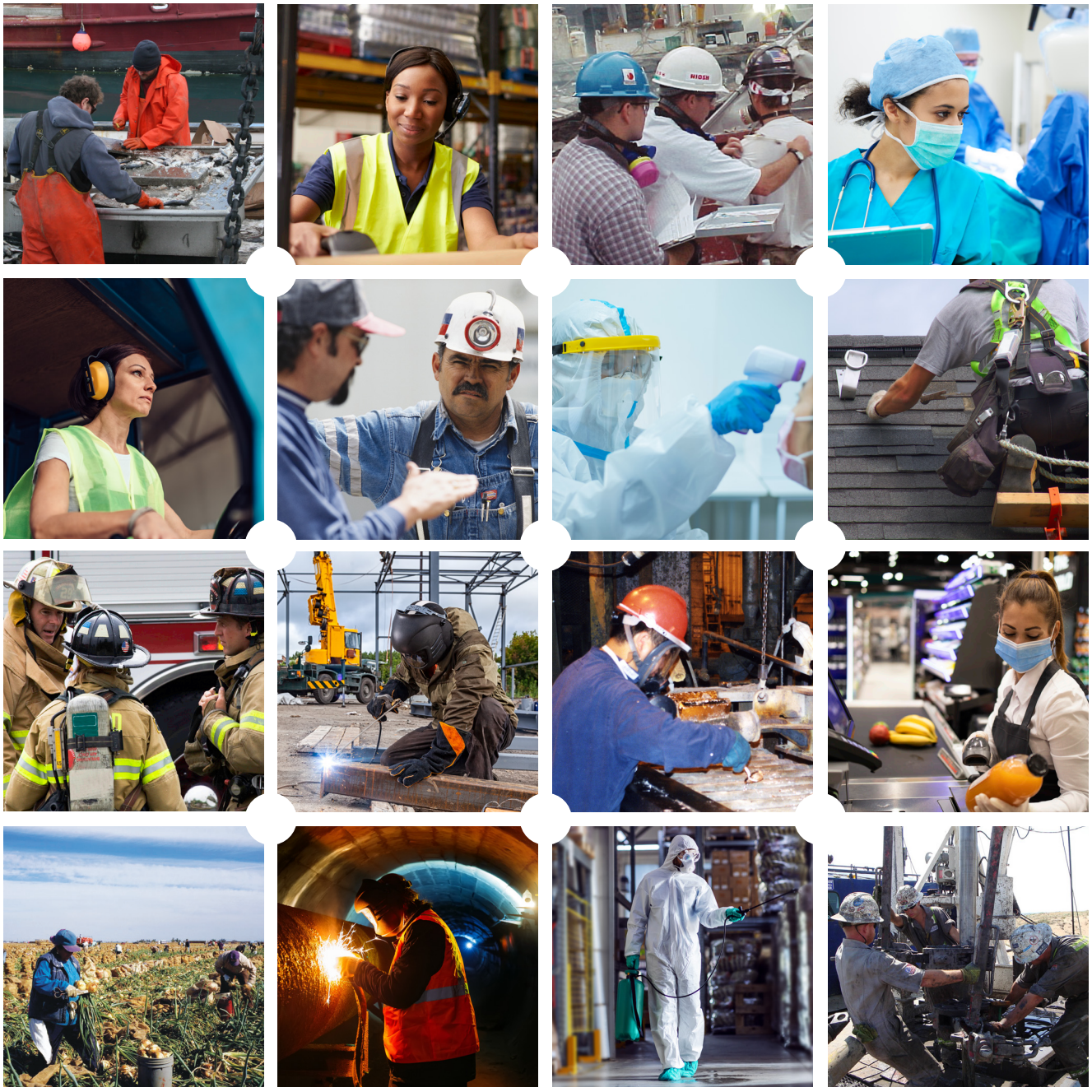
NIOSH BIBLIOGRAPHY OF COMMUNICATION AND RESEARCH PRODUCTS | 2020

50 Years | Marking five decades of the NIOSH mission to protect worker safety and health



Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

Cover: The photographs on the cover of the *NIOSH Bibliography of Communication and Research Products 2020* represent just a few of the workers and professions that NIOSH has served in its 50-year history. The photographs are described below:

1. Workers in the fishing industry process their catch in Alaska.
   Photo by NIOSH
2. A worker uses a barcode reader in a distribution warehouse.
   Photo by ©Monkeybusinessimages/Getty Images
3. NIOSH staff assist recovery workers near "Ground Zero" after the 9/11/2001 attacks.
   Photo by NIOSH
4. An anesthesiologist writes updates.
   Photo by ©Gpointstudio/Getty Images
5. A forklift operator works in a warehouse.
   Photo by ©Kerkez/Getty Images
6. Mine workers confer at a worksite.
   Photo by ©Photodisc/Photodisc-Getty Images
7. A doctor uses an infrared forehead thermometer to check for COVID-19 symptoms.
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8. A construction worker repairs a roof.
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9. A trainer speaks to two firefighters.
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10. A worker welds at a worksite.
    Photo by ©Vitalij Sova/Getty Images
11. A worker recycles lead-acid batteries.
    Photo by NIOSH
12. A cashier in a supermarket wears a mask and gloves to protect against COVID-19.
    Photo by ©Smederevac/Getty Images
13. Field workers harvest a crop.
    Photo by Library of congress
14. A worker in a protective mask welds pipe in a tunnel.
    Photo by ©Vladimir Zapletin/iStock-Getty Images Plus
15. A man in a protective suit and mask disinfects a warehouse full of food products from COVID-19.
    Photo by ©Dusanpetkovic/Getty Images
16. "Roughnecks" work equipment at an oil drilling site.
    Photo by NIOSH

NIOSH

Bibliography of Communication and Research Products

2020

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
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April 2021

Foreword

Fifty years ago, Congress created the National Institute for Occupational Safety and Health to ensure that all workers have a safe and healthy workplace. Back then, each year tens of thousands of American lives were lost at work and millions of workers injured. Families of lost workers and survivors of workplace injuries paid a heavy toll in lost wages, pain, and suffering. Thanks in part to the work of NIOSH, other federal agencies, and employers and workers—the yearly toll of dead, injured, and sick workers has declined by two-thirds even though the U.S. population has risen.

NIOSH was given authority to conduct occupational safety and health research, enter worksites and investigate hazards, and train worker safety and health professionals. Our mission was, and still is, to pursue safe and healthful work conditions for all workers across the United States through scientific endeavors, leading to recommendations and guidance.

Our 50th anniversary gives us a reason to reflect on and celebrate our past and the progress we have made in the field of worker safety and health. As we look forward to the challenges the future of work presents, our progress reassures us that we stand ready to meet the challenges.

This bibliography represents the scientific endeavors and communication products NIOSH has achieved during 2020 in pursuit of keeping workers safe. Each year, a new edition of this bibliography marks a year of progress. Please explore this bibliography and share it freely in workplaces and with professionals in the occupational health and safety community.

John Howard, M.D.
Director,
National Institute for Occupational Safety and Health

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NIOSH at 50:
A Special Report

A Look Back at Many Successes and Directors

A NIOSH Milestone

By JEANETTE NOVAKOVICH

Fifty years ago, the National Institute for Occupational Safety and Health (NIOSH) was created to protect the health and safety of the U.S. workforce. NIOSH's incoming first director, Marcus M. Key, observed that 10 million injuries, 14 thousand worker deaths, $1.7 billion in lost wages, $9 billion in gross national product loss, and $2.3 billion in workers' compensation costs gave rise to the Occupational Safety and Health Act of 1970 (OSH Act), which established NIOSH in 1971.[1]

The OSH Act charged NIOSH, a research agency, with recommending scientific criteria for standards for exposure to harmful work substances. NIOSH would present its recommendations to the Occupational Safety and Health Administration (OSHA), a regulatory agency that finalized the standards and enforced them. NIOSH was also empowered to make on-site hazard evaluations and promote the training of safety and health professionals.

The OSH Act passed with bipartisan support

President Richard Nixon described the OSH Act as one of the most important pieces of legislation ever passed. He noted: "Usually on an occasion like this the President stands up and says, 'I did it,' or the Congress says, 'I did it,' or the Democrats say they did it, the Republicans say they did it, or labor takes the credit or management takes the credit. I would like to have the record very clear here that this bill could not be signed by the President of the United States today unless everybody had worked together to get it through."[2]

Photo by Occupational Safety and Health Administration (colorized)

President Richard M. Nixon signs the Occupational Safety and Health Act on December 29, 1970.

1970s

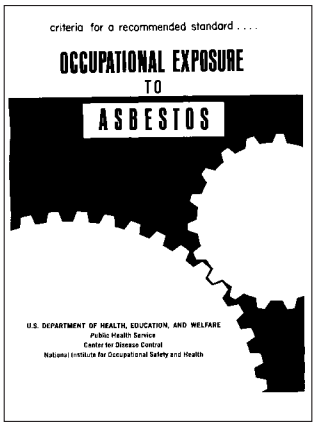
Director Marcus M. Key, 1971–1975

Few activities or concepts burst forth fully developed as did Athena who sprang fully grown from Zeus' forehead. The same has been true of the … Occupational Safety and Health Act of 1970. [2]

—Marcus M. Key MD

Marcus M. Key, MD, NIOSH's first director, previously served as director of the Bureau of Occupational Safety and Health. Key oversaw 475 employees and worked with an initial budget of $17.8 million (nearly $115 million today, adjusted for inflation). In 1973, the institute was transferred from the Health Services and Mental Health Administration into the Centers for Disease Control. During Dr. Key's tenure, NIOSH produced 23 criteria documents, a NIOSH priority in the 1970s. Criteria documents are the basis for comprehensive occupational safety and health standards. The National Academy of Sciences estimated then that 500,000–600,000 chemicals were used in the United States, with health standards for only 400 of them.[3]

Dr. Key had planned to develop 20–30 criteria documents annually, but only five were produced the first year. They covered workers exposed to asbestos, beryllium, carbon monoxide, noise, and heat stress.[3] Key explained the challenge: "In all of our criteria documents, NIOSH will attempt to be practical as well as idealistic. Adherence to both concepts is difficult ... but without this our recommendations are identified as feasible only in another world, or else we are accused for settling for the lowest common denominator."[3] The first criteria document, and the first OSHA acted on, dealt with asbestos.



The first NIOSH criteria document was about exposure to asbestos. OSHA acted on the information to regulate asbestos.

More than 100 health hazard evaluations (HHEs)[2] were conducted in the first 2 years. HHEs help employees, unions, and employers learn whether health hazards are present at their workplace, and they recommend ways to reduce hazards and prevent work-related illness. NIOSH researchers investigated why dentists were more likely to commit suicide than other workers, why hairdressers had high rates of lung and bladder cancer, and why surgical nurses have high rates of miscarriage.[4] NIOSH also investigated formaldehyde in dry cleaning shops, embalming parlors, paper mills, textile plants, and school laboratories.[5] NIOSH published an annual list of toxic substances and provided project grants to train the next generation of occupational health and safety professionals.

In 1974, publication of the *NIOSH Manual of Analytical Methods* (NMAM) guided the evaluations by providing scientific methods for sampling and analyzing contaminants in workplace air, on surfaces, and in blood and urine of occupationally exposed workers.

During his tenure, Dr. Key expressed concern that workers didn't even know what chemicals they worked with because substances were given only code numbers.[6] In 1975, he suggested that rather than recommend safe exposure levels, industry should just adopt protective work practices and eliminate exposure to all agents. Later that year, he retired.

Director John F. (Jack) Finklea, 1975–1978

John F. (Jack) Finklea, MD, PhD, was appointed director of NIOSH in 1975. In the institute's early years, Congress judged NIOSH by its production of criteria documents.[7] Dr. Finklea immediately invested the institute's resources into producing criteria documents.[8] During Dr. Finklea's tenure, NIOSH produced 65 criteria documents.[9]

A healthy workplace is not simply ... where potentially harmful chemicals and physical agents are well-controlled. Sometimes ... we lose sight of the fact that work should be a positive experience as well as a way to earn your daily bread.[10]

—Dr. John Finklea

Since 1972, NIOSH had sent 15 criteria documents to OSHA recommending exposure standards. OSHA had issued regulations governing only one, asbestos.[10] OSHA explained that NIOSH's input was one of many and suggested NIOSH withhold making specific recommendations for standards.[10] Late in his tenure, Finklea would observe that the debate over what constituted proof made it difficult for NIOSH to describe a chemical as carcinogenic.[11]

NIOSH faced many challenges in its early years

NIOSH was fully engaged in investigating a broad range of occupational safety and health concerns, from lung, liver, and bladder cancer associations with chemicals, soaps, detergents, cosmetics, and printing inks[12] to reports of leukemia outbreaks among workers in synthetic rubber plants,[13] permanent nerve damage among workers in pesticide plants,[14] and deafening noise in a nail mill. NIOSH also investigated old concerns. An investigation of coke oven workers in the steel industry found they were inhaling the same coal combustion by-products known to have caused cancer more than 200 years earlier in chimney sweeps.[12]

Before the OSH Act, industry conducted most occupational safety and health research. Consequently, industry often resisted accepting NIOSH's research practices and findings.[15] As an example, NIOSH completed an investigation of lung cancer among miners exposed to asbestos-like fibers and reported that the longer workers had been exposed to these fibers, the higher the number of cancer cases were found among workers. The company involved rejected NIOSH's findings, because it didn't understand how NIOSH could have reached its conclusions based on an early study from 1960 and information recorded on death certificates.[16]

Photo by NIOSH

NIOSH studied the association between cancer and work around coke ovens. This undated photo was taken from the collection of Dick Lemen, retired industrial hygienist and former NIOSH deputy director.

Photo from the Library of Congress

NIOSH examines exposures in workplaces. Above, sometime after 1980, a construction worker pours molten metal at the restoration of the Reading Terminal and Market in Philadelphia, Pennsylvania.

A success story: a standard for vinyl chloride

Vinyl chloride is ubiquitous. It's used in paints, pipes, furniture, packages, toys, flooring, and more. In 1970, when OSHA was empowered to regulate standards for exposures to harmful substances, the agency adopted the same standard for vinyl chloride that industry had proposed back in 1954 at 500 parts per million.[15]

In the years that followed, industry-backed studies revealed that tumors occurred in rats at much lower exposures. NIOSH conducted an investigation of its own in a Louisville tire plant. Researchers from NIOSH found that rare liver cancer deaths were likely linked to prolonged exposure to vinyl chloride gas.[17] In response, NIOSH set up a worldwide taskforce to investigate vinyl chloride.[18] In 1974, the institute forwarded to OSHA criteria for a recommended exposure limit of 50 ppm.

OSHA issued a temporary standard of 50 parts per million, later to be reduced to 1 part per million in 1975. Concerned that the new standard would cause massive layoffs and plant closings, along with an estimated $90 billion revenue loss, industry unsuccessfully challenged the standard in courts.[15] Instead of massive layoffs and plant closings, the industry remained competitive and expanded under the new standard, which cost industry about $300 million.[15]

Working women and birth defects

In 1976, the institute requested that health funds be allocated to give special emphasis to women and the fetus, male infertility, and potential environmental reproductive harms.[19] Finklea testified at a congressional hearing that more than 1 million women of childbearing age were at risk of exposure to chemicals that might cause birth defects and miscarriages. When asked if current standards would provide protection, Dr. Finklea replied, "Most of the consensus standards were not established with the view of protecting women of childbearing age in the workplace." At that time, more than 20 chemicals had been identified as suspected agents that might cause birth defects and miscarriages, among them lead, benzene, vinyl chloride, and anesthetic gases.

NIOSH holds its mandated ground

In 1977, NIOSH investigated a rubber plant where employees who stripped rubber were having problems from severe blisters

and peeling skin.[20] In a battle over access to medical records, even workers were not convinced more regulation would benefit their lives and were reluctant to share their medical records. One worker at the plant stated, "You may contract cancer, but that's better than starving to death."[21] Without medical records, NIOSH argued, it would not be able to serve its mandate effectively. The court held that NIOSH had a statutory right to enter workplaces, see the medical records, and disseminate research findings.[22]

Another notable success under Finklea's tenure was establishing the first nine Educational Resource Centers (ERCs), known today as Education and Research Centers. ERCs play a significant role in preparing the future occupational safety and health workforce to respond to new challenges posed by the changing nature of work.

Director Anthony Robbins, 1978–1981

Dr. Anthony Robbins was appointed director of NIOSH in 1978. With limited funding, NIOSH could do only so much. Each director had stark choices about what could be accomplished. Robbins focused the institute's efforts on health hazard evaluations (HHEs).[23] Under Dr. Robbins' direction, NIOSH quadrupled the number of evaluations. NIOSH researchers investigated a variety of workplaces at the request of the employer, union, or workers. Like his predecessor, Robbins fell under heavy criticism.[8] Industry complained HHEs were so akin to inspections that NIOSH was known as "Baby OSHA." Internally, some scientists felt the information derived from HHEs was too limited and short-term.

If workers are exposed to something that causes this cancer, we can almost be certain that that malignancy can be prevented.[26]

—Dr. Anthony Robbins

In 1979, NIOSH had an estimated 20–30 studies ongoing, each taking 3 years to complete.[24] That same year, NIOSH completed a survey of work conditions in 80,000 plants.[24] Its aim was to determine how workers are exposed to hazards and how to determine appropriate hazard levels. The survey examined death rates of employees in specific industries to help determine whether some illnesses were unique to specific occupations.[24] NIOSH's focus also expanded to consider diversity factors in the workforce when testing safety factors of equipment. Previously, the standard measuring unit had been the "white male."[24]

As Dr. Robbins' tenure progressed, relations with industry began to evolve in a cooperative direction. As an example, NIOSH was asked to investigate why workers in a spray-coating business were so dizzy and weak that they needed help tying their shoelaces and buttoning their shirts in the morning. NIOSH investigators traced the trouble to a chemical used in the spray coating and convinced the company to find a substitute.[25]

Dr. Robbins also advised the White House on the Three Mile Island nuclear reactor accident in 1979. Afterward, NIOSH helped the Nuclear Regulatory Commission set up a registry of workers and a program to monitor occupational radiation exposures.

Photo from the Library of Congress

President Jimmy Carter walks with members of the Three Mile Island Commission in 1979.

Challenging the 'lifestyle school of blame'

During Dr. Robbins' tenure, NIOSH joined with OSHA to challenge the predominant "lifestyle school of blame." The lifestyle school looks at workers' hereditary factors along with diet and other lifestyle choices that may contribute to cancer. Industry proposed a strategy of segregating workers most susceptible to cancer from cancer-causing agents and providing educational programs on obesity and weight loss, among other remedies.[26] Dr. Robbins was skeptical of the success of separating potential disease victims from their jobs, pointing toward the recent finding of sterility among female workers due to exposures at a cyanide plant.[26] NIOSH proposed that changing manufacturing processes and introducing engineering controls would prevent worker exposure to harmful chemicals altogether.

Photo by ©Darren Thompson/Getty Images

No safe level exists for exposure to asbestos

Under Dr. Robbins' tenure, NIOSH recommended sharply reducing permissible levels of asbestos. Robbins believed a long-term goal of U.S. industry should be to eliminate the use of asbestos altogether, and he welcomed an announcement by General Motors that it had perfected a non-asbestos fiber for brake linings.[27] Dr. Robbins argued that although lower permissible levels of asbestos would lower rates of cancer, there was no known level for which asbestos-related deaths would not occur.[28]

1980s

NIOSH's role in worker safety needs to expand, says Dr. Finklea

In 1977, as former director, Finklea testified before a senate committee that NIOSH was powerless to inform an estimated 14 million American workers that their health may be in danger from regular exposure to poisonous chemicals.[29]

The agency lacked the manpower and authority to warn them of potential chemical hazards and was unable to provide medical follow-ups for workers exposed to toxic substances. It was estimated to cost $40 million to locate and notify the workers who had been exposed to these hazards and $54 billion to provide medical surveillance—not treatment.[30]

NIOSH has the authority to enter any workplace and subpoena records for research purposes; it lacks the authority or funding to inform workers of its findings and provide medical surveillance. In 1980, a pilot project was formed to take place in 1981. NIOSH and the AFL-CIO joined to inform 1,100 chemical plant workers of possible exposure to toxic chemicals and to conduct medical surveillance.

Director J. Donald Millar, 1981–1994

Dr. J. Donald Millar was appointed director of NIOSH in 1981. In its first 10 years, NIOSH had sent 105 recommendations to OSHA, and OSHA had established regulations for only 10 of them.[31] Early on, Dr. Millar navigated the unique roles of the two federal agencies.[31] NIOSH's mandate was to follow the science, but OSHA's mandate required it to calculate the economic impact and technical feasibility of a potential regulation on industry.[31] As an example, Dr. Millar sent a recommendation to regulate formaldehyde as a carcinogen; OSHA responded that it could not issue regulations "based upon the simple classification of the substance as a human carcinogen."[31] A U.S. Supreme Court decision on the chemical benzene made it necessary for OSHA to also prove a substance posed a significant risk to occupationally exposed workers and that regulations could lessen this risk.[31]

If you see only the numbers in this book, you have missed the point. Each number, each death counted, represents a life, the life of an American worker, a life cut short while simply trying to earn a living.[34]

—Dr. J. Donald Millar

Illustration from British Medical Journal

Dr. Millar's top ten list of leading workplace injuries and illnesses became fodder for jokes about Moses coming down the mountain with the Ten Commandments.

Dr. Millar's top ten list of workplace illnesses, injuries

During Dr. Millar's tenure, the lack of attention paid to occupationally related diseases and injuries was a concern. All too frequently, doctors omitted questions related to occupational health when they probed the medical history of patients.[32] A few states, with NIOSH's urging, began to include facts about occupations on death certificates. Dr. Millar believed state public health reports on infectious diseases should include job injuries to help identity dangerous workplaces.[33] At a hearing before the House Subcommittee on Manpower and Housing, Dr. Millar advocated as a first step to list silicosis as a lung disease caused by exposure to silica dust.[33]

Subsequently, Dr. Millar developed a top ten list of leading occupational diseases and injuries. His list included occupational lung disease; musculoskeletal disorders; occupational cancer; fractures, amputations, eye losses, and traumatic deaths; cardiovascular disease; reproductive problems; neurotoxic illness; noise-induced hearing loss; and psychological disorders.[34]

Photo from the Library of Congress

Construction has long been a key focus of NIOSH. At left, iron workers in 1985 install a glass dome on the top of the State of Illinois Building in Chicago. Several iron workers died during construction of the building.

Controversy returns over notifying workers

Notifying workers identified in NIOSH studies as having health risks from workplace exposures had been debated since 1977, when it was raised in Congressional hearings.[35] In 1983, NIOSH compiled a list of all industrial health studies performed by the agency to assess whether the results should be shared with the affected workers. NIOSH recommended notifying workers who participated in 66 studies that involved a total of 200,000 to 250,000 workers.[35]

Amid this controversy, the Assistant Secretary for Health and Human Services commented: "The National Institute of Occupational Safety and Health (NIOSH) goes to great lengths to make its findings public. NIOSH notifies companies involved, appropriate labor unions or employee representatives, and appropriate federal and state agencies. In addition, the Centers for Disease Control, parent organization of NIOSH, has long distributed these findings through the general scientific literature and in special publications available to the public."[36]

The CDC also issued a statement: "NIOSH does have an ethical obligation to inform, particularly when NIOSH is the exclusive holder of data, or when there is clear evidence of a cause-and-effect relationship between an exposure and a health risk."[37]

A NIOSH pilot program is evidence of this. The pilot took place in a Georgia plant where workers from poor Black communities had been exposed to beta-naphthylamine (BNA), which is used to manufacture synthetic dyes. Exposure to the chemical can cause bladder cancer, which can be treated when detected early. The pilot program notified 849 out of 1,000 survivors and found 15 cases of cancer and 26 precancerous conditions.[37,38]

Emerging evidence surrounding manufactured fibers

In the late '80s, evidence emerged that fiberglass and other manufactured mineral fibers may cause lung cancer and other diseases, alarming industry and federal agencies.[39] Industry insisted the evidence was too weak to draw conclusions[38] and fibrous glass had not been officially classified as a carcinogen. Synthetic fibers were widely used in building materials and insulation, cars, furniture, and packaging, and increasingly used as a substitute for asbestos. Animal tests suggested that the substitutes themselves posed a health threat. More studies emerged; of most concern were findings based on mortality records of workers exposed to low levels 30 years earlier.

NIOSH, as far back as 1977, proposed limits for exposure to these fibers to protect workers from eye and respiratory inflammation; these limits were published in Criteria for a Recommended Standard: Occupational Exposure to Fibrous Glass. OSHA had not acted on the recommendation. Furthermore, research published in 1977 indicated that the size and shape of the fiber,[39] rather than physical properties, presented a health risk that could lead to cancer or other health problems. The acting director of the chemical control division of the Environmental Protection Agency stated at the time, "If I had a choice of being exposed to asbestos at current exposure levels and to respirable man-made fibers, I would breathe asbestos every time because the exposure limits are so much more stringent."[39]

Photo from U.S. Geological Survey

The particle above is anthophyllite asbestos.

1990s

NIOSH warns of the danger of secondhand smoke to workers

In 1991, NIOSH released *Current Intelligence Bulletin 54: Environmental Tobacco Smoke in the Workplace: Lung Cancer and Other Health Effects*, warning that tobacco smoke in the workplace is a health hazard. The report estimated that annually 3,700 people die from cancer because of secondhand smoke.[39] NIOSH recommended that employers ban smoking in the workplace and offer help and incentives to encourage workers to stop smoking. Until then, employers could designate separate and enclosed areas for smoking.

A spokesperson from the tobacco industry argued that the study had failed to break new ground and was flawed because it failed to consider other indoor air pollutants or address proper ventilation.[40]

Focus shifts to farm workers

In the early 1990s, NIOSH's focus expanded to include field and farm work. Farmers were dying in large numbers from incidents involving tractors, grain bins, and manure pits. A NIOSH report found that tractor rollovers alone killed

Photo from the Library of Congress

NIOSH has long worked to benefit agricultural laborers, such as these field workers harvesting onions in the Imperial Valley, El Centro, California, in the early 2000s.

132 farmers each year.[41] Tractor rollovers can be prevented by installing rollover protective structures.

Grain farmers also faced deadly hazards associated with grain bins. In 1992, large harvests under wet conditions led to 4,500 grain bin injuries.[42] Dr. Millar responded to the tragedy, saying, "We must act to prevent this tragic loss of life. The harvest should yield life, not take it away."[42] He added that this type of workplace injury belongs on an "obscenities list" because the deaths could have been prevented.

Another tragedy unfolding on the farm involved manure pits. In response, NIOSH issued *Preventing Deaths of Farm Workers in Manure Pits* in 1990. In one case, one family member after another entered a manure pit on a rescue mission, father after son, leading to the deaths of five members of the family.

Manure pits are oxygen-deficient, toxic, explosive environments. Dr. Millar commented, "It is outrageous that we are losing virtually entire families in manure pit tragedies. While we know we cannot prevent a father from entering a pit to save his son, we can and will continue to do everything in our power to prevent farm workers from jeopardizing their lives by entering manure pits in the first place."[43]

Toward the end of his term, Dr. Millar made world headlines when he testified before the U.S. Senate that nearly half of workplace deaths involving women in the United States—41%—were homicides.[44,45] The information came from a NIOSH study, *Fatal Injuries to Workers in the United States, 1980–1989: A Decade of Surveillance*.

Director Linda Rosenstock, 1994–2000

This nation cannot accept that in today's society children are still being robbed of their health, their youth, and their lives by workplace hazards. [48]

—Dr. Linda Rosenstock

When Dr. Linda Rosenstock was appointed director in 1994, the director's office and 15 Atlanta employees were moved to Washington, D.C., in hopes the proximity to Congress and the White House would increase NIOSH's influence and outreach efforts.[46] Dr. Rosenstock began her tenure overseeing 960 employees in Atlanta, Cincinnati, and West Virginia with a budget of $133 million (about $235 million today, adjusted for inflation).

Later, NIOSH acquired the health and safety functions from the former Bureau of Mines and added 400 staff members from the Pittsburgh and Spokane research centers.[47]

Under Dr. Rosenstock's tenure, NIOSH adopted a new exposure limit policy that was based on both health effects data and technological feasibility. As an example, updated NIOSH respirator testing and certification requirements significantly decreased the cost of respirators and resulted in considerable savings for the healthcare industry. [23, 47]

Vice President Gore presented Dr. Rosenstock with a Hammer Award, for excellence in reinventing government, for leading a collaborative effort with industry, government, and labor to develop and implement engineering controls for the asphalt paving industry.

Dr. Rosenstock noted of her partnership, "Although the health risks from asphalt exposure are not yet fully defined, all partners agreed that prudent action was needed to reduce worker exposures. The willingness of all partners to find a workable approach should serve as a model for others who are developing occupational safety and health recommendations."[48]

NIOSH builds on collaboration

A year into Dr. Rosenstock's tenure, the U.S. House budget committee chairman recommended that NIOSH be phased out by 2000.[49] Doctors, industry, and the current administration rallied to save the agency that had defended the nation's workers for a quarter of a century. Dr. Rosenstock issued a public statement: "I have grave concerns about what that would do to worker health in this country."[49] The proposal came on the heels of NIOSH's formation of a joint 5-year research agreement with industry and unions to conduct research on work-related injuries and illness.[50] Dr. Rosenstock successfully weathered the budget crisis—NIOSH's budget actually increased by 65% during her appointment.

Launching the National Occupational Research Agenda

Dr. Rosenstock led NIOSH's first major initiative in collaborative problem solving. From 1994 through 1996, she began an extensive effort to engage all NIOSH stakeholders and led the creation of the National Occupational Research Agenda (NORA), a framework for guiding occupational safety and health research. The NORA framework involved hundreds

of external partners from industry, labor, academia, and other stakeholders, working together to solve worker safety and health concerns. Dr. Rosenstock received the Presidential Distinguished Executive Rank Award in recognition of her contribution to worker safety and health.

NIOSH helps protect many workers from many harms

In the '90s, NIOSH was involved in many worker safety and health concerns, including the risks posed by nitrous oxide and the injuries and deaths in commercial fishing, construction, and fire fighting. Violence in the workforce continued to make headlines into Rosenstock's tenure.[51] A NIOSH Alert, *Preventing Homicide in the Workplace*, documented 7,603 workplace homicides in the 1980s. Most violent acts happening in U.S. workplaces involved violence coming from people outside the workforce and violence between workers.

Late in Dr. Rosenstock's tenure, NIOSH continued to tackle significant worker safety and health issues, from defending ergonomics from the charge of junk science,[52] to providing noise level recommendations, to examining stress levels in the workplace in a first-of-its-kind study, Stress At Work.[53]

One of the greatest risks for healthcare workers in the late '90s involved workers inadvertently sticking themselves with needles used on patients with bloodborne pathogens, such as hepatitis C, which carried a 30% risk of infection.[54] Dr. Rosenstock described it as a "terrible ordeal."[52] In response to the crisis, NIOSH issued a new report, *Preventing Needlestick Injuries in Health Care Settings*, with the goal of reducing needlestick injuries by as much as 88%.[54]

2000s

Photo by NIOSH

At left, in the first 2 weeks after the September 11, 2001, terrorist attacks, NIOSH staff arrived to monitor and assist workers at the massive cleanup site at the ruins of the former World Trade Center buildings. NIOSH staff Eric Esswein and Dino Mattorano place a personal sampling device on one of the cleanup workers preparing to enter the contaminated work zone.

Director John Howard, 2002–2008

Do not hesitate to put your science in front of independent evaluators to ask the questions that matter: Is our scientific research relevant? Are we having a positive impact on the health and well-being of Americans? [59]

—Dr. John Howard

Dr. John Howard was appointed director in 2002. Dr. Howard previously worked as chief of the Division of Occupational Safety and Health with California's Department of Industrial Relations, where he oversaw the state's occupational safety programs. Howard reorganized the National Occupational Research Agenda with priority on translating research into practice and further bolstered its programs by having the National Academy of Sciences review them. Under his tenure, NIOSH received high marks from its stakeholders.[55] A number of workforce initiatives were launched during Howard's first tenure, including the Steps to a Healthier U.S. Workforce Initiative (which later became the Total Worker Health® program), the Research to Practice approach, and the Nanotechnology Research Center.

Dr. Howard continued to show how progress could be made in occupational safety and health through nonregulatory means, with cooperation and collaboration. For example, in 2002, NIOSH scientists worked with plant managers in microwave popcorn factories to discover why workers were becoming ill. They discovered that emissions from open vats of flavonoids were poisoning the workers. Using prevention through design, NIOSH came up with a low-cost solution to closing the vats. In sum, increased stakeholder involvement, enhanced transparency and accountability, and the translation of research into practice vastly improved the agency's reputation and in turn safety and health outcomes in the U.S. workforce.[56]

In 2006, Dr. Howard administrated the World Trade Center (WTC) health programs and advocated for congressional funding for treating emergency response workers and other workers who became ill from the World Trade Center attacks.

Dr. Howard received many accolades in his first tenure. The president of American Industrial Hygiene Association stated, "Since the creation of NIOSH back in 1970, the agency has been well-served by directors with an understanding, dedication and knowledge of occupational health and safety. However, I believe I am safe in saying that never in the history of the Institute has a director been as successful and respected by partners and stakeholders as Dr. John Howard. This applies to one and all—professional associations, labor, industry, employers, and workers."[57]

Director John Howard, 2009–Present

Dr. Howard served as NIOSH director until 2008. In 2009, Dr. Howard worked as a consultant with the U.S.–Afghanistan Health Initiative. In September of 2009, Dr. Howard was again appointed NIOSH Director, and was reappointed for a third 6-year term in 2015.

Dr. Howard continued to share his concern over both the small and large incidents that harm the U.S. workforce. In 2009, a tragedy aboard a commercial fishing vessel took the lives of five crewmen, including the captain.[56] Dr. Howard issued a statement: "For occupational safety and health professionals, these catastrophes

Photo by NIOSH

At left, a worker in a microwave popcorn plant wears proper PPE while working with flavorings. Using prevention through design, NIOSH came up with a low-cost solution to closing vats of flavoring chemicals, which will help lessen the chance that workers will be exposed.

are compounded by the toll of deaths, disabilities, and impairments that occur with little or no media coverage, individually, every day—wrenching personal tragedies for families and communities."[58] Howard did more than publicly address the tragedy; 5 years later, NIOSH established the Center for Maritime Safety and Health Studies.

2010s

NIOSH expanded the National Occupational Research Agenda, with a renewed focus around industry sectors and cross-sector concerns, including the establishment of a Center for Motor Vehicle Safety, National Center for Productive Aging and Work, Safe • Skilled • Ready Workforce program, Center for Occupational Robotics Research, and Center for Work and Fatigue Research. NIOSH continued to provide technical assistance to emergency response workers. As an example, NIOSH helped workers who participated in the Deepwater Horizon containment and cleanup, along with many natural disasters throughout the decade.

Dr. Howard began shifting some of NIOSH's focus toward emerging technologies, but the institute maintained a focus on prevailing hazards. As an example, the construction office launched a widely popular annual National Campaign to Prevent Falls in Construction that has saved countless lives in the construction industry.[59] NIOSH also launched a framework to

Photo by C-Span

NIOSH Director John Howard testifies at a 2015 hearing on a bill to reauthorize the World Trade Center Health Program and the September 11th Victim Compensation Fund.

Photos by NIOSH

NIOSH staff deployed to the Deepwater Horizon oil spill clean-up operation in 2010.

tackle the opioid crisis. Howard noted, "The opioid crisis is one of the most pressing public health challenges our nation faces today, and the workplace is not immune. We are working with our partners to better understand what places workers at risk for opioid use and misuse, and identifying what research and information is needed to keep workers and first responders safe at work and in their communities."[60] As the decade closed, in 2019, NIOSH launched a "future of work" initiative to understand the implications of future work scenarios and interventions to address them.

Photo from office of U.S. Rep. Greg Stanton

Comedian and 9/11 responder activist John Stewart hugs John Feal, a demolition supervisor at Ground Zero. The two celebrated in 2019 the extension of the 9/11 victims and first responders fund. Stewart and Feal appeared in a 2016 NIOSH video promoting the World Trade Center Health Program.

NIOSH created the Center for Occupational Robotics Research in 2017 to help industry and workers deal with the dramatic rise of robots in the workplace. At right, orange robots make welds and do other tasks in an automotive plant.

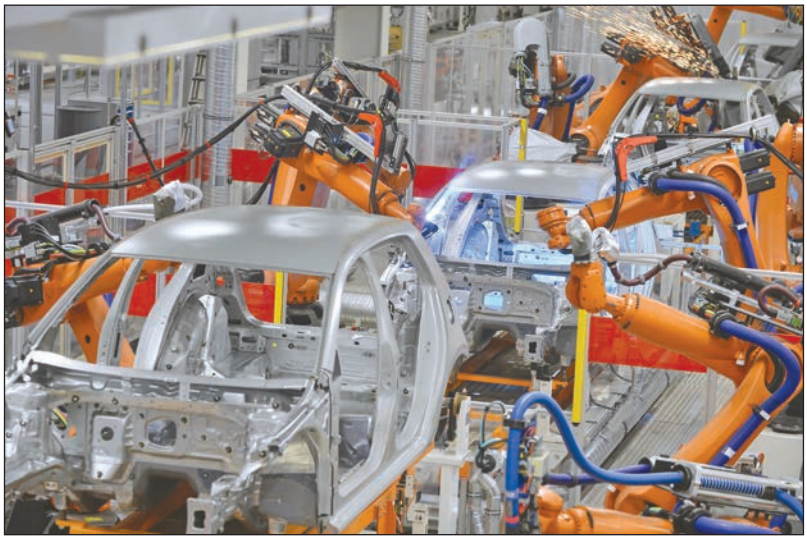


Photo by © Olga Serdyuk/Getty Images

2020s

The year 2020 will never be forgotten by NIOSH, the nation, and the world. In 2020, the nation relied on NIOSH to protect the U.S. workforce from a pandemic that by early 2021 had claimed more than half a million people in the United States.

As the nation learned about the role of essential workers in society and how crucial it is to protect their lives, NIOSH stepped up and provided resources to protect them.

The health crisis brought occupational inequities to the forefront of NIOSH's research-to-practice efforts. Long-standing systemic health and social inequities put certain worker populations, including racial and ethnic minority groups, at a higher risk of becoming sick and dying from COVID-19.

NIOSH continues to move forward to correct safety and health inequities in the U.S. workforce through its Occupational Health Equity (OHE) Program. OHE seeks to remove occupational health inequities that are closely linked with social, economic, or environmental disadvantage. These disadvantages can lead to overrepresentation of workers from certain social groups in dangerous occupations, differential treatment on the job, and limited access to resources protect workers on the job.

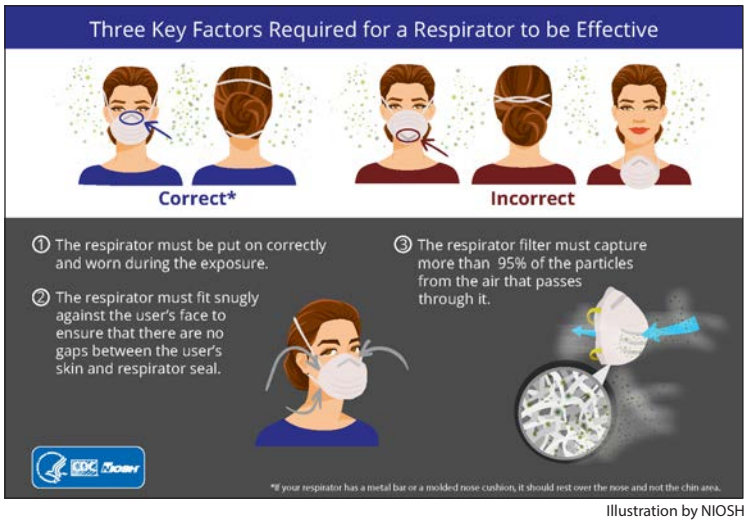


Illustration by NIOSH

To aid healthcare facilities facing shortages of N95 respirators due to high demand across the nation, NIOSH developed the Strategies for Optimizing the Supply of N95 Respirators in Healthcare Settings guidance. It was featured in a *NIOSH Science Blog* in March 2020.

Photo from the Library of Congress

NIOSH strived during the pandemic to protect workers, many of whom became sick or died from COVID-19. Above, the New York Metropolitan Travel Authority (MTA) honored the lives of its workers who died from COVID-19. The posters above were on display at the Canal Street Station, Manhattan, in early 2021.

Photo from the Library of Congress

Nurses and other front-line workers became heroes for their tireless and valiant efforts to support patients stricken with the illness. The poster above was based on the "Rosie the Riveter" WWII poster.

Illustration by NIOSH

This NIOSH illustration, used on NIOSH social media sites, depicts one facet of life during the COVID-19 pandemic—grocery store shoppers and cashiers wearing face coverings and gloves. NIOSH social media played an important role in getting information to workers and the public about staying safe during the pandemic.

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50 Years of NIOSH®

1970s

1970

- March 10, 1970, the first **Health Hazard Evaluation** is conducted at the Sager Glove Corporation in Murray, Kentucky, where researchers study asbestos exposures.
- NIOSH begins to certify **respirators**.
- December 29, 1970, the **Occupational Safety and Health Act**, creating NIOSH, is signed by President Richard Nixon.

1971

- **NIOSH** begins in April 1971.
- **First toxic substances list** is published.

1972

- **The first Criteria Document is published.** Criteria Documents are used for developing comprehensive workplace safety and health standards.

- NIOSH supports **training project grants** that address the burden of OSH in the United States by training the next generation of OSH leaders.

1973

- NIOSH is transferred into the **Centers for Disease Control**, which later becomes the Centers for Disease Control and Prevention (CDC).

1974

- NIOSH and OSHA develop the **Standards Completion Program,** which includes 387 substance-specific draft standards. This leads to the NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards.
- The ***NIOSH Manual of Analytical Methods (NMAM)*** is first published. The manual is a collection of methods for sampling and analyzing contaminants in workplace air, on surfaces, and in the blood and urine of workers.

1975

- First **Current Intelligence Bulletins** published.

1977

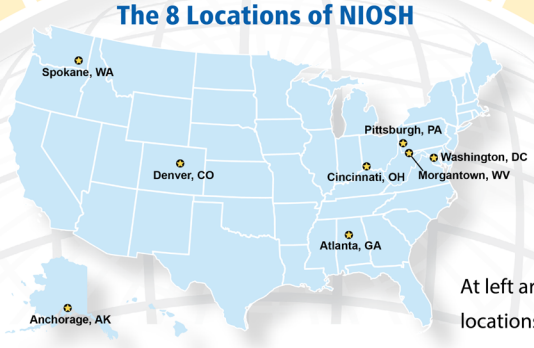
- First nine **Education and Research Centers (ERCs)** awarded (Harvard University, University of Cincinnati, Johns Hopkins University, University of Texas Houston, University of Minnesota, University of North Carolina, University of Washington, University of Illinois at Chicago, and University of Arizona). ERCs help prepare the future OSH workforce to respond to new challenges posed by the changing nature of work.
- Courts affirm authority to **enter workplaces, look at medical records, and release research findings.**
- ***Occupational Diseases: A Guide to Their Recognition*** informs about how to detect workplace diseases.

1978

- The ***Pocket Guide to Chemical Hazards*** is first published. The guide gives information for hundreds of chemicals/classes, helping users recognize and control chemical hazards in the workplace.

1970 1971 1972 1973 1974 1975 1976 1977 1978

The 8 Locations of NIOSH



At left are the current eight locations of NIOSH facilities.

1980s

1980

- First **state-based workplace health cooperative agreements** are developed.

1982

- The **Fatality Assessment and Control Evaluation (FACE)** program begins. Investigations conducted through the FACE program help identify factors that contribute to fatal injuries. This information is used to develop comprehensive recommendations for preventing similar deaths. NIOSH goes on to publish the first three FACE reports the same year.

1984

- First meeting of the **NIOSH Board of Scientific Counselors** convenes. The committee gives advice on NIOSH's workplace safety and health research and prevention programs.

1985

- On the 15th anniversary of the OSH Act, the Office of Technology Assessment issues a report concluding that the Act helped to reduce exposures to **vinyl chloride, cotton dust, and lead**.
- NIOSH publishes a **research agenda** focusing on the top 10 most important topics for workplace health and safety at the time. This is considered to be the foundation of the **National Occupational Research Agenda (NORA)**.

1986

- Proposed **National Strategies for the Prevention of Leading Work-Related Diseases and Injuries** are published, focusing on actions to prevent occupational musculoskeletal injuries.
- NIOSH, OSHA, and EPA establish the **ONE Committee** to coordinate the agencies' research efforts.
- Collaboration with ILO International Programme on Chemical Safety establishes **hazard communication cards** to give essential safety and health information in a clear and concise way to workers and OSH professionals.

1987

- **Sentinel Event Notification System for Occupational Risk (SENSOR)** program established. The program would go on to support changes in federal regulations to reduce pesticide-related health risks, improvements in training and certification for pesticide applicators, safer pest control in schools, and improved labels on pesticide products.
- NIOSH publishes landmark studies showing hazards of exposure to **asbestos-contaminated vermiculite** and lung cancer mortality from Libby, Montana.
- **Adult Blood Lead Epidemiology and Surveillance (ABLES)** launched to help lower the proportion of persons who have elevated blood lead levels from work exposure.

1989

- NIOSH establishes the **Alice Hamilton Award for Excellence in Science in Occupational Safety and Health**, recognizing the scientific excellence of technical and instructional materials by NIOSH scientists and engineers in the areas of biological science, engineering and physical science, human studies, and educational materials.

- State **FACE program** established.

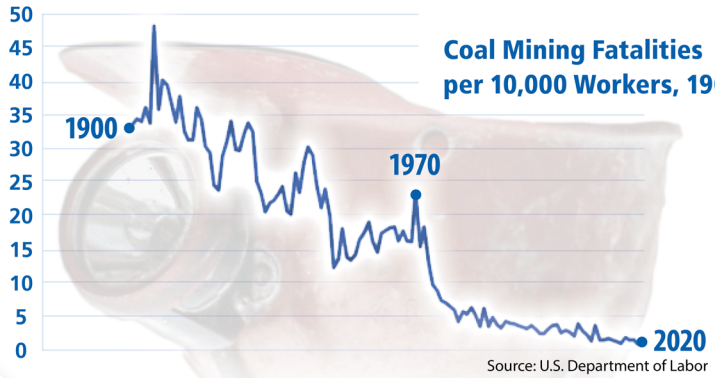
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989

The 10 Sectors of NORA

- Agriculture, Forestry and Fishing
- Construction
- Healthcare and Social Assistance
- Manufacturing
- Mining
- Oil and Gas Extraction
- Public Safety
- Services
- Wholesale and Retail Trade
- Transportation, Warehousing, and Utilities

NORA

The National Occupational Research Agenda (NORA) stimulates research and improved workplace practices.



Source: U.S. Department of Labor

Coal mining fatalities have declined from nearly 48 per 10,000 workers in 1907 to fewer than 1 per 10,000 workers in 2020.

1990 1991 1992 1993 1994 1995 1996 1997 1998 1999

1990s

1990

- **Centers for Agricultural Disease and Injury Research, Education, and Prevention** are established. The centers conduct research, education, and prevention projects to address the nation's pressing agricultural, forestry, and fishing health and safety problems in their geographic regions.
- **National Center for Construction Safety and Health Research and Translation** established.

1991

- Current Intelligence Bulletin, ***Environmental Tobacco Smoke in the Workplace: Lung Cancer and Other Health Effects*** published, explaining effects of environmental tobacco smoke.
- First **Work-Related Lung Disease (WoRLD)** Surveillance Report published (in 2008 it became an online surveillance system).

1993

- ***Preventing Homicide in the Workplace Alert*** released.

1994

- **Certified Equipment List**, a searchable database of all NIOSH-approved respirators, published.
- **NIOSH Lifting Equation (NLE)** published. It has contributed to improved risk assessments for manual-lifting jobs. In the late 2010s, the NLE was converted to an app.

1996

- **Mine safety research authority** is transferred to NIOSH following the defunding of the U.S. Bureau of Mines.
- **Engineering Control Guidelines for Hot Mix Asphalt Pavers** is published. This represents a new paradigm for conducting research by developing a partnership between labor, industry, and government.
- ***Preventing Allergic Reactions to Natural Rubber Latex in the Workplace Alert*** is published, addressing reports of workers' allergic reactions to latex.
- NIOSH publishes "The Yellow Book," or ***Musculoskeletal Disorders and Workplace Factors: A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity, and Low Back***.

1998

- **Fire Fighter Fatality Investigation and Prevention Program** established.

1999

- NIOSH issues recommendations for preventing **job-related stress**.
- NIOSH issues recommendations for preventing **work-related needlestick injuries**.

2000s

2001

- NIOSH provides technical assistance for responder safety and health in the **World Trade Center rescue and recovery**.
- **NIOSH en Español** website launches.
- NIOSH responds to **Anthrax attacks**.
- NIOSH creates a **coordinated emergency preparedness and response program** to improve its ability to respond to future emergencies and disasters.
- NIOSH assumes the role of **compensation analysis and support** from HHS in response to the Energy Employees Occupational Illness Compensation Program Act of 2000.

2002

- NIOSH scientists publish their research findings about a new lung disease found in workers at a series of microwave-popcorn plants (***Identification of Flavoring-Related Lung Disease***), giving comprehensive recommendations for preventing similar deaths.

2003

- ***eNews***, the NIOSH monthly newsletter, debuts.
- **Steps to a Healthier U.S. Workforce Initiative** is launched. This later became the **Total Worker Health™ (TWH) program**.

2004

- **Research to Practice (r2p)** initiative is established to speed the adoption of new research findings into practice to benefit workers.
- **Nanotechnology Research Center** established.

2005

- NIOSH gives technical and humanitarian help after **Hurricane Katrina**.
- "Hot spots" of rapidly progressive **coal workers' Black Lung** in the U.S. are identified.

2006

- NIOSH funds **Total Worker Health™ Centers of Excellence.**
- After Sago mine disaster, the MINER Act calls for NIOSH to **conduct mining research**.

2007

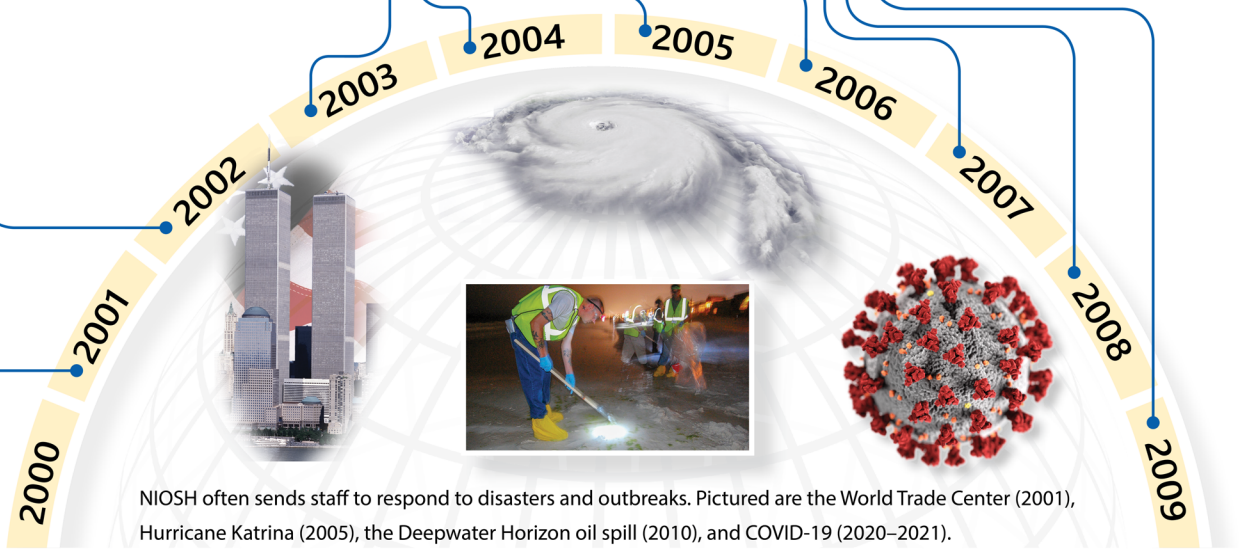
- **NIOSH Science Blog** debuts.

2008

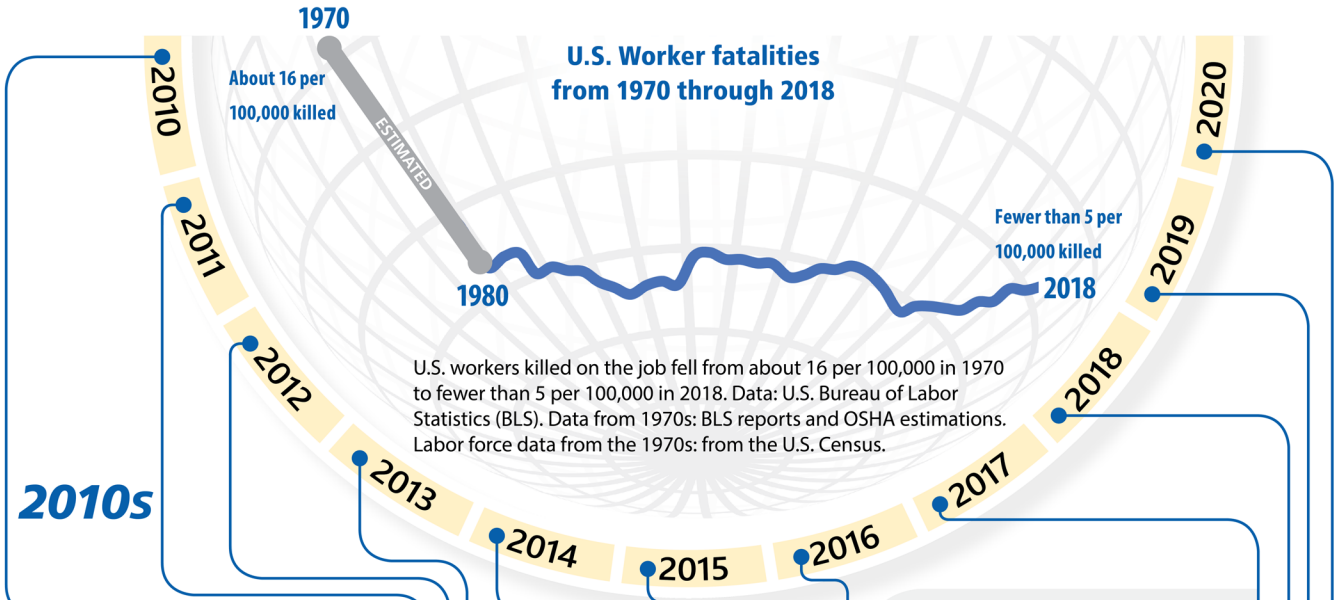
- NIOSH-developed **Coal Dust Explosibility Meter** released to allow mines to measure and remediate areas that need to be treated with rock dust to cut down on their explosibility.
- NIOSH jumps into social media by establishing its **Facebook page**.

2009

- **A new sizing structure** for fall arrest harnesses to better fit the diverse sizes and shapes of construction workers is released.
- NIOSH publishes ***Approaches to Safe Nanotechnology***, the first risk management guidance document on safe handling of engineered nanomaterials to compile information about hazard, exposure, and controls.
- Oversight of the **World Trade Center Health Registry** is moved to NIOSH.
- NIOSH responds to **2009 H1N1 influenza** pandemic.
- NIOSH expands social media presence by **joining Twitter.**



NIOSH often sends staff to respond to disasters and outbreaks. Pictured are the World Trade Center (2001), Hurricane Katrina (2005), the Deepwater Horizon oil spill (2010), and COVID-19 (2020–2021).



2010

- NIOSH gives technical assistance for responder safety and health in the **Deepwater Horizon** oil spill containment and cleanup.
- **Center for Motor Vehicle Safety** established.
- **Prevention through Design (PtD)**: ***Plan for the National Initiative*** published. PtD was noted as the best way to prevent occupational injuries and illnesses.
- New occupational health hazard, **Indium Lung Disease,** identified.

2011

- James Zadroga 9/11 Health and Compensation Act of 2010 signed into law 1/02/2011, creating the **World Trade Center Health Program.**
- **Emergency Responder Health Monitoring and Surveillance (ERHMS™)** framework published to help organizations monitor the health and safety of emergency responders.
- NIOSH research and assistance enables ILO standards for using **digital chest radiographs** in worker screening programs.

2012

- Start of the **National Campaign to Prevent Falls in Construction**.

2013

- First mobile application released, **Ladder Safety App**.
- **Occupational Exposure to Carbon Nanotubes and Nanofibers** CIB released.
- **Center for Workers' Compensation Studies** begins.

2014

- NIOSH staff respond to the **Ebola epidemic.**
- **Safe Skilled Ready Workforce program** launches.
- **Center for Direct Reading and Sensor Technologies** created.
- **NIOSH Instagram** launched.

2015

- **National Center for Productive Aging and Work** created.
- **Center for Maritime Safety and Health Studies** established.

2016

- **"Emission of Particulate Matter from a Desktop Three-Dimensional (3D) Printer"** publishes.
- Criteria Document on **diacetyl and 2,3-pentanedione** sets a diacetyl recommended exposure limit.

2017

- Award-winning video highlights NIOSH research with the **ambulance industry** to increase ambulance safety through standards.
- **Center for Occupational Robotics Research** established.

2018

- ***Chemical, Biological, Radiological, and Nuclear (CBRN) Respiratory Protection Handbook*** to guide respirator selection and use is published.
- New tools developed to help identify dampness/mold in schools and buildings.

2019

- **Commercial Fishing Occupational Safety Research and Training Program** established.
- **Center for Work and Fatigue Research** established.
- National **robotics research** funded through partnerships.

2020

- NIOSH responds to the **COVID-19 pandemic**. It is the longest response activation in NIOSH history.
- **National Firefighter Registry** aids studies of possible links between firefighter exposures and cancer.

Timeline by John Lechliter/NIOSH

Impact of Institute Saves Lives, Protects Workers

NIOSH in Action

By CHERYL HAMILTON

NIOSH serves U.S. workers, first responders, employers, and health and safety professionals in impactful and effective ways. Different from other federal agencies, NIOSH performs research to help keep workers safe and healthy. This includes specialized research programs and widely distributed publications for U.S. workers. NIOSH expertise helps serve those who have sacrificed while working to serve others. The institute protects and serves in times of natural disasters, viral outbreaks, and domestic and international threats. NIOSH touches the daily lives of U.S. workers through continual and extensive outreach, as well as with technology that fits in the palm of their hands. Science-based, evidence-based, and action-based—NIOSH serves workers and those who employ them.

1 Protecting First Responders and the U.S. Workforce

NIOSH sharply focuses on making PPE more effective

In 1999, NIOSH was asked, through a Senate report, to protect workers who wear personal protective equipment (PPE) when responding to terrorist attacks. Today, NIOSH achieves this and more, serving more than 20 million U.S. workers across multiple sectors in emergency response, healthcare, mining, fire fighting, and public safety.

Photo by NIOSH

NIOSH tests a PPE ensemble to protect against Ebola.

Photo from Public Health Information Library

NIOSH staff worked alongside CDC staff as they investigated cholera cases after Hurricane Matthew in 2016.

In its work, NIOSH conducts field and laboratory research, develops guidance and consensus standards, and provides factsheets and other tools for workers and employers to optimize their use of personal protective technology (PPT).

Within NIOSH is the Personal Protective Technology Program, which includes the NIOSH Respirator Approval Program. This cutting-edge program is responsible for testing and approving of respirators used in workplace settings. The program ensures that respirators employed by the U.S. workforce meet minimal requirements to protect workers. Webpage visitors can look up respirators by manufacturer, model number, and other details. The Respirator Approval Program conducts hundreds of respirator approval decisions each year, completing almost 600 in 2017 alone.

In 2012, NIOSH released an informational PPE database, PPE-INFO. This database gives those who make, buy, or use PPE a way to research federal standards, PPE product types, specific occupations, conformity assessment standards, and other vital PPE information. The impetus behind this database was a recommendation by the Institute of Medicine that NIOSH become a "clearinghouse for reliable information on non-respirator PPT." This information helps ensure that when protective equipment is made and then used, it works.

During the COVID-19 pandemic, NIOSH has shared valuable resources that the U.S. workforce relies on. In 2020, NIOSH webpages, such as the recommended guidance on the extended use of N95 respirators, have received millions of page views.

NIOSH Health Hazard Evaluation Program probes work site hazards

One NIOSH program about as old as NIOSH is the Health Hazard Evaluation (HHE) Program. When the OSH Act of 1970 was passed by Congress, representatives wanted NIOSH to be able to investigate workplace hazards: the HHE Program fulfills this goal. Once a request is received by the HHE program, it goes through a triage process that prioritizes requests. This allows routine questions to be answered through communication and consultation, while higher priority requests can receive more immediate action.

Many aspects of fighting fires pose dangers to firefighters. At right, Air Force firefighters test a high-pressure fire hose that sprays a mist intended to cool the gas surrounding the flames. NIOSH research supports the safety of all firefighters.

Photo from Public Health Information Library

During an evaluation, NIOSH staff, including industrial hygienists, physicians, and epidemiologists, may observe work practices, collect samples, interview workers, perform medical tests and physicals, and review pertinent documentation such as injury logs, test results, and facility safety procedures. The results are compiled into a final report, which is published and available to the public. Along with workplace evaluations, HHE Program staff are involved in consulting, training, and providing technical assistance, as well as hazard surveillance and injury prevention research. They also engage in emergency response efforts, such as those for the 9/11 terrorist attacks, the Deepwater Horizon oil spill, natural disasters, and the COVID-19 response.

The first HHE, in March 1970, was at the Sager Glove Corporation in Murray, Kentucky. The request came from Kentucky's Occupational Health Program and involved employees' exposure to asbestos. Since that time, the HHE Program has received more than 17,000 requests and provided almost 3,400 final reports.

Photo from Public Health Information Library

NIOSH Health Communication Specialist Elizabeth Dalsey interviews members of a CALFire crew of young Hispanic firefighters at the French Fire, in the Sierra National Forest, in Madera County, California.

NIOSH investigates firefighter fatalities

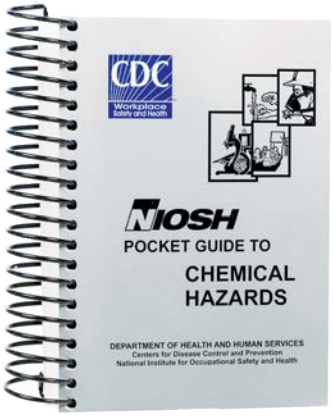
The Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) was started through an Act of Congress in 1998 to investigate line-of-duty firefighters' deaths. Like the HHE Program, FFFIPP strives to characterize line-of-duty deaths and recommend health and safety actions, with no enforceable regulatory role. Through the information and recommendations presented in the final report, lives can be saved. About 80–90 firefighters die each year while on duty. Since 1998, FFFIPP has investigated more than 700 firefighter deaths, which is about 40% of all line-of-duty firefighter deaths.

2 Researching Standards That Keep Workers Safe

NIOSH Pocket Guide gives information on chemical hazards

Decades ago, NIOSH partnered with OSHA to form the Standards Completion Program to develop occupational health standards for substances with OSHA permissible exposure levels (PELs). In 1974, the Standards Completion Program published about 380 draft standards with information adopted by OSHA to use in occupational health regulations.

The NIOSH Pocket Guide to Chemical Hazards (NPG) was created as a place to keep this technical information, making it widely available to employers, employees, and those in occupational safety and health fields. The name "pocket guide" was given because the first guide was small enough to fit into the pockets of firefighters and others who used it in the field. The information inside is drawn from many sources, including criteria documents, Current Intelligence Bulletins, and professional sources in analytical chemistry, toxicology, and occupational medicine.



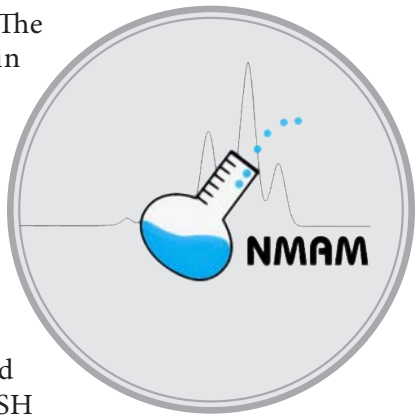
The NPG overflows with critical information. Displayed in easy-to-read tables are chemical names, structures, and formulas, industry numbers, synonyms and trade names, conversion factors, exposure limits, and chemical and physical properties. Readers can also find IDLH (immediately dangerous to life and health) concentrations, physical descriptions, incompatibilities and reactivities, measurement methods, signs and symptoms of exposure, personal protection, first aid, and respiration selection.

NIOSH periodically adds more chemicals to the NPG or updates recommended exposure limits (RELs) and other information, including recommended practices. The first printing of this popular guide was in 1978, and several more editions have followed. The guide currently has almost 700 chemicals and substance groupings. In 2019, the NPG webpage had more than 236,000 views.

The newest addition to the NPG family is the *NIOSH Pocket Guide to Chemical Hazards* mobile app. The app, which can be used offline, has been downloaded more than a million times.

NIOSH Manual of Analytical Methods sets procedures

NIOSH is tasked with keeping workers safe, and the *NIOSH Manual of Analytical Methods* (NMAM) helps do just that. First published in 1974, NMAM contains more than 300 methods for sampling and analyzing workers' blood and urine, along with surfaces and workplace air, to evaluate for contaminant exposure. This monitoring is crucial, because if workers are exposed to unsafe contaminant levels, steps can be taken to protect them. The methods within NMAM come from NIOSH researchers and their partners. A number of commercial test kits have been developed based on NIOSH methods. Using the standard methods in NMAM provides consistency and accurate, reliable results.



Since 1974, NMAM has been updated through five editions and three supplements. The fourth edition in 1994 was the last print copy; NMAM is a living document now published only online. Publishing electronically makes it possible to add new methods as they are validated, along with re-evaluating and modifying existing methods. Searching by chemical name, by CAS number, and by method number is easier and faster. Other NMAM chapters include information on quality assurance, portable instrumentation, sample collection, method evaluation, aerosols, biological monitoring, and special measurements, as well as a new chapter on filter pore size.

NMAM is widely used worldwide. It is an invaluable resource for those in occupational safety and health professions who serve the U.S. workforce. NMAM is consistently one of the most often viewed and downloaded NIOSH documents.

3 Supporting Workers Through Programs and Deployments

Legislation gives NIOSH a role to aid the compensation of energy workers

The Energy Employees Occupational Illness Compensation Program Act (the Act) was passed by Congress in 2000. The purpose of the Act is to compensate and provide medical benefits to current or past atomic weapons workers of the Department of Energy (DOE) who developed certain illnesses, such as cancer, possibly caused from workplace exposures. NIOSH formed a division in 2001 to perform dose reconstructions and other associated tasks. Dose reconstruction is a method to estimate job-related radiation exposure. It may include gathering worker and worksite information, using sampling data, and determining radiation sources. The process

The Energy Employees Occupational Illness Compensation Program Act was passed by Congress in 2000. The Act prescribes ways to compensate and provide medical benefits to current or former atomic weapons workers of the Department of Energy who develop certain illnesses, such as cancer, possibly caused from workplace exposures.

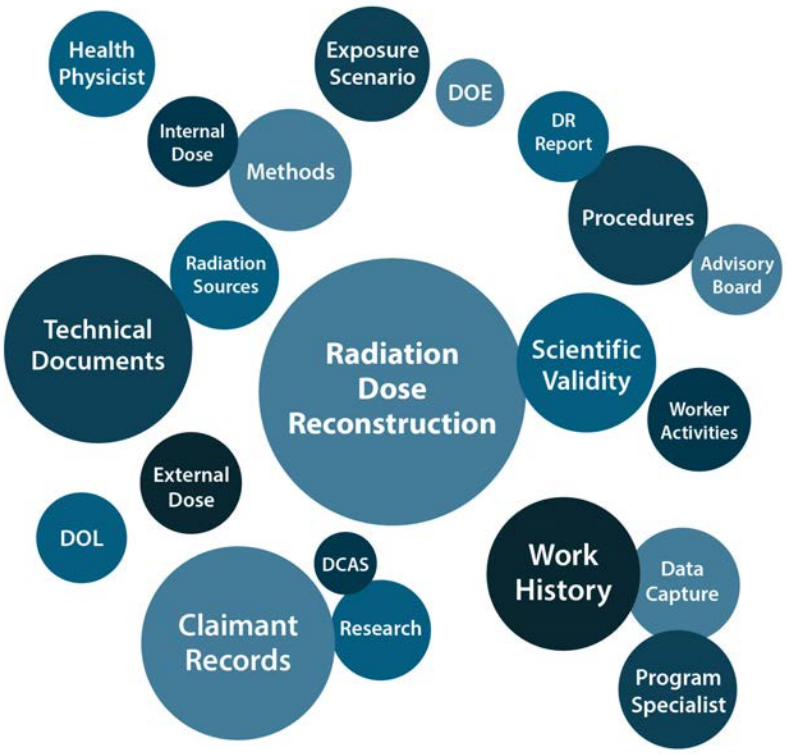


Illustration by NIOSH

Photo by NIOSH

Within days of the September 11 terrorist attacks at the World Trade Center, NIOSH staff arrived at the scene to monitor and assist workers who participated in the massive clean-up efforts. Pictured is biomedical engineering tech Donald Booher.

can also involve reviewing incident reports, medical tests, technical documents, facility (worksite) records, and interviews.

NIOSH developed the dose reconstruction process and the guidelines to determine the Probability of Causation, which is the likelihood that the worker's illness was caused by workplace radiation. The U.S. Department of Labor grants compensation to the worker, or if deceased, their family, if the probability is 50 percent or greater that the cancer came from workplace exposure.

NIOSH works to complete each dose reconstruction within 5 months or less, and that goal is met 90% of the time. NIOSH has completed more than 53,000 dose reconstructions.

NIOSH responded early in 9/11 aftermath, and continues today

This year the United States will remember the 20th anniversary of the 9/11 terrorist attacks. Soon after the attacks in 2001, CDC and NIOSH set up the World Trade Center (WTC) Health Registry, a voluntary registry to monitor

Photo by Pete Souza/White House

In 2011, President Barack Obama signs the legislation creating the World Trade Center Health Program.

health effects of people who lived, went to school, or worked near the WTC area. CDC and NIOSH also funded after-disaster activities such as medical treatment, health screenings, and medical monitoring.

In 2011, the James Zadroga 9/11 Health and Compensation Act of 2010 (the Act) was passed by Congress and signed into law by President Obama. The Act established the WTC Health Program, which gives medical care, monitors health effects, and compensates 9/11 responders, volunteers, and other survivors from all locations,

including New York City, the Pentagon, and Shanksville, Pennsylvania. In 2015, the WTC Health Program was reauthorized for another 75 years.

Who was James Zadroga? He was a New York police detective who participated in rescue efforts in the weeks following the September 11, 2001, terrorist attacks. He died in 2006, at 34 years old, from a respiratory illness caused from breathing in the toxic dust at Ground Zero. Detective Zadroga is reported to be the first person to die as a result from inhaling the toxic dust. The WTC Health Program currently has more than 105,000 members; almost 80,000 are first responders and about 26,000 are survivors. Its services are provided at no cost to members for certified 9/11-related illnesses that range from asthma and mental health disorders to cancer. The Act also funds ongoing research and the WTC Registry. In 2019, the WTC Health Program webpage received almost 80,000 page views.

James Zadroga

Photo by NIOSH

NIOSH staff stand just inside the NIOSH Safety Research Coal Mine and Experimental Mine complex, at the Pittsburgh campus.

NIOSH leads federal mine safety research

The U.S. Bureau of Mines (USBM), in the Department of the Interior, was established in 1910, largely because of the hundreds to thousands of workers dying in mines each year. The USBM objectives focused on safe blasting, gas and dust explosion prevention, and post-disaster management.

The Federal Coal Mine Health and Safety Act of 1969 shifted the focus to include health and safety research, with an aim to end hazards in mining, including respirable dust and harmful noise. In the 1970s, USBM transferred many of its roles to other agencies, and in 1996, Congress voted to close USBM. Some functions of the USBM ended, while others were transferred to other agencies. In 1997, the USBM's Health and Safety Research Program, in Pittsburgh and Spokane, transferred to NIOSH.

Although focused on mining, sectors often overlap, and contributions to mining have directly benefited other sectors, including construction.

The NIOSH Mining Program aims to eliminate injury, illness, and death in the mining industry.

NIOSH develops tools for monitoring hazardous dust in coal mines

NIOSH has unique simulators and testing facilities, including a 32-foot mobile laboratory where NIOSH staff evaluate workers' hearing on-site. In 2012, they developed the Coal Dust Explosibility

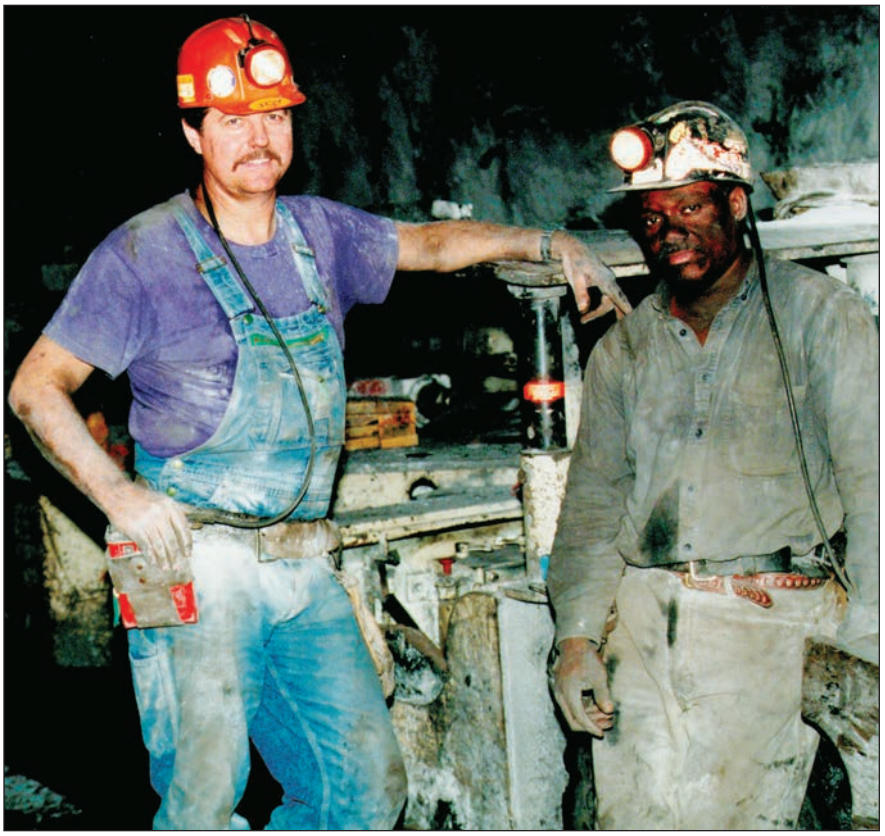


Photo from MSHA.gov

The Federal Coal Mine Health and Safety Act of 1969, amended in 1977, established the Coal Workers' Health Surveillance Program.

Photo by NIOSH

The Coal Dust Explosibility Meter.

Meter (CDEM), which won the "People's Choice" Health and Human Services award for innovation and the R&D 100 Award for Innovation in Technology. The device measures the explosibility of rock dust in mines, allowing miners to take action to lessen the hazard.

NIOSH conducts field and laboratory research in many areas, which includes a thermal chamber that simulates the effects of heat and humidity on workers. Focusing on miner health, the Miner Health Program works with the mining community to improve the lives of the miner worker population.

The Federal Coal Mine Health and Safety Act of 1969, amended in 1977, established the Coal Workers' Health Surveillance Program (CWHSP).

Available to all coal miners, the program researches respiratory diseases related to coal mine dust exposure with a goal of early detection and treatment of lung diseases, including black lung (pneumoconiosis).

Through the program, coal workers go to local health facilities or NIOSH mobile units for free lung function testing and other health and respiratory screenings.

Researchers use the data to monitor lung disease trends.

Photo by NIOSH

An LED cap lamp was developed in 2012 by researchers at the NIOSH Office of Mine Safety and Health Research.

Photo by NIOSH

NIOSH staff in protective gear work at an emergency response exercise.

4 Standing Up in National Emergencies

NIOSH answers the call when emergencies strike

NIOSH responds to natural and national emergencies through the Emergency Preparedness and Response (EPR) Program. NIOSH is also often called to support responses with other federal agencies, such as CDC, OSHA, and FEMA. The Emergency Preparedness Response Office (EPRO) coordinates much of this work with other agencies and NIOSH programs, including staff deployment.

EPRO's mission is to protect the health and safety of all emergency and recovery workers. NIOSH EPR initiates and participates in preparedness training to assist local governments to be ready for the next disaster. After the 9/11 attacks, EPR developed the Emergency Responder Health Monitoring and Surveillance (ERHMS) framework, which tracks emergency responders through pre-deployment, deployment, and post-deployment.

Photo from Public Health Information Library

A NIOSH researcher investigates mold presence inside a home that had been flooded by Hurricane Katrina in 2005.

In 2018, an independent panel assessed EPR on certain areas of emergency preparedness and response, including the ERHMS framework. EPR received the highest possible scores for both relevance and impact.

Through the decades, NIOSH has provided technical assistance and personnel to many national and international events, including the Exxon Valdez oil spill, World Trade Center attacks, West Nile Virus, Anthrax attacks, major hurricanes, H1N1 Influenza Pandemic, Japan Earthquake and Tsunami, MERS-CoV, Deepwater Horizon Oil Spill, Ebola, Zika, and, of course, the COVID-19 pandemic.

NIOSH has learned much from responding to disasters and public health emergencies. During and after an event, the Disaster Science Responder Research (DSRR) Program conducts occupational safety and health research, to study aspects like the impact of an event, severe health effects, and the influence of certain interventions. For example, during COVID-19, DSRR is currently researching critical areas such as engineering controls to reduce exposure risk, mental health outcomes, and SARS-CoV-2 transmission.

5 NIOSH Shares What it Has Learned

The *NIOSH Science Blog* sparks discussions about work

The *NIOSH Science Blog* was introduced in late 2007, not just as a way to share information, but also to spark discussions about NIOSH's work. At its introduction, the *Science Blog* was one of many ways that NIOSH reached out to communicate with the public. Each blog post highlights current NIOSH work and accomplishments, be it in areas of research, events, publications, or recommendations.

The *NIOSH Science Blog* doesn't communicate in just one direction—blog posts generate interest in the scientific and lay communities who can respond and comment on every blog post. The *Science*

Photo by NIOSH

Crude oil is contained by barriers during the Deepwater Horizon spill.

Blog is another channel that demonstrates the real difference that NIOSH makes in the everyday life of workers.

So far, 676 blog posts have been published, with these posts inspiring almost 9,500 comments. Now, that is a dialogue! Most of these posts are written by NIOSH researchers, although occasionally guest writers contribute posts.

And the *NIOSH Science Blog* is popular. In 2020, the Science Blog was viewed more than 1,700,000 times. This is a 325% increase over 2019. One of the most viewed blogs in 2020 was about respirator use and was written in Spanish—the first time a Spanish blog was in the top five. From its beginning, through the end of 2020, the *Science Blog* has been viewed more than 5.6 million times.

Interested in learning about NIOSH and the impactful work that is done every day? Head on over to the *NIOSH Science Blog*—and tell your friends. Written in plain language, the blog will interest you, excite you, teach you, and perhaps change the way you think about certain occupational topics.

Mobile apps empower users to benefit from NIOSH data

NIOSH has released nine mobile applications since 2013. The most recent, the NIOSH PPE Tracker Mobile App, was created in response to the COVID-19 pandemic. The app gives those working in healthcare and nonhealthcare settings a way to track their personal protective equipment (PPE) inventory use. Like the NIOSH PPE burn rate calculator webpage, the mobile app records different types of PPE and calculates how fast it is being used. With other features such as inputting the number of patients, adding restock, and downloading data into reports, the NIOSH PPE Tracker App makes it easier for inventory managers and others to work on the floor and not at their desks.

As mentioned in the NPG section, the NIOSH Pocket Guide to Chemical Hazards (mNPG) Mobile App offers

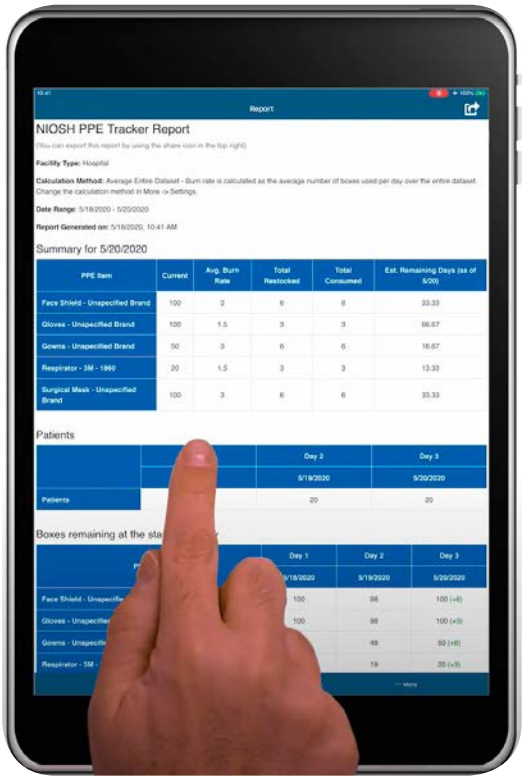


Photo by NIOSH

Mobile apps like the NIOSH PPE Tracker put NIOSH research and data into the palms of workers and safety professionals.

much the same chemical information as in the guide, with in-depth information about workplace chemicals. Available data include chemical synonyms and trade names, properties, as well as exposure limits and PPE recommendations. Users can customize how the data appear and can save records for later access. To date, the app has been downloaded more than 135,000 times.

The award-winning Ladder Safety App was NIOSH's first mobile app. The Ladder App is designed to improve ladder safety, a major concern for those working in construction and other industries where ladders are used. Besides measuring ladder angles, the app also has interactive guides, training, and other resources. The Ladder Safety App is used in some companies' safety programs. It has been downloaded more than 400,000 times.

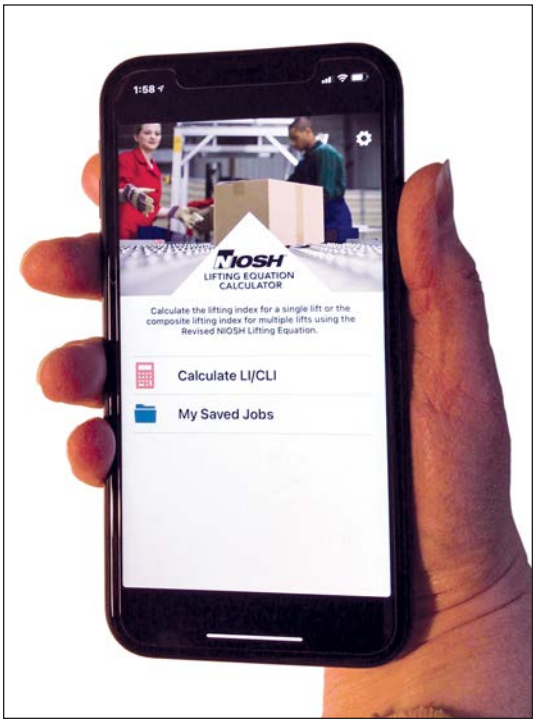


Photo by NIOSH

The NIOSH Lifting Equation (NLE Calc) App helps workers avoid musculoskeletal injuries.

The ErgoMine Audit Tool App is an ergonomics audit tool for the mining industry.

Workers and others can conduct various types of audits for jobs done in surface mining and at processing facilities. Using answers to the audit questions, the app recommends ways to improve the ergonomics of the task. Mine workers do not have to be experts to use the audit tool but can share their findings to help reduce ergonomic stresses on the jobsite.

The NIOSH Lifting Equation (NLE Calc) App helps protect workers from musculoskeletal injuries. With it, workers can calculate their overall risk while doing manual lifting. The app is based on the Revised NIOSH Lifting Equation (RNLE) and works by calculating the CLI (composite lifting index). Those who do manual lifting, such as in construction, healthcare, and manufacturing, can benefit from using the app.

Heat stress can cause illness and death—workers need to be protected. The OSHA-NIOSH Heat Safety Tool app gives visual information on the current heat index, with OSHA and NIOSH recommendations for those working in the heat to stay safe. The app can be edited to location conditions and offers symptom and first aid information, along with other features. The Heat App has been downloaded over one million times, making it one of NIOSH's most popular apps.

Developed by hearing loss experts and acoustic engineers, the award-winning NIOSH Sound Level Meter (SLM) App gives workers and others sound metrics found in professional sound equipment. In 2019, the NIOSH Sound Level Meter App webpage received almost 70,000 page views. The app is a tool for workers to learn about the noise in their workplace, but also can be used by safety professionals to collect noise data and promote hearing protection efforts.

Photo by NIOSH

The ErgoMine Audit Tool App gives data to improve ergonomics at mining sites.

Photo from Public Health Information Library

This photo from 1974 shows the building at 1014 Broadway in Cincinnati, which housed NIOSH laboratories.

Long Careers Spent in Service to Worker Safety and Health

NIOSH Longtimers Recount Years Past

By SELEEN COLLINS

In its earliest years, NIOSH sought to fill its rosters with established experts as well as promising young scientists just setting out at the brink of their careers. Although NIOSH might not have been on their radar, they were excited to learn about the institute's mission and become a part of it. Many have spent their careers serving the institute, workers, and employers. Here are some of their stories.

Getting started in the early years of NIOSH

Frank Hearl didn't plan to stay when he arrived at NIOSH in the early 1970s. He had a fresh degree in chemical engineering from Purdue University and was hoping for a position with another agency. During the previous summer he had worked in COSTEP, the Commissioned Officer Student Training and Extern Program, for the National Institutes of Health (NIH). There he enjoyed working on a pharmacokinetic modeling project, and he set his sights on returning to it.

"I thought that applying chemical engineering principles to model the human body was very cool, and I wanted to come back," he says. "However, when I graduated, there were no positions at NIH. Since I was already in the U.S. Public Health Service (PHS) personnel system, it was easy for NIOSH to reactivate my commission and hire me." Hearl accepted a position in

> *I had the intention of working my way back to pharmacokinetics, (but) I found that NIOSH's mission was pretty cool, too. ... So here I am, 46 years later, still with NIOSH.*
>
> ***—Frank Hearl***

Morgantown, WV, on a project that involved testing and certifying gas detector tubes. The year was 1974; Dr. Marcus Key was in place as the first NIOSH director; and Richard Nixon was president.

"I had the intention of working my way back to pharmacokinetics, (but) I found that NIOSH's mission was pretty cool, too," Hearl says. "So here I am, 46 years later, still with NIOSH."

In the summer of 1971, **David Sundin** had just earned a degree in mechanical engineering at the University of Wyoming. NIOSH was eager to hire engineers and PHS workers for its fledgling operations, and Sundin landed a job over the phone.

"My first assignment was writing scope-of-work documents for various contracts to develop protective equipment. We were in a building at 1014 Broadway (in Cincinnati), which has since been demolished. After a short period, I transferred to another division, with the opportunity to travel and conduct workplace surveys."

Sundin recalls being involved in interesting field studies at government facilities such as the Bureau of Printing and Engraving, the U.S. Mint, federal penitentiaries, and border crossings. He also conducted heat stress surveys in the steam tunnels under the streets of Washington, D.C. "People asked me why I would want to work for the government," Sundin said, "and I was always proud to describe to them the mission of conducting research and field investigations to protect worker health and safety."

NIOSH, along with its workers, was on the move

Paul Schulte arrived at NIOSH in 1975. He had never heard of NIOSH until his academic advisor was hired as a consultant and helped him come on board. "NIOSH was creating new standards for chemicals, and I worked as a consultant, producing CDs (Criteria Documents)," he says. "When they decided to bring this work in-house, I became a federal worker. My father had instilled in us the need to contribute to society, and I always felt fortunate that I was able to contribute to the safety of workers."

In Cincinnati, NIOSH had offices in the Post Office Building on Fountain Square but moved them in the late 1970s to the Federal Building across the street. Schulte remembers that everyone simply piled their things on carts. "We just rolled them through an underground tunnel beneath Sycamore Street and up to the 9th floor."

Photo from the Library of Congress

An early location for NIOSH in Cincinnati was in the Potter Stewart U.S. Post Office and Courthouse, near Fountain Square in Cincinnati.

Things were simpler then, but not easy. By the 1980s, Schulte worked in the NIOSH Taft Laboratories building, east of downtown. He was working part-time, studying for a doctoral degree at the University of Cincinnati, and remodeling a house. He shuttled back and forth in his old car, which in its early life had been a Checker cab. Sometimes he wished it still had a cabbie behind the wheel.

Marie Sweeney also remembers the move out of the Post Office Building. "We were in tiny cubicles and people had so much stuff stacked up on the floor. It was absolute chaos to box up everything. Once we got up to the big (new) office, we discovered that the furniture was just all piled up and you couldn't get in."

Sweeney has spent almost all of her working years at NIOSH. She has worked since 1977 as an epidemiologist, except for 3 years serving at the U.S. Embassy in Hanoi as the health attaché to Vietnam for the U.S. Department of Health and Human Services (HHS). She now heads the Health Informatics Branch.

"In Hanoi, I met people from CDC and HHS and came to understand the breadth of what we do," she says. "Lots of workers were young, and they wanted to do the best they could do. NIOSH was brand new and not as procedure driven."

Sweeney remembers that there was a little more freedom to do things, with less direction. "I would go out in the field after about 10 minutes of instruction. Clerks basically did all the epidemiology paperwork, and binders were stacked everywhere; it was all paper-driven at that point."

Scientists wrote reports with pens and pencils, and secretaries prepared them on typewriters. Materials for slide presentations had to be typed and then taken to a photographer, who would make the slides. "If you found a typo, you had to start the process all over again," she recalls.

> *"In Hanoi I met people from CDC and HHS and came to understand the breadth of what we do. ... Lots of workers were young, and they wanted to do the best they could do. NIOSH was brand new and not as procedure driven."*
>
> ***—Marie Sweeney***

Following a new game plan leads to a career at NIOSH

Pete Kovalchik played soccer for the University of Pittsburgh in Johnstown but never went to class. His parents were none too happy with the outcome, so he scrambled to come up with Plan B: earning an associate's degree in electronics. At that point, he could not have dreamed of a 40-year career in mining systems safety. But while working on a contract at Carnegie Mellon University, he got to know people at the Bureau of Mines, which proved providential. "I accepted a job as an electronic technician with the bureau in 1978, but it took a year to come on board. Even back then, the hiring process was long."

The Bureau of Mines offered to let Kovalchik work part-time so that he could return to the University of Pittsburgh to earn his bachelor's degree. However, because of his academic record there, he had to clear some hurdles before he was admitted. "They took a chance on me," he explains, "and within 3 years I had my bachelor's (in 1983)." When the Bureau of Mines became part of NIOSH in 1996, he was excited about opportunities to work his way into management, such as serving a lengthy detail as a team lead. "It was hard to explain to my wife that I had to go back to a lower pay grade afterward," he admits, "but I really enjoyed my work and wanted to stay at NIOSH." Kovalchik earned funding for a hearing loss research project, which led eventually to a new program. In 2012, the former collegiate soccer player became chief of the Electrical and Mechanical System Safety Branch, and he has led the Mining Systems Safety Branch since 2020. When he earned the James P. Keough Award in 2018 for outstanding service in OSH, his colleagues congratulated him with a trophy he treasures: a bobblehead of his likeness, wearing Pittsburgh Steelers fan gear.

Courtesy Photo

The "Kovalchik trophy."

Bill Murphy, a research physicist in Cincinnati, is also concerned with protecting workers' hearing. He now leads the Hearing Loss Prevention Cross-Sector Council but came to NIOSH by accident. In 1992 he was finishing his doctoral degree in physics at Purdue University and wanted to teach, but he became aware that he was qualified for other jobs. "I got a letter from NIOSH and was being actively recruited by other companies. The day before a hiring freeze, NIOSH called and offered me a job, but I had to decide right away. I said 'Well, I need to think about this.' So I paused briefly and then said 'Okay!'" He started working 4 days after defending his dissertation and immediately started applying his skills and knowledge to research projects.

Jobs and technology evolve as the years pass by

Many employees saw their relatively small roles grow into large contributions over the years. Likewise, they watched

Photo from USA.gov

Paper file storage and early computing required vast spaces, similar to this federal office.

paper-driven work processes give way to technologic efficiency that fueled scientific advancements. As the institute grew, however, dedication to its mission remained a common thread that prompted employees to spend their careers at NIOSH.

Marilyn Fingerhut, for example, came on board in the first year of the Public Health Service Traineeship in Epidemiology, in 1980. She went on to roles such as NORA Coordinator, working closely with two NIOSH directors (Dr. Linda Rosenstock and Dr. John Howard) on global activities and international issues. "When I was helping Director Rosenstock set up her D.C. workplace, where space was really limited, some of my colleagues and I ended up having desks in a large chemical storage room—if you can imagine that," she relates. Although the chemicals were sealed in containers, they decided to ensure that no one would be at risk. "We had to have someone from the hazard evaluation team come check it out."

In 1981, Fingerhut served with members of other agencies on a White House task group on Agent Orange, working to determine the harm that Agent Orange weedkillers had posed for the military during the Vietnam War. As part of these efforts, NIOSH was looking at exposures at U.S. chemical plants that produced the chemical. "We were working in the basements of these 12 plants, digging through files and papers, looking at workers' assignments and job titles to determine exposure," she explains. There was no easy way to make copies, so it was an immense, time-consuming task.

> *"... Some of my colleagues and I ended up having desks in a large chemical storage room—if you can imagine that."*
>
> ***—Marilyn Fingerhut***

Clerks and researchers spent many months working together at each site. "One plant was near Niagara Falls, and we were there in the winter," she recalls. "A huge snowstorm blew in and closed all the roads. The highway behind our little hotel had been plowed, so we decided to walk along it to view the falls. The scenery was unbelievable."

Photo from Wikimedia Commons

Niagara Falls in the 1970s, without snow and ice.

Diane Porter was looking toward the future when she came from OSHA to NIOSH headquarters in Rockville, MD, in December 1981. "I was the first person to go from a regulatory agency to the research agency," she says. "That gave me a unique perspective, and I felt I could help the institute be more relative at that time." Forty years later, she still works in the NIOSH Office of the Director, mentoring new staff and leaders on policy, budget, and legislative issues.

"I had a chance to return to D.C. in the 1990s, but my growing family kept me in Atlanta. I worked on budget, personnel, facilities; it was indoctrination by fire, because these were not things I had learned over the years. I became well versed in adding and subtracting and making sure people had jobs. Not a day went by that I didn't learn something."

Photo from Public Health Information Library

This 1976 photo shows the NIOSH Taft building in Cincinnati.

Changing, learning, and advancing as the times change

Memories of daily worklife in the institute's fledgling years are worthy of time capsules. In the 1970s and early 1980s, paper memos still filled wall-mounted mailboxes. Punch cards ran computer programs. Pets visited the offices. Coworkers met for hot meals in on-site eateries that even townspeople could enjoy (such as a German restaurant at Cincinnati's Hamilton building), long before security gates became basic necessities.

In the 1970s, thumbing through the Civil Service Register was the best way to learn about government job openings. **Tim Pizatella** had worked for several years after college in Pittsburgh, first at U.S. Steel and then at the Children's Hospital, when a family friend suggested he check out the register. His research led to a job at NIOSH. When he was hired in 1980, at the age of 25, he was the youngest person in the Division of Safety Research. Now he is the division's longest-tenured member and is deputy director.

"It has been gratifying to have an opportunity to have an impact on safety and health and to hear about its impact from stakeholders," says Pizatella. "In the early days of the division, we didn't have a very large staff and relied on contractors. We slowly added our own engineers, statisticians, and epidemiologists to bring our research in house." As the division numbers grew, so did the extent of its publications.

"We published one of the first NIOSH alerts in the 1980s (on a robot-related fatality) and then moved on to journal articles, workplace solutions, hazard identifications, and easily digestible publications," Pizatella says. He is proud of his work on lockout-tagout procedures and the first injury-related Current Intelligence Bulletin, on injuries due to power presses. "We pay attention to getting our findings out in more useable formats now, as opposed to the numbered documents we concentrated on in the beginning."

Roger Rosa recalls hitting the ground

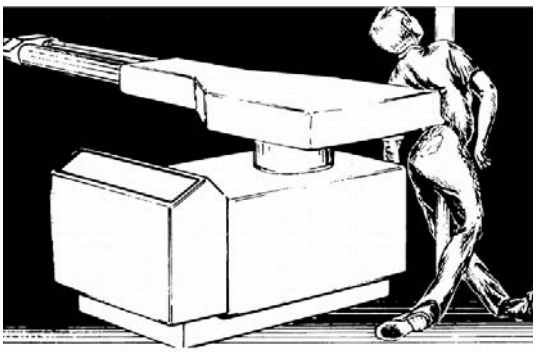


Illustration by NIOSH

This illustration is from the 1984 alert about danger from robots.

running, despite workspace limitations. In 1984 he joined NIOSH as a research psychologist, evaluating demanding work schedules and other factors contributing to sleep loss and fatigue. On the top floor of the Taft building in Cincinnati, the working quarters were close; each office had two or three researchers and labs were at the end of the hallway. He says the crowding was alleviated somewhat by pleasant views from the eastern windows, which looked over grassy fields and the Little Miami River.

"We used a network of Wang word processors and performed statistical analyses on a CDC mainframe computer located in Atlanta. The worksite test system ran on Compaq "portable" computers with 100-megabyte hard drives." Rosa says he once was allowed to lug one onto a plane as a carry-on. "And no, it didn't fit under the seat."

Steven Sauter also remembers the Wang computer terminals, which were a step up from the memory (magnetic card) typewriters in use when he arrived from the University of Wisconsin in 1985. The local networks of six or seven machines marked the beginning of NIOSH's networking capacity, although interoffice mail had not yet been deposed by fax machines or the internet.

> *... It always has been a tremendous pleasure being part of an institute that is like a family, offering support to all its members.*
>
> ***—Steven Sauter***

The institute was ahead of its time, however, in studying occupational stress in the early 1980s, Sauter says. When NIOSH recruited him from the University of Wisconsin, he was one of very few graduates trained in both psychology and occupational safety and health.

Through his work in occupational stress over 35 years at NIOSH, he helped establish the Society for Occupational Health Psychology and the Work, Stress, and Health Conference, which has been held since 1990. "NIOSH made this all possible," Sauter says, "and it always has been a tremendous pleasure being part of an institute that is like a family, offering support to all its members."

Photo by NIOSH

In 1969, the ground was broken for the ALFORD building in Morgantown, West Virginia.

> *The door used to be wide open, and WVU colleagues could walk right over.*
>
> ***—David Weissman***

This working environment appealed to **David Weissman** when NIOSH approached him about a job opening in Morgantown, WV. Now the director of the Respiratory Health Division, he recalls joining NIOSH in 1997. "I was a physician at WVU in pulmonary diseases, taking care of patients with occupational lung diseases, and was recruited by NIOSH for a medical officer opening. It has been rewarding to learn about important issues that lead to helping people and making a difference."

Weissman has studied lung cancer in workers exposed to exhaust from diesel equipment in mines, and his work in identifying the risk of beryllium lung disease led to OSHA regulations. "Exposing previously unknown diseases and addressing disease in coal miners are still a big part of what we do. We've gone from films on view boxes to transmittable electronic images, and mobile outreach now makes up 30% to 40% of our service to workers." He has watched the Morgantown campus grow from one building in 1970 to a greatly expanded one in 1996.

There are more people and there is more work, Weissman says, but also, "It is a very different world since 2001 and anthrax. In the last 20 years, we have become more conscious of security."

Making a difference for minorities in the workforce

Making a difference for minorities in the workforce has been a concern for **Vanessa Williams**, who has been with NIOSH since 1984. She started as an office assistant in her early 20s and is now the Director of Visual Communications in her division. On the day she interviewed for her first position with NIOSH, she was concerned that she didn't see anyone who was Black.

Williams notes that although her experience at NIOSH has been good, she knows that others may feel differently about their own experience. That's why she

> *Seeing Black scientists on staff and learning about the current plans for workforce (diversity) assessments and programs give me hope.*
>
> ***—Vanessa Williams***

Photo by NIOSH

NIOSH uses a mobile unit to provide health screenings for surface coal miners under its Enhanced Coal Workers' Health Surveillance Program.

Photo by NIOSH

Staff members of the Hazard Evaluations and Technical Assistance Branch (HETAB) gathered for a group photo in front of the Taft building in 1978.

has continually participated in NIOSH-wide diversity activities. In the 1990s she brought to her division director an idea for partnering NIOSH scientists with a local elementary school to introduce students to diversity and careers in STEM areas.

She also became involved with NIOSH internships offered through Project Imhotep, which helps increase the knowledge and skills of minority students in biostatistics, epidemiology, and occupational safety and health.

Although NIOSH has addressed workforce diversity in the past, this time she thinks it may be possible to look ahead toward long-term impacts. "Seeing Black scientists on staff and learning about the current plans for workforce (diversity) assessments and programs give me hope," she says. "If we're learning from where we've been and setting clear goals for what we're trying to accomplish, that gives the whole approach some credibility."

> *I used to tell people that I was married to NIOSH. People here have a loyalty not just to the mission of the agency but to their coworkers.*
>
> ***—Diane Porter***

Diane Porter remembers being the only woman in the room at leadership meetings. She tells of one particular meeting to which a facilitator had been invited. "I was used to expressing opinions privately to the director and my close colleagues," she explains, but she was surprised when the facilitator asked for her thoughts during the meeting. Her comments were met with vehement pushback from a male colleague, who questioned whether she should have a voice. "My other male colleagues rallied around me afterward," Porter relates, "and their support helped foster a change in the culture."

Marie Sweeney describes her own experience as a woman working at NIOSH. At the beginning of her career, there were no women in senior leadership positions. "I never felt that my access to training or positions was held up because of being female."

Sweeney felt that NIOSH gave everyone who took the initiative, including women, a chance to progress, grow into higher positions, and take on greater responsibility. "By the early 1990s into the 2000s, all the branch chiefs and the deputy and director were female," she says. "It went full circle."

Marilyn Fingerhut is pleased to note that now there are many women in high leadership roles. "Back in the day, when I started, almost everybody in a supervisory position was a man," she says.

Longtime employees reflect on what it means to work at NIOSH

Many long-time NIOSH staffers say they stayed because of the congenial, collaborative atmosphere. As **Diane Porter** puts it, "I used to tell people that I was married to NIOSH. People here have a loyalty not just to the mission of the agency but to their coworkers. All the teamwork—industrial hygienists, engineers, scientists, writer-editors, all working together—is what makes NIOSH unique. I'm proud of being part of that."

Bill Murphy says that a key aspect has been the ability to collaborate across industry sectors to set priorities toward accomplishing the mission of protecting workers. "The exciting part is that our research benefits people. I want to do things for people, and I think that applies to all the researchers at NIOSH."

David Weissman agrees. "Over the years, I've seen that with better information technology, it has become easier to work with groups across the institute. We have evolved and changed, adapted and modernized, so that together we have taken part in contributions that have made a difference."

"I find that NIOSH folks are some of the hardest working," says Marie Sweeney. "When I was in Sierra Leone on detail, the NIOSH people came in, rolled their sleeves up, and asked 'What can I do?' They were focused and never slacked off." In following the NIOSH mission, Sweeney says, "I don't think of it in terms of my work but teamwork."

What resonates with Marilyn Fingerhut is that "NIOSH's work illustrates what the institute has always done: the right thing. It looks at problems that need looking at."

> *When I was in Sierra Leone on detail, the NIOSH people came in, rolled their sleeves up, and asked 'What can I do?'*
>
> ***—Marie Sweeney***

Photo by CDC

Two CDC case surveillance officers walk to the local clinic in the remote village of Tongo Walla, Sierra Leone, to assess surveillance practices related to Ebola in 2016. Many NIOSH staff members deployed to Sierra Leone as part of the response.

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Research Highlights

Transfers often too late to stop black lung progression

Many coal miners with black lung disease who transferred to jobs with lower dust exposure still progressed to more severe forms of the disease, according to new research published in the journal *Occupational and Environmental Medicine*. These findings indicate that coal miners may be transferring when it is already too late to prevent the disease from progressing.

Black lung disease, or pneumoconiosis, can cause severe shortness of breath and even death. Although the scarring lung disease cannot be cured, it can be prevented by avoiding exposure to coal mine dust. Under the NIOSH-administered Coal Workers' Health Surveillance Program, coal miners receive periodic chest X-rays to identify black lung disease in its early stages, before it progresses to severe disease. Miners with evidence of black lung on their chest X-rays can exercise their "Part 90 option" to transfer to a position at the mine with lower dust exposures.

Photo by ©Tinatin1/Getty Images

Many coal miners with black lung disease who transferred to jobs with lower dust exposure still progressed to more severe forms of the disease, according to new research published in the journal *Occupational and Environmental Medicine*.

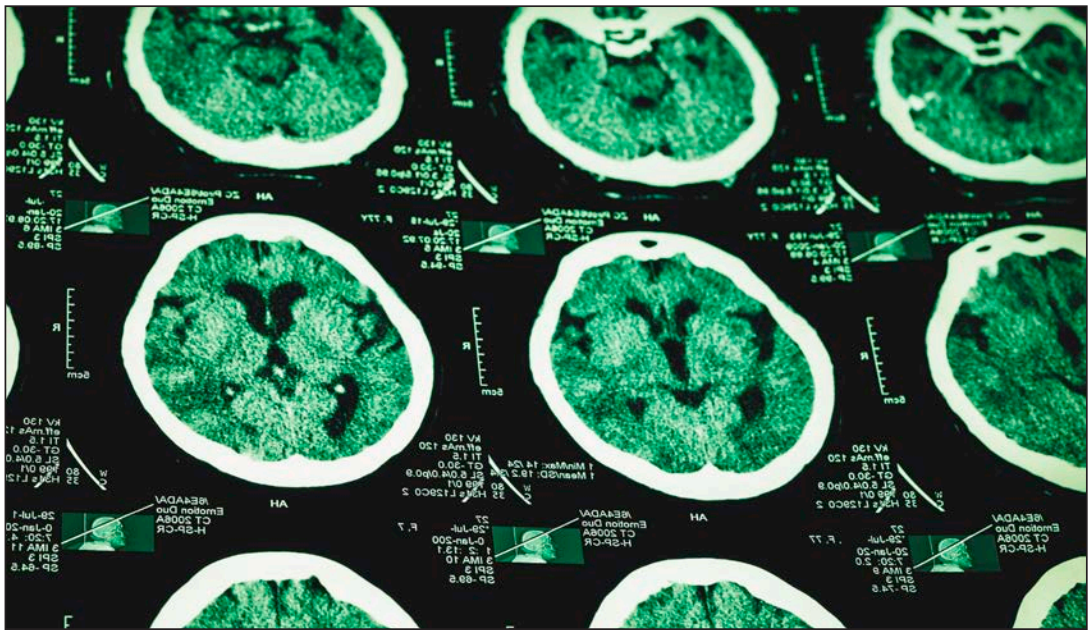

Photo by ©Bekisha Getty images

The devastating consequences of occupational traumatic brain injury prompted NIOSH researchers to conduct an analysis of work-related TBIs, which was published in the *American Journal of Industrial Medicine*.

Investigators looked at chest X-rays for 513 coal miners across the United States who transferred under the Part 90 option from January 1, 1986, to November 21, 2016. All participants received chest X-rays from the Coal Workers' Health Surveillance Program from January 1, 1981, to March 19, 2019. After transferring to a less dusty work environment, nearly a third of miners with at least two chest X-rays later developed more severe black lung disease. Compared with miners who did not develop more severe disease, these miners already had more advanced black lung disease before exercising their Part 90 option. These findings show the importance of identifying black lung as early as possible and minimizing further exposure to respirable coal mine dust.

•••

Hall NB, Blackley DJ, Halldin CN, Laney AS [2020]. Pneumoconiosis progression patterns in U.S. coal miner participants of a job transfer programme designed to prevent progression of disease. Occup Environ Med *77*(6):402–406.

Prioritizing prevention efforts for traumatic brain injuries

Traumatic brain injury (TBI) is a common occupational injury, accounting for somewhere between 20% and 25% of work-related trauma. Researchers at NIOSH are working to identify how best to focus prevention efforts for occupational TBIs. TBIs can be mild; however, some can be fatal or cause short- to long-term disability. More severe TBIs can impact a worker's ability to return to their pre-injury job and can be expensive for both workers and employers in long-term rehabilitation and disability costs. The devastating consequences of occupational TBI prompted NIOSH researchers to conduct an analysis of work-related TBIs, which was published in the *American Journal of Industrial Medicine*.

The NIOSH study used data from the Ohio Bureau of Workers' Compensation to analyze 12,891 TBI cases from 2001 through 2011. The aim was to identify which industries are at higher risk for TBI to prioritize occupational prevention efforts. Of these cases, 40%

(n = 5,171) were lost-time TBIs (meaning the employee lost 8 or more days of work). Spectator sports had the highest lost-time TBI rate (13.5 per 10,000 full-time employees), while general freight trucking had the highest number of lost-time TBIs (n = 293). Several industry groups within the construction sector also represented a large number of the top 10 rankings for lost time TBIs. The authors suggest that prevention efforts could be tailored for each industry because TBI risks vary based on the nature of work. Large, hazardous industries require comprehensive prevention programs including enforcement, outreach, and communication. A focused assessment for injury prevention would be better for groups with a low count but high rate when risk is concentrated in one area.

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Konda S, Al-Tarawneh IS, Reichard AA, Tiesman HM, Wurzelbacher SJ, Pinkerton LE, Meyers AR, Hendricks SA, Tseng C-Y, Lampl MP, Robins DC [2020]. Workers' compensation claims for traumatic brain injuries among private employers—Ohio, 2001–2011. Am J Ind Med *63*(2):156–169.

Injuries, illnesses, and deaths in wholesale and retail sector

More than 20 million workers are employed in wholesale and retail trade jobs. The vast size of the workforce means that even a small rate of injury or illness can affect large numbers of workers. In 2016, wholesale and retail workers experienced more than half-a-million injuries and illnesses and more than 450 deaths.

With scarce information on safety and health risks in retail and wholesale, NIOSH investigators reviewed Bureau of Labor Statistics fatal and nonfatal injuries and illnesses records in this sector from 2006 through 2016 to identify fatal and nonfatal injury and illness cases and incidence rates in the WRT sectors and in high-risk subsectors that pose an elevated health and safety risk.

They found a 5% higher burden of nonfatal injuries and illnesses when compared to private industry as a whole, according to the study in the *American Journal of Industrial Medicine*.

Photo by © Gorodenkoff Productions OU/Getty Images

Wholesale and retail workers had higher rates of nonfatal injuries and illnesses when compared to private industry, according to the study in the *American Journal of Industrial Medicine*.

Photo by © Anthony Boulton/Getty Images

Workplace exposures to flame-retardant chemicals may harm the health of workers, according to a recent NIOSH study.

In wholesale, high rates of nonfatal injuries and illnesses occurred in durable and nondurable goods, recycling, motor parts, lumber, metal and mineral, grocery, and alcohol merchants. In retail, high rates occurred in motor parts dealers, gasoline stations, non-brick-and-mortar stores, tire dealers, home and garden centers, supermarkets, meat markets, warehouse clubs, pet stores, and fuel dealers. Transportation incidents accounted for the most deaths among wholesale workers, while violence accounted for the most deaths among retail workers.

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Putz-Anderson V, Schulte PA, Novakovich J, Pfirman D, Bhattacharya A [2020]. Wholesale and retail trade sector occupational fatal and nonfatal injuries and illnesses from 2006 to 2016: implications for intervention. Am J Ind Med *63*(2):121–134.

Exposure to flame retardants found across industries

Flame-retardant chemicals found in many popular products, such as carpets and furniture, can slow a fire or even prevent it from igniting. Despite this benefit, research shows that workplace exposure to these chemicals during manufacturing or recycling may cause health concerns such as disruption to the immune and reproductive systems, increasing the risk of disease.

In a recent study, investigators looked at exposure to flame retardants among 105 workers representing nine industries that use flame-retardant materials. These industries included carpet installation, chemical manufacturing, foam manufacturing, electronic scrap recycling, gymnastics, rigid board installation, nail salons, roofing, and spray polyurethane foam application and manufacturing. Using air and hand-wipe samples, the investigators measured levels of three classes of flame retardants: organophosphate flame retardants (OFRs), polybrominated diphenyl ethers (PBDEs), and non-PBDE brominated flame retardants (NPBFRs). Although PBDE production has ceased in the United States, previously produced batches of the chemical can still be found in some industries.

Workers who used spray polyurethane foam had the highest exposures to OFRs, followed by chemical manufacturers, according to the paper published in the journal *Environment International*. Overall, levels were highest in polyurethane foam application and manufacturing, chemical manufacturing, nail salons, roofing, and rigid board installation. Although PBDE exposures seemed to be lower than in previous studies, exposure still occurred among carpet installers, electronic scrap workers, and gymnastics workers. These findings show that air and skin exposure to flame retardants, especially OFRs, is widespread across industries. They underscore the importance of using exposure controls, such as ventilation and enclosure of flame retardants, and personal protective equipment, including gloves and respirators.

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Estill CF, Slone J, Mayer A, Chen IC, La Guardia MJ [2020]. Worker exposure to flame retardants in manufacturing, construction and service industries. Environ Int *135*:105349.

Toxicity of products with silver nanoparticles studied

In the workplace, exposure to silver dust and fumes can occur through

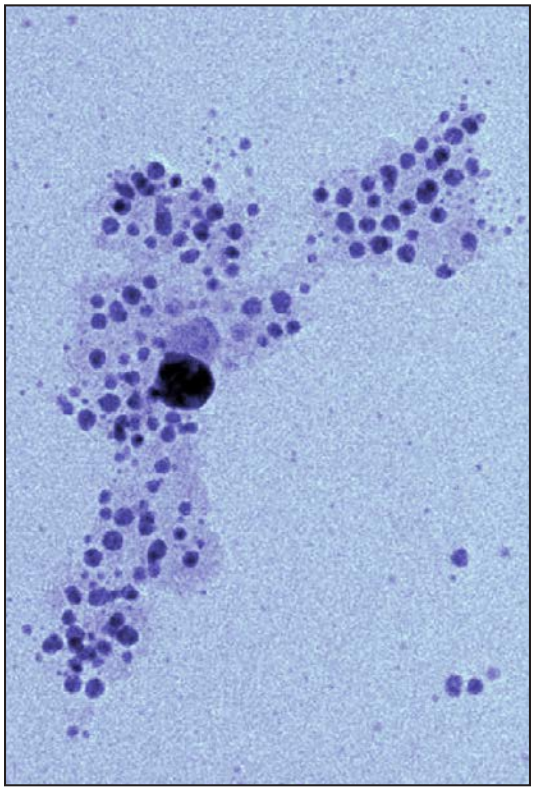


Photo by National Institute of Standards and Technology

To explore the effect of silver spray products on living cells, investigators at the U.S. Environmental Protection Agency and NIOSH recently tested five commercially available spray products advertised as dietary supplements, immune-system boosters, or spray disinfectants.

breathing, ingesting, or contact with skin or eyes. Previous research linked long-term exposure to silver dust and fumes to a bluish-gray discoloration of the skin and eyes, but research is limited about the safety of consumer sprays containing silver nanoparticles.

To explore the effect of silver spray products on living cells, investigators at the U.S. Environmental Protection Agency and NIOSH recently tested five commercially available spray products advertised as dietary supplements, immune-system boosters, or spray disinfectants. They used a specialized imaging technique to produce detailed pictures of the silver nanoparticles and to measure their size in the spray products.

Results showed that silver nanoparticles, dissolved silver, and other substances in the products decreased cell survival by 5 to 10 times, depending on the amounts tested. Of additional concern, the product labels did not accurately list how much silver they contained. While three product labels did not list silver as a component, one listed much higher levels of silver than it contained and another listed much lower levels than it contained, according to the investigators' report in the journal *Science of the Total Environment*.

•••

Rogers KR, Henson TE, Navratilova J, Surette M, Hughes MF, Bradham KD, Stefaniak AB, Knepp AK, Bowers L [2020]. In vitro intestinal toxicity of commercially available spray disinfectant products advertised to contain colloidal silver. Sci Total Environ 728:138611.

Masks block more cough particles than face shields

CDC recommends wearing face masks in all public settings to help prevent the spread of COVID-19. NIOSH recently tested face masks, neck gaiters, and face shields to see how well they block the small aerosol particles produced by people when they cough. Researchers asked lead author William Lindsley, NIOSH biomedical research engineer, to explain the study, published in the journal *Aerosol Science and Technology*.

The study investigated how well face coverings stopped cough aerosols from being expelled into the air (called source control). Researchers used a device that simulates coughs to propel small aerosol particles through different face coverings placed on a manikin head. They did not test these devices as personal protective equipment to prevent aerosols in the environment from being inhaled by the wearer.

The study found that for the largest-size particles a 3-ply cotton face mask blocked 51% of the cough aerosol, and a polyester

neck gaiter blocked 47% as a single layer and 60% when folded into a double layer. Face shields, however, blocked only 2%.

Future investigations will test face masks and gaiters for how different materials perform, the effect of fit, and effectiveness during breathing versus coughing. The researchers would also like to investigate alternative designs for face shields and test all these devices using a broader size range of aerosol particles.

•••

Lindsley WG, Blachere FM, Law BF, Beezhold DH, Noti JD [2020]. Efficacy of face masks, neck gaiters and face shields for reducing the expulsion of simulated cough-generated aerosols. Aerosol Sci Tech *55*(4): 449–457.

Expanded firefighter cancer study finds more deadly risks

Compared with the general U.S. population, firefighters face a greater risk of death from non-Hodgkin's lymphoma, or NHL, according to new research published in the journal *Occupational and Environmental Medicine*. Additionally, their risk of death from chronic obstructive pulmonary disease, or COPD, increases with the amount of time spent at fires.

Launched in 2010, the NIOSH Firefighter Cancer Study is the largest study of cancer among U.S. firefighters, including nearly 30,000 career firefighters who served in the Chicago, Philadelphia, and San Francisco Fire Departments between 1950 and 2009. Most were white males, and many had worked as firefighters for over 20 years. Previous findings from this study showed that career firefighters had higher rates of respiratory, digestive, and urinary cancers than the general population. They also were more likely to develop mesothelioma, a rare cancer caused by exposure to asbestos.

The investigators extended the study through 2016, for an additional 7 years of follow-up. Patterns of cancer deaths were largely consistent with the previous study, both showing increased deaths from cancers of the esophagus, intestine, rectum, lung, and kidney, and mesothelioma. However, this study yielded stronger evidence of increased risk of dying from NHL, a cancer of white blood cells. The rate of death from NHL in firefighters was increased by about 20% compared with national rates. The study also observed that the risk of dying

Photo by © Jani Bryson/Getty Images

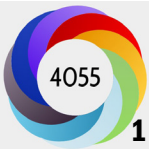
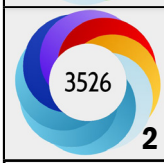
Compared with the general U.S. population, firefighters face a greater risk of death from non-Hodgkin's lymphoma, or NHL, according to new NIOSH research.

from COPD increased with increasing time spent at the fire scene. COPD is a group of lung diseases that cause airflow blockage and breathing-related problems. Together, the study findings underscore the importance of continuing efforts to control work-related exposures among firefighters.

•••

Pinkerton L, Bertke SJ, Yiin J, Dahm M, Kubale T, Hales T, Purdue M, Beaumont JJ, Daniels R [2020]. Mortality in a cohort of U.S. firefighters from San Francisco, Chicago and Philadelphia: an update. Occup Environ Med *77*(2):84–93.

Top 5 NIOSH 2020 Products by Altmetric Score

	**Presymptomatic SARS-CoV-2 Infections and Transmission in a Skilled Nursing Facility** *New England Journal of Medicine,* **May 2020**
	**Characteristics of Health Care Personnel with COVID-19—United States, February 12–April 9, 2020** *MMWR: Morbidity* **&** *Mortality Weekly Report,* **April 2020**
	**COVID-19 Among Workers in Meat and Poultry Processing Facilities —19 States, April 2020** *MMWR: Morbidity & Mortality Weekly Report,* **May 2020**
	**Asymptomatic and Presymptomatic SARS-CoV-2 Infections in Residents of a Long-Term Care Skilled Nursing Facility—King County, Washington, March 2020** *MMWR: Morbidity & Mortality Weekly Report,* **April 2020**
	**Update: COVID-19 Among Workers in Meat and Poultry Processing Facilities—United States, April–May 2020** *MMWR: Morbidity & Mortality Weekly Report,* **July 2020**

Source: Altmetric.com

The Colors of the Donut

- Policy documents
- News
- Blogs
- Twitter
- Post-publication peer-reviews
- Facebook
- Sina Weibo
- Syllabi
- Wikipedia
- Google+
- LinkedIn
- Reddit
- Research highlight platform
- Q&A (Stack Overflow)
- Youtube
- Pinterest
- Patents

Journals Publishing NIOSH Articles in 2020

Rank	Top Journals Ranked by Number of NIOSH Articles Published	No.
1	Morbidity and Mortality Weekly Report	34
2	American Journal of Industrial Medicine	22
3	Mining, Metallurgy & Exploration	20
4	International Journal of Mining Science and Technology	19
5	Annals of Work Exposures and Health	11
	Journal of Occupational and Environmental Hygiene	
	Toxicology and Applied Pharmacology	
6	Journal of Occupational and Environmental Medicine	10
	Occupational and Environmental Medicine	
7	Journal of Safety Research	9
8	Toxicological Sciences	7
9	International Journal of Environmental Research and Public Health	6
10	Public Library of Science One	5
11	Nanotoxicology	4
	Particle and Fibre Toxicology	
12	Applied Ergonomics	3
	Archives of Environmental & Occupational Health	
	Clinics in Chest Medicine	
	Frontiers in Immunology	
	International Journal of Audiology	
	Journal of Asthma	
	Journal of the Experimental Analysis of Behavior	
	Journal of the International Society for Respiratory Protection	
	Journal of the National Cancer Institute Monographs	
	New England Journal of Medicine	
	Safety and Health at Work	
	The Synergist	

Journals Publishing Two Articles

American Journal of Infection Control • American Journal of Public Health • Brain, Behavior, and Immunity • Building and Environment • Dermatitis • Disaster Medicine and Public Health Preparedness • Environmental International • Environmental Research • Fire Technology • Food and Chemical Toxicology • Frontiers in Public Health • Inhalation Toxicology • International Journal of Coal Science & Technology • International Journal of Industrial Ergonomics • International Journal of Vehicle Performance • Journal of Allergy and Clinical Immunology: In Practice • Journal of Construction Engineering and Management • Journal of Exposure Science and Environmental Epidemiology • Journal of Nanoparticle Research • Journal of Sleep Research • Lighting Research & Technology • Policing: An International Journal of Police Strategies and Management • Professional Safety • Risk Analysis • The Hearing Journal

Journals Publishing One Article

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Journal Articles

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COVID-19 Communication Products

NOTE: NIOSH published many communication products dealing with the COVID-19 pandemic in 2020. Some products in this section with NIOSHTIC-2 numbers appear in other chapters of this bibliography. Those with no NIOSHTIC-2 numbers may have been nominated for one of two special COVID-19 categories in the 2021 NIOSH Science Awards. Some products with NIOSHTIC-2 numbers were also nominated.

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- Managing fatigue during times of crisis: guidance for nurses, managers, and other healthcare workers
- COVID-19 stress among your workers? Healthy work design and well-being solutions are critical
- Economic security during the COVID-19 pandemic: a healthy work design and well-being perspective
- Improve sleep: tips to improve your sleep when times are tough
- The role of organizational support and healthy work design
- The COVID-19 pandemic and the opioid overdose epidemic: a perfect storm for workers?
- Working from home: how to optimize your work environment and stay healthy

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- General business frequently asked questions
- Resuming business toolkit

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- Meat and poultry processing workers and employers
- Meat and poultry processing facility assessment toolkit
- Meat and poultry processing employees
- Meat and poultry processing facilities
- Carpooling factsheet

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- Understanding the use of imported non-NIOSH-approved respirators
- Respiratory protection during outbreaks: respirators versus surgical masks
- Supplementing the supply of N95s with reusable elastomeric half mask respirators
- Respiratory protection vs. source control – What's the difference?
- Proper N95 respirator use for respiratory protection preparedness
- The need for fit testing during emerging infectious disease outbreaks
- The physiological burden of prolonged PPE use on healthcare workers during long shifts
- Considerations for covering N95s to extend use
- Skin irritation from prolonged use of tight-fitting respirators
- Heat stress imposed by PPE worn in hot and humid environments

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Including:

- PPE burn rate calculator
- PPE tracker app
- PPE burn rate calculator tutorial video
- PPE tracker app tutorial video
- Strategies for optimizing the supply of N95 respirators
- Summary for healthcare facilities: strategies for optimizing the supply of N95 respirators during shortages
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- Decontamination and reuse of filtering facepiece respirators
- Factors to consider when planning to purchase respirators from another country
- Considerations for release of stockpiled N95s beyond the manufacturer-designated shelf life
- Personal protective equipment: questions and answers

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- Example COVID-19 prioritization questions for non-health care worksite

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- Strategies for protecting K-12 school staff from COVID-19
- K-12 schools COVID-19 mitigation toolkit

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