Respiratory Diseases Research at NIOSH: Reviews of Research Programs of the National Institute for Occupational Safety and Health

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Respiratory diseases caused by exposures to dangerous materials in the workplace have tremendous implications for worker health and, by extension, the national economy. The National Institute for Occupational Safety and Health (NIOSH) estimates that deaths from work-related respiratory diseases and cancers account for about 70% of all occupational disease deaths. NIOSH conducts research in order to detect and reduce work-related hazardous exposures, injuries, and diseases; its Respiratory Disease Research Program (RDRP) focuses on respiratory diseases. This National Research Council book reviews the RDRP to evaluate the 1) relevance of its work to improvements in occupational safety and health and 2) the impact of research in reducing workplace respiratory illnesses. The assessment reveals that the program has made essential contributions to preventing occupational respiratory disease. The National Research Council has rated the Program a 5 out of 5 for relevance, and a 4 out of 5 for impact. To further increase its effectiveness, the Respiratory Disease Research Program should continue and expand its current efforts, provide resources for occupational disease surveillance, and include exposure assessment scientists in its activities.
Summary

ABSTRACT  Respiratory diseases from occupational exposures have a major adverse effect on worker health, with the National Institute for Occupational Safety and Health (NIOSH) estimating that deaths from work-related respiratory disease and malignancies account for about 70% of all occupational disease mortality. NIOSH has a range of research activities in the Respiratory Diseases Research Program (RDRP) that are intended to protect worker health. These activities focus on airway diseases such as asthma and chronic obstructive pulmonary disease (COPD), interstitial lung diseases such as silicosis and asbestosis, respiratory infectious diseases including tuberculosis and avian influenza and severe acute respiratory syndrome (SARS), and respiratory cancers.

This report assesses the relevance of the RDRP’s activities to improve occupational safety and health and evaluates the impact that the program’s research has had in reducing work-related hazardous exposures, illnesses, and injuries. It is one of multiple reviews based on a request from NIOSH to the National Academies to independently evaluate several NIOSH programs. The review by this committee was conducted on the basis of a framework established by a parent committee established by the National Academies. That framework document established a scoring system from 1 to 5 for impact and relevance, with 5 being the highest.

Relevance of the program was evaluated in terms of the degree of research priority and connection to improvements in workplace protection. Factors taken into account include the frequency and severity of health outcomes and the number of people at risk, the structure of the program, and the degree of consideration of stakeholders’
The impact of the program's research is evaluated in terms of its contributions to worker health and safety. The committee has assigned a score of 5 in its rating of relevance. This reflects the judgment of the committee that the activities related to most of the strategic goals are in the highest-priority subject areas and highly relevant to improvements in workplace protection and that the RDRP is engaged in transfer activities at a significant level. The committee has assigned a score of 4 in its rating of impact. This reflects the committee's judgment that most subprograms within the RDRP have made major contributions to worker health and safety on the basis of end and well-accepted intermediate outcomes. If the committee had been given the option of providing non-integer scores, the score for program impact would have been between 4 and 5.

The committee provides recommendations intended to assist NIOSH in identifying opportunities to improve the relevance and impact of its research portfolio. These recommendations include an emphasis on the need to expand surveillance activities to detect exposure to those agents responsible for disease and to detect outbreaks of known diseases and identify new respiratory diseases affecting workers. The committee also recommends continued support of research on the development and improvement of methods to detect respiratory effects earlier and more accurately, continued research on the molecular mechanisms driving the pathogenesis of workplace respiratory diseases, the characterization of those agents (or attributes of those agents) responsible for adverse respiratory effects, evaluations of genetic variability that affects worker susceptibility, and research on improving respirator technology.

The committee’s recommendations are important, despite the high scores given for relevance and impact. The high scores reflect the guidance for ranking established by the framework committee and the committee’s recognition of the financial constraints the RDRP has operated under. The committee’s evaluation is of necessity retrospective. The recommendations are prospective, and are meant to help ensure that the RDRP continues to maintain its progress toward its goal of protecting workers from respiratory disease.

BACKGROUND

NIOSH was established by the Occupational Safety and Health Act of 1970 to “conduct . . . research, experiments, and demonstrations relating to occupational safety and health” and to develop “innovative methods, techniques, and approaches for dealing with [those] problems” (Public Law 91-596, 84 STAT. 1590, 91st Congress, S.2193, December 29, 1970). As part of the Centers for Disease Control and Prevention within the Department of Health and Human Services, NIOSH is authorized to conduct research, training, and education related to worker health and safety; perform on-site investigations to evaluate hazards in the workplace;
recommend occupational health and safety standards; and fund research by other agencies and private organizations.

NIOSH has a wide portfolio of activities that support a number of industrial sectors including mining; health care and social attitude; manufacturing; transportation, warehousing, and utilities; construction; agriculture, forestry, and fishing; trade; and service. One component of these activities is the RDRP, whose stated mission is “to provide national and international leadership for the prevention of work-related respiratory diseases, using a scientific approach to gather and synthesize information, create knowledge, provide recommendations, and deliver products and services to those who can effect prevention.” Work-related respiratory diseases are a serious problem of major magnitude. NIOSH indicates that deaths from work-related respiratory disease and malignancies account for about 70% of all mortality due to occupationally related disease.

RDRP interests and research spans all of NIOSH. The program represents a broad range of individuals and groups that do work relevant to occupational respiratory disease, including at several NIOSH divisions and laboratories. Preventing occupational respiratory disease has been a key part of the NIOSH research portfolio since the agency’s inception in 1970 when, for example, health screening and research related to coal workers’ pneumoconiosis (CWP) was undertaken per the Federal Coal Mine Health and Safety Act of 1969. Current work-related respiratory diseases and disorders that NIOSH is studying consist of a broad spectrum of adverse health effects including airway diseases such as asthma and COPD, interstitial lung diseases such as silicosis and asbestosis, respiratory infectious diseases such as tuberculosis and avian influenza and SARS, and respiratory cancers. These health effects can arise in a wide range of occupational settings and range from mild, reversible conditions to progressive fatal disorders and can be linked to short-term or long-term exposures. These health effects have tremendous implications for worker health and, by extension, the national economy.

**CHARGE TO THE COMMITTEE**

In September 2004, NIOSH requested that the National Academies review several NIOSH programs with respect to the impact and relevance of their work in reducing workplace injury and illness and to identify future directions that their work might take. The “Committee to Review NIOSH’s Research Programs” (termed the “framework committee”) was established as an oversight committee and created a framework document that will be used to evaluate individual programs. The RDRP was selected as one of the programs to undergo such a review. The National Research Council convened the Committee to Review the NIOSH Respiratory Diseases Research Program in late 2006. Briefly, the statement of task charges
the committee with evaluating the program’s impact and relevance to health and safety issues in the workplace and make recommendations for improvement. In conducting the review, the committee was tasked with assessing the relevance of the program’s activities to the improvement of occupational safety and health and evaluating the impact that the program’s research has had in reducing work-related hazardous exposures, illnesses, and injuries. The full statement of task is provided in Chapter 1. Per the assessment protocol the framework committee established, this committee was charged with rating the performance of the program for its relevance and impact on a scale of 1 to 5 (see Box S-1). The committee was also asked to provide a qualitative narrative assessment of the program’s efforts and suggestions about emerging issues that the program should be prepared to address.

The evaluation committee was selected to include members with expertise in epidemiology, exposure assessment, industrial hygiene, inhalation toxicology, occupational medicine, and pulmonology. The committee reviewed the RDRP focusing on the period since 1996, recognizing that improvements in workers’ health with regard to respiratory diseases that occurred during this period may be a result of earlier NIOSH research activities. The committee met three times between October 2006 and March 2007. The first two meetings were data-gathering sessions that included presentations by NIOSH staff and other invited speakers in open session where an opportunity was provided for stakeholders and the general public to comment. Site visits at the NIOSH Morgantown, Cincinnati, and Pittsburgh facilities were also held.

**REVIEW OF THE RDRP**

The review of the RDRP follows the organization of the program’s strategic goals. Five goals, intended to support the RDRP mission statement provided above, were provided:

- Prevent and reduce work-related airway diseases.
- Prevent and reduce work-related interstitial lung diseases.
- Prevent and reduce work-related infectious respiratory diseases.
- Prevent and reduce work-related respiratory malignancies.
- Prevent respiratory and other diseases potentially resulting from occupational exposures to nanomaterials.

Each of these strategic goals has several subgoals and components on which NIOSH provided information to the committee. Several other RDRP activities cut across these subgoals—for example, surveillance, the health hazard evaluation and technical assistance program, emergency response and disaster preparedness, respirator policy, and sampling and analytical methods activities.
Summary

BOX S-1
Scoring Criteria for NIOSH Program Reviews from Framework Document

Rating of Impact

5 = Research program has made a major contribution to worker health and safety on the basis of end outcomes or well-accepted intermediate outcomes.
4 = Research program has made a moderate contribution on the basis of end outcomes or well-accepted intermediate outcomes; research program generated important new knowledge and is engaged in transfer activities, but well-accepted intermediate outcomes or end outcomes have not been documented.
3 = Research program activities or outputs are going on and are likely to improve worker health and safety (with an explanation of why not rated higher).
2 = Research program activities or outputs are going on and may result in new knowledge or technology, but only limited application is expected.
1 = Research activities and outputs are NOT likely to have any application.
NA = Impact cannot be assessed; program is not mature enough.

Rating of Relevance

5 = Research is in highest-priority subject areas and highly relevant to improvements in workplace protection; research results in, and NIOSH is engaged in, transfer activities at a significant level (highest rating).
4 = Research is in high-priority subject area and adequately connected to improvements in workplace protection; research results in, and NIOSH is engaged in, transfer activities.
3 = Research focuses on lesser priorities and is loosely or only indirectly connected to workplace protection; NIOSH is not significantly involved in transfer activities.
2 = Research program is not well integrated or well focused on priorities and is not clearly connected to workplace protection and is inadequately connected to transfer activities.
1 = Research in the research program is an ad hoc collection of projects, is not integrated into a program, and is not likely to improve workplace safety or health.

Assessment of Relevance and Impact

Chapter 2 of this report describes in detail the NIOSH activities, outputs, and outcomes relating to each of the RDRP’s strategic goals and their subgoals; an assessment of the relevance and assessment of the impacts of those activities and outcomes follows that description. To develop scores for the program as a whole, the committee considered its assessment of the relevance and impacts of NIOSH activities directed at individual program subgoals. It then weighted them qualita-
tively to arrive at an overall program assessment. Relevance was evaluated in terms of the degree of research priority and connection to improvements in workplace protection. Factors taken into account include the frequency and severity of health outcomes and the number of people at risk, the structure of the program, and the degree of consideration of stakeholders’ input. The impact of the program’s research is evaluated in terms of its contributions to worker health and safety. The scoring criteria are described in Box S-1.

The committee has assigned a score of 5 in its rating of relevance. This reflects the judgment of the committee that the activities related to most of the subgoals are in the highest-priority subject areas and highly relevant to improvements in workplace protection and that the RDRP is engaged in transfer activities at a significant level. This is particularly true for activities related to interstitial lung diseases as well as many parts of the activities related to airways and infectious diseases and malignancies. The committee also noted that the activities related to nanotechnology were highly relevant, even though this emerging area has yet to see any impacts related to intermediate or end outcomes. Activities related to parts of some subprograms, including some of the activities related to malignancies and infectious diseases, do not reach this highest level of relevance as reflected in the assessment of the subprograms described in Chapter 2. But those NIOSH activities are in important research areas with some connection to improvements in workplace protection.

The committee has assigned a score of 4 in its rating of impact. This reflects the committee’s judgment that most subprograms within the RDRP have made major contributions to worker health and safety on the basis of end and well-accepted intermediate outcomes, while others have had a smaller impact or the impact is not easily discernible. For example, the documented decrease in the prevalence of latex sensitization, early decreases (pre-2000) in CWP, and decreases in silicosis-related deaths in the mining industry have had a high impact on protecting worker health. In other cases—for example, the lack of new emerging infectious diseases or further spread of infectious diseases such as avian influenza and SARS—it is nearly impossible to disentangle the contribution NIOSH has had in limiting the onset or spread of respiratory diseases and resulting decrease in risk or death to exposed workers. However, insofar as the RDRP has played a major role in developing and disseminating personal and building respiratory protection systems and guidance documents and educational materials for their use, it is fair to credit the Infectious Diseases Program with helping to contain what could have been a larger disaster with greater cost in human lives. After much deliberation on how to weigh the assessments of different subprograms, the committee reached a consensus that the program was clearly better than that called for in a score of 4, but not in sum what the committee would rate a 5. If the committee had been given the option of providing non-integer scores, the score for program impact would have been between 4 and 5.
Identifying Emerging Issues and Research Areas

The committee assessed progress by the RDRP in targeting new research relevant to future improvements in workplace protection from occupational respiratory disease and sought to identify significant emerging research areas important to the mission of NIOSH. Several specific areas of interest relating to various subgoals are presented in Chapter 3. One issue that recurs throughout the discussion is the importance of robust surveillance for diseases and exposures to toxicants. This surveillance is necessary to determine the agents responsible for disease, to detect outbreaks of known diseases, and to identify new respiratory diseases affecting workers. Surveillance activities are critical to fulfilling the objectives of all the major program goals and to assessing the performance of current and future RDRP activities. The committee understands that the lack of financial and personnel resources and not the lack of awareness or expertise are the major causes of inadequate surveillance. While the needed resources are not likely to emerge in the near future, the committee strongly emphasizes this limitation as a continuing and emerging issue. Disease surveillance and exposure monitoring activities in the workplace typically require strong collaborations with industry, as seen in efforts on chronic beryllium disease, CWP and COPD, and respiratory malignancies. The committee supports ongoing, and encourages future, collaborations in studies of occupational diseases, particularly in the face of emerging evidence of a link between exposure and outcome.

The committee supports a range of ongoing RDRP activities that proactively address the incidence of future diseases and emerging diseases. These activities include the development and improvement of methods (e.g., spirometry, radiography, and novel biomarkers) to detect respiratory effects earlier and more accurately, continued research on the molecular mechanisms driving the pathogenesis of workplace-related respiratory diseases, characterization of those agents (or attributes of those agents) responsible for respiratory effects, and evaluations of genetic variability that affects worker susceptibility. A primary means for NIOSH to prevent diseases and protect worker health is by reducing and eliminating exposure to toxicants and pathogenic organisms. In this regard, NIOSH research on improving respirators is another essential means to address the threat of respiratory diseases among workers.

RECOMMENDATIONS FOR PROGRAM IMPROVEMENT

As indicated in the discussion about the scoring of the RDRP, the committee views past and current research efforts quite favorably. In this section, the committee provides summary recommendations and a brief justification for each of
the program’s strategic goals and for cross-cutting issues identified by the committee; see Box S-2 for a summary of these recommendations. The committee hopes these recommendations will help support NIOSH in identifying opportunities to improve the relevance and impact of its research portfolio. Chapter 4 of this report provides greater detail on these recommendations.

**Strategic Goal 1: Prevent and Reduce Work-Related Airway Diseases**

1. *Improve detection of work-related asthma, work-related fixed obstructive airway disease, and relevant exposures.* The committee is concerned that the new NORA2\(^1\) industrial-sector-based priority-setting approach may lead to a decreased emphasis on needed disease-focused research related to airway diseases. The RDRP should systematically evaluate whether work-related asthma activities are being compromised under the new approach. Because the contribution of occupational exposures to the burden of adult asthma is high, work in pursuit of the four work-related asthma subgoals (preventing and reducing rubber-latex asthma and allergy among health care workers, preventing and reducing work-related asthma in the isocyanate-production industry, preventing and reducing work-related asthma related to nonindustrial indoor environmental quality, and improving detection of work-related asthma and relevant exposures, described in more detail in Chapter 4), can have a potentially great impact on improved occupational safety and health among the U.S. workforce. In terms of COPD, understanding the contribution of occupational exposures is difficult. To understand this issue, the committee strongly recommends that the RDRP continue to support population-based studies of associations between occupational exposures and COPD to better define groups of workers at greatest risk for planning preventive strategies. In the flavoring industry, the RDRP response to the initial identification of diacetyl-induced bronchiolitis obliterans has led to surveillance efforts in multiple locations in an effort to detect and prevent disease. The committee agrees that continued surveillance, prevention of exposures, and mechanistic research to better understand this disease should continue to be a high priority for the RDRP.

**Strategic Goal 2: Prevent and Reduce Work-Related Interstitial Lung Diseases**

2. *Continue and expand efforts to prevent coal workers’ pneumoconiosis (CWP), silicosis, fiber-induced interstitial lung disease, and chronic beryllium disease.* The activities related to interstitial lung diseases form a critical core of the RDRP and

\(^1\)The second phase of the National Occupational Research Agenda (NORA) process, which established a framework to guide and organize research activities in a fiscally constrained environment.
have provided well-documented improvements in occupational health. It is impor-
tant that the RDRP continue to expand its activities in these areas so it can build
on its earlier successes and respond to new challenges. In particular, the committee
recommends giving high priority to research on the increasing incidence of CWP,
“hot spots” of rapidly progressive CWP, and the possible role of concentration and
duration of exposure, coal rank, and silica level in the rapidly progressive cases of
CWP. Other important areas of research the committee recommends are exper-
imental studies of silica-induced cytotoxicity and fibrogenesis and the development
of control technologies that include silica substitutes, particle surface coatings, and
dust reduction measures. In addition, fibers that are asbestiform, such as wincherite
and tremolite, which were found as containments of vermiculite mined in Libby,
Montana, or of synthetic origin, such as nylon flock and refractory ceramic fiber,
require continued study with attention to fiber characteristics, such as cleavage
fragments, and low-level exposures, respectively. The committee recommends
that the RDRP target work in support of a new recommended OSHA standard
that would lead to improved controls to reduce airborne and dermal exposure to
beryllium in all workplaces where it is used. The committee recommends that the
effectiveness of digital radiography in CWP surveillance should be an important
continuing research priority, which will extend to all interstitial lung diseases.

**Strategic Goal 3: Prevent and Reduce Work-Related Infectious Respiratory Diseases**

3. Continue to support efforts to protect workers from occupational exposures
and to define mechanisms that make workers susceptible to respiratory infections.
Enhance surveillance for outbreaks of known occupational respiratory infections as
well as emerging respiratory infections. Develop an overarching structure for the
infectious disease component and coordinate with other federal agencies to adopt
technologies for the detection of bioterrorism agents for the protection of workers.
The RDRP’s efforts on infectious diseases appropriately concentrate on preventing
infection through the use of respirator controls and understanding the mechanisms
that underlie susceptibility. More robust surveillance for disease outbreaks in occupa-
tional settings is needed. These three approaches represent NIOSH’s primary
tools to prevent and reduce known and unknown (emerging) respiratory infectious
diseases. The committee recommends that the RDRP collect specific occupational
TB surveillance data and explore ways to improve TB surveillance. It also should
consider dropping its subgoal of preventing outbreaks of histoplasmosis, because
no new RDRP research is planned and no resources are available for specific sur-
veillance activities.
Strategic Goal 4: Prevent and Reduce Work-Related Respiratory Malignancies

4. Develop a comprehensive plan for addressing respiratory malignancies in the workplace while assuring the integration of this plan with NIOSH and other federal agency research program efforts to study malignancies. Refocus research on diagnostic tools to research on biomarkers of exposure or early detection of risk specific to occupational cohorts. The impact of the respiratory malignancies program has been strong with regard to the three specific carcinogenic exposures listed as subgoals by the RDRP: hexavalent chromium, silica, and diesel exhaust. Ongoing research on respiratory malignancies resulting from workplace exposures continues to address challenging problems related to occupational risk of lung cancer, and the RDRP has been effective in engaging stakeholders from industry and the workforce. To enhance their efforts, the RDRP needs to develop, in collaboration with other relevant federal agencies (National Cancer Institute, National Institute of Environmental Health Sciences, Food and Drug Administration, Department of Defense, Department of Labor), a coordinated planning process to address occupational cancer risks to provide a comprehensive approach to detection, surveillance, and prevention. The committee recommends that the RDRP ensure that respiratory malignancies are well integrated into an overall program of occupational cancer research, and not arbitrarily separated from those efforts. The RDRP should consider refocusing its research on biomarkers for early detection to biomarkers of exposure or to early detection that addresses the needs of specific workers at high occupational risk of contracting lung cancer. The RDRP should continue efforts to develop and validate exposure methods for diesel particulate matter, especially in the presence of other sources of carbon aerosols, and to validate the methods used to measure diesel particulate matter in coal mines. The RDRP should consider developing long-term follow-up of workers exposed to asbestos and should consider enhancing surveillance for asbestos-related risks.

Strategic Goal 5: Prevent Respiratory and Other Diseases Potentially Resulting from Occupational Exposures to Nanomaterials

5. NIOSH should continue to play a leading role in informing and guiding national and international efforts to address potential occupational hazards and risks associated with the use of manufactured nanomaterials. The growing recognition of the usefulness of nanomaterials in various industrial applications has created an urgent need to study the potential health effects of exposures to nanoparticles and methods to control exposures to these particles. The RDRP has taken a lead at the national and international levels to address these questions. The RDRP is well suited to continue to develop exposure assessment methods and technology
to monitor effective control of exposures to nanomaterials in work settings. The committee generally supports the RDRP’s research efforts on nanomaterial toxicity, exposure, and dose-response as part of a coordinated effort with other federal agencies and with appropriate prioritization for resource allocation to this problem. However, the committee is concerned that available data—especially on human-health effects—might not be sufficient for quantitative risk assessments and therefore suggests that the RDRP should consider other approaches for dealing with the potential health impacts of these new materials in a precautionary manner.

Cross-Cutting Issues

Systems for Surveillance

6. NIOSH should provide appropriate resources for and engage in high-priority occupational disease surveillance. The United States is practically alone among highly developed countries with regard to its lack of comprehensive surveillance of occupational diseases. The effectiveness of past NIOSH surveillance activities for coal-dust-related diseases, both CWP and COPD, highlight the importance of improved surveillance for other occupational respiratory disorders. NIOSH should engage in development and evaluation of surveillance methods as a high priority for occupational respiratory disease surveillance, including methods to systematically review and analyze the findings of reports through the health hazard evaluation and technical assistance program and other data collection approaches.

Exposure Assessment

7. Produce a programmatic approach to the development of sampling and analytic methods that include exposure assessment scientists as an integral part of RDRP activities. Exposure assessment is a core component of occupational respiratory disease research and prevention activities. However, the RDRP does not present an explicit or comprehensive focus on exposure assessment methods. Also, while the RDRP has focused on exposure assessment research in the past, no specific mention of current or future needs for exposure assessment activities is explicitly made.

Emergency Response

8. The RDRP is encouraged to explore research strategies in its emergency response efforts. For example, the RDRP should assess how NIOSH-supported research and medical surveillance of World Trade Center disaster emergency responders and recovery workers may or may not be relevant to work-related asthma, work-related
fixed obstructive airway disease, interstitial lung diseases, and possibly malignancies. The RDRP has made important contributions to the emergency response to recent disasters, including the World Trade Center and anthrax terror attacks, and hurricanes Katrina and Rita. However, much more can be learned about exposure-response relationships and ultimately about protecting emergency responders by conducting longitudinal cohort studies relating to catastrophic events. Information from emergency responses to toxicant exposures should be applicable to models of irritant-induced asthma, fixed airway obstruction, interstitial lung disease, and possibly even malignancies. The RDRP is encouraged to continue to develop cooperative work with other agencies that have mandates in infection and terrorism.

RDRP Resource Allocation

9. The RDRP should prioritize all research proposals under consideration for funding, whether intramural or extramural, according to the RDRP strategic plan, which needs to be updated periodically. The RDRP has recently been organized to emphasize sector-based as opposed to disease-based research; an emerging issue is how research priorities for respiratory diseases that cut across sectors will be treated, particularly as the RDRP encompasses many divisions and laboratories across NIOSH. The RDRP needs systems to govern the awarding of extramural grants, contracts, and cooperative agreements and to integrate the results of this external research into the intramural program. This system should ensure that unnecessary duplication and inappropriate expenditure on low-priority research projects are avoided.

Importance of the Committee’s Recommendations

The committee’s recommendations are important, despite the high scores given for relevance and impact. The high scores reflect the guidance for ranking established by the framework committee and the committee’s recognition of the financial constraints the RDRP has operated under. The committee’s evaluation is of necessity retrospective. The recommendations are prospective, and are meant to help ensure that the RDRP continues to maintain its progress toward its goal of protecting workers from respiratory disease.
Summary of Recommendations

Box S-2

Strategic Goal 1: Prevent and Reduce Work-Related Airway Diseases

1. Improve detection of work-related asthma, work-related fixed obstructive airway disease, and relevant exposures.

Strategic Goal 2: Prevent and Reduce Work-Related Interstitial Lung Diseases

2. Continue and expand efforts to prevent coal workers' pneumoconiosis, silicosis, fiber-induced interstitial lung disease, and chronic beryllium disease.

Strategic Goal 3: Prevent and Reduce Work-Related Infectious Respiratory Diseases

3. Continue to support efforts to protect workers from occupational exposures and to define mechanisms that make workers susceptible to respiratory infections. Enhance surveillance for outbreaks of known occupational respiratory infections as well as emerging respiratory infections. Develop an overarching structure for the infectious disease component and coordinate with other federal agencies to adopt technologies for the detection of bioterrorism agents for the protection of workers.

Strategic Goal 4: Prevent and Reduce Work-Related Respiratory Malignancies

4. Develop a comprehensive plan for addressing respiratory malignancies in the workplace while assuring the integration of this plan with NIOSH and other federal agency research program efforts to study malignancies. Refocus research on diagnostic tools to research on biomarkers of exposure or early detection of risk specific to occupational cohorts.

Strategic Goal 5: Prevent Respiratory and Other Diseases Potentially Resulting from Occupational Exposures to Nanomaterials

5. NIOSH should continue to play a leading role in informing and guiding national and international efforts to address potential occupational hazards and risks associated with the use of manufactured nanomaterials.

Cross-Cutting Issues

Systems for Surveillance

6. NIOSH should provide appropriate resources for and engage in high-priority occupational disease surveillance.

Exposure Assessment

7. Produce a programmatic approach to the development of sampling and analytic methods that include exposure assessment scientists as an integral part of RDRP activities.

continued
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Respiratory Diseases Research at NIOSH

Reviews of Research Programs of the National Institute for Occupational Safety and Health

Committee to Review the NIOSH Respiratory Diseases Research Program
Board on Environmental Studies and Toxicology
Division on Earth and Life Studies
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Preface

The National Institute for Occupational Safety and Health (NIOSH) was established by the Occupational Safety and Health Act of 1970 to “conduct . . . research, experiments, and demonstrations relating to occupational safety and health” and to develop “innovative methods, techniques, and approaches for dealing with [those] problems.” One component of these activities is the Respiratory Diseases Research Program, whose stated mission is “to provide national and international leadership for the prevention of work-related respiratory diseases, using a scientific approach to gather and synthesize information, create knowledge, provide recommendations, and deliver products and services to those who can effect prevention.” Work-related respiratory diseases are a serious problem of major magnitude. NIOSH indicates that deaths from work-related respiratory disease and malignancies account for about 70 percent of all occupational disease mortality.

In this report, the Committee to Review the NIOSH Respiratory Diseases Research Program evaluates NIOSH’s Respiratory Diseases Research Program (RDRP). Using a framework developed by the NRC Committee to Review the NIOSH Research Program, this committee focused primarily on the last 10 years of RDRP activities to review the relevance and impact of RDRP’s research portfolio. In its evaluation the committee also discusses and makes recommendations for upcoming research areas and challenges to be addressed by RDRP.

This report has been reviewed in draft form by persons chosen for their diverse perspectives and technical expertise in accordance with procedures approved by
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Mark J. Utell, Chair
Committee to Review the NIOSH Respiratory Diseases Research Program
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# Abbreviations and Acronyms

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<th>Description</th>
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<tbody>
<tr>
<td>AIHA</td>
<td>American Industrial Hygiene Association</td>
</tr>
<tr>
<td>ALFORD</td>
<td>Appalachian Laboratory for Occupational Respiratory Diseases</td>
</tr>
<tr>
<td>ALOSH</td>
<td>Appalachian Laboratory for Occupational Safety and Health</td>
</tr>
<tr>
<td>AMT</td>
<td>3-amino-5-mercapto-1,2,4-triazole</td>
</tr>
<tr>
<td>AOEC</td>
<td>Association of Occupational and Environmental Clinics</td>
</tr>
<tr>
<td>APR</td>
<td>Air Purifying Respirators</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>ATS</td>
<td>American Thoracic Society</td>
</tr>
<tr>
<td>ATSDR</td>
<td>Agency for Toxic Substances and Disease Registry</td>
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<tr>
<td>BDS</td>
<td>Biological Detection Systems</td>
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<tr>
<td>BEST</td>
<td>Board on Environmental Studies and Toxicology</td>
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<tr>
<td>BLS</td>
<td>Bureau of Labor Statistics</td>
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<tr>
<td>BRDPI</td>
<td>Biomedical Research and Development Price Index</td>
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<tr>
<td>BRFSS</td>
<td>Behavior Risk Factor Surveillance Survey</td>
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<td>BSC</td>
<td>Board of Scientific Counselors</td>
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<tr>
<td>CBD</td>
<td>Chronic Beryllium Disease</td>
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<tr>
<td>CBR</td>
<td>Chemical, Biological, and Radiological</td>
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<tr>
<td>CBRN</td>
<td>Chemical, Biological, Radiological, and Nuclear</td>
</tr>
<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
</tr>
<tr>
<td>COPD</td>
<td>Chronic Obstructive Pulmonary Disease</td>
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</table>
Respiratory Disease Research at NIOSH: Reviews of Research Programs of the National Institute for Occupational Safety and Health

http://books.nap.edu/catalog/12171.html

Abbreviations and Acronyms

CPWR Center to Protect Workers’ Rights
CWP Coal Workers’ Pneumoconiosis
CSTE Council of State and Territorial Epidemiologists

DART Division of Applied Research and Technology
DBBS Division of Biological and Behavioral Science
DELS Division of on Earth and Life Sciences
DHHS Department of Health and Human Services
DOD Department of Defense
DOE Department of Energy
DOI Department of the Interior
DPSE Division of Physical Sciences and Engineering
DRDS Division of Respiratory Disease Studies
DSHEFS Division of Surveillance, Hazard Evaluations and Field Studies
DSR Division of Safety Research

EC Evaluation Committee
EID Education and Information Division
EPA Environmental Protection Agency

FBI Federal Bureau of Investigation
FC Framework Committee
FDA Food and Drug Administration
FDNY Fire Department of New York
FEMA Federal Emergency Management Agency
FEV$_1$ Forced Expiratory Volume in One Second
FTE Full-Time Equivalent
FVC Forced Vital Capacity

HELD Health Effects Laboratory Division
HEPA High-Efficiency Particulate Aerosol
HETA HHE and Technical Assistance
HHE Health Hazard Evaluation
HMW High Molecular Weight

IARC International Agency for Research on Cancer
ILO International Labour Office
ILSI International Life Sciences Institute
IOM Institute of Medicine
ISO International Standards Organization
**ABBREVIATIONS AND ACRONYMS**

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<tr>
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<th>Full Form</th>
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<tr>
<td>JEM</td>
<td>Job-Exposure Matrix</td>
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<tr>
<td>LMW</td>
<td>Low Molecular Weight</td>
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<tr>
<td>MDI</td>
<td>Methylene Diisocyanate</td>
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<tr>
<td>MESA</td>
<td>Mine Enforcement and Safety Administration</td>
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<td>MINER</td>
<td>Mine Improvement and New Emergency Response</td>
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<td>MMWR</td>
<td>Morbidity and Mortality Weekly Report</td>
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<td>MOU</td>
<td>Memorandum of Understanding</td>
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<td>MSHA</td>
<td>Mine Safety and Health Administration</td>
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<td>NA</td>
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<td>NACOSH</td>
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<td>NCEH</td>
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<td>National Fire Protection Association</td>
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<td>NHANES</td>
<td>National Health and Nutrition Examination Survey</td>
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<td>National Health Interview Survey</td>
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<td>NHLBI</td>
<td>National Heart, Lung, and Blood Institute</td>
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<td>NIEHS</td>
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<td>NIOSH</td>
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<td>NMAM</td>
<td>NIOSH Manual of Analytical Methods</td>
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<tr>
<td>NNI</td>
<td>National Nanotechnology Initiative</td>
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<td>NOHSM</td>
<td>National Occupational Health Survey of Mining</td>
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<td>NORA</td>
<td>National Occupational Research Agenda</td>
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<td>NRC</td>
<td>National Research Council</td>
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<td>National Study of Coal Workers’ Pneumoconiosis</td>
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<td>NSET</td>
<td>Nanoscale Science, Engineering and Technology Subcommittee</td>
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<td>NSTC</td>
<td>National Science and Technology Council</td>
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<td>NTP</td>
<td>National Toxicology Program</td>
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<tr>
<td>NTRC</td>
<td>Nanotechnology Research Center</td>
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<tr>
<td>OHC</td>
<td>Office of Health Communications</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<td>OMB</td>
<td>Office of Management and Budget</td>
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<td>ORA</td>
<td>Office of Regulatory Analysis</td>
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<td>Occupational Respiratory Disease Surveillance</td>
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<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
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<td>PAPR</td>
<td>Powered Air Purifying Respirator</td>
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<td>PART</td>
<td>Program Assessment Rating Tool</td>
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<td>PCR</td>
<td>Polymerase Chain Reaction</td>
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<td>PEL</td>
<td>Permissible Exposure Limit</td>
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<td>Public Health Service</td>
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<td>Personal Protective Equipment</td>
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<td>PRL</td>
<td>Pittsburgh Research Laboratory</td>
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<td>RCF</td>
<td>Refractory Ceramic Fibers</td>
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<tr>
<td>RDRP</td>
<td>Respiratory Diseases Research Program</td>
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<tr>
<td>REL</td>
<td>Recommended Exposure Limit</td>
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<td>SARS</td>
<td>Severe Acute Respiratory Syndrome</td>
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<td>SENSOR</td>
<td>Sentinel Event Notification System for Occupational Risks</td>
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<td>SPIROLA</td>
<td>Spirometry Longitudinal Data Analysis</td>
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<td>SRL</td>
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<td>TB</td>
<td>Tuberculosis</td>
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<tr>
<td>TC</td>
<td>Total Carbon</td>
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<tr>
<td>TDI</td>
<td>Toluene Diisocyanate</td>
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<tr>
<td>TIL</td>
<td>Total Inward Leakage</td>
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<tr>
<td>UMWA</td>
<td>United Mine Workers of America</td>
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<td>USPS</td>
<td>United States Postal Service</td>
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<tr>
<td>UVGI</td>
<td>Ultraviolet Germicidal Irradiation</td>
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<td>VA</td>
<td>Veterans’ Administration</td>
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<tr>
<td>VOC</td>
<td>Volatile Organic Compound</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<tr>
<td>WoRLD</td>
<td>Work-Related Lung Disease</td>
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<td>WRA</td>
<td>Work-Related Asthma</td>
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