AIRBORNE HAZARDS RELATED TO DEPLOYMENT

Section I: Airborne Exposures and Characterization

Humvees in the theater of war move cautiously during a dust storm with gusts of up to 29 knots, stirring up sand and cutting down visibility.

Photograph: Courtesy of the US Army Public Health Command (Aberdeen Proving Ground, Maryland). Photographer: Specialist Jacob Boyer.

Chapter 1

OVERVIEW OF AIRBORNE HAZARDS IN OPERATION ENDURING FREEDOM, OPERATION IRAQI FREEDOM, AND OPERATION NEW DAWN

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INTRODUCTION

The terrorist attacks of September 11, 2001 on the continental United States were quickly followed on October 7, 2001 by overseas military actions against Al-Qaeda and the supporting Taliban government in Afghanistan.[1] The initial deployment of US Special Forces was small compared with the peak number of service members who ultimately served in Iraq or Afghanistan. By late 2007, deployment of the US Army, the most represented service, peaked with a combined number of 150,000 personnel serving at the same time in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF).[2] In total (as of June 2012), more than 2.4 million US service members were deployed to OEF, OIF, and Operation New Dawn (OND).[3] In addition to active duty service members, units of the National Guard and the US Army Reserve deployed frequently. The large number of personnel; the repeated individual deployments; the geographical span from southwest to south central Asia; and evolving missions, tactics, and equipment present a broad array of potential health risks. From occupational and environmental health perspectives, these items translate to an increased breadth of potential stressors and an increase in the potential for individuals with enhanced susceptibility to be present in the population at risk to those stressors.

In southwest and south central Asia, inhalational hazards (ie, airborne hazards that may enter the respiratory system) may be naturally occurring or manmade (anthropogenic). Naturally occurring dust from sandstorms caused by disruption of the crustal layer is ubiquitous. Manmade sources of inhalational hazards include local nation and military activities. Military activities and operations (eg, fuel combustion, propellant gases, and other activities) may generate additional inhalational hazards in locations with high levels of preexisting local and regional pollution. Military operations often place service members in locations with little foreign government oversight. These "failed states" lack the governmental services and infrastructure that are essential for the development and enforcement of environmental regulations, particularly regulations related to industrial and vehicle emissions. Military operations may also require emphasis on short-term mission requirements that must be balanced with public and occupational health priorities. The US Department of Veterans Affairs (VA) and the US Department of Defense (DoD) are addressing concerns raised by service members about the long-term health effects related to serving in Iraq and Afghanistan, most notably from exposure to emissions from open waste burning pits that are commonly used for trash disposal. Of note, airborne hazards were also a concern during Operation Desert Shield and Operation Desert Storm; veterans of the 1991 Gulf War expressed health concerns from exposure to smoke from oil well fires and burn pits.[4] These Gulf War concerns are among numerous environmental issues investigated in the context of Gulf War veterans' illnesses and were most recently evaluated in the National Academy of Sciences/Institute of Medicine's (IOM's) *Gulf War and Health*.[5] The two relevant summary findings from this report are (1) "insufficient/inadequate evidence to determine whether an association exists between deployment to the Gulf War and respiratory diseases," and (2) "limited/suggestive evidence of no association between deployment to the Gulf War and decreased lung function in the first 10 years after the war."[5(p149)]

POTENTIAL EXPOSURES OF CONCERN

High levels of ambient particulate matter (PM) were identified as a potential threat to respiratory health early in OIF.[6] Sampling conducted by preventive medicine personnel deployed to the US Central Command (USCENTCOM) area of operations typically demonstrated levels of PM (sometimes referred to as particle pollution in public communications) above those considered healthy by the US Environmental Protection Agency's (USEPA's) National Ambient Air Quality Standards (Exhibit 1-1).[7] In the United States, sources of coarse particles (2.5–10 μm in aerodynamic diameter) include resuspension of soil from roads and streets; disturbance of soil and dust by agricultural, mining, and construction operations; and ocean spray.[8] US sources of fine particles (<2.5 μm) include emissions generated by motor vehicles and coal-fired power plants. "In the Middle East, major sources of particles may differ from those in the United States and other industrialized regions where fossil fuel combustion and vehicle emissions are primary sources of PM."[8(p3)] Generally, the major contributor to PM in southwest Asia is resuspension of dust and soil from the desert floor. Open-air burn pits (hereinafter referred to as "burn pits") were alternate forms of waste disposal used by the US military to dispose of solid waste before incinerators became available during OEF and OIF (Exhibit 1-2). Burn pit emissions contributed to the total burden of pollutants, including gases and PM, to which deployed personnel were exposed. Emissions from open-air burn pits are likely to vary over time and between locations because

EXHIBIT 1-1

DEFINITION, SOURCES, AND GUIDELINES FOR PARTICULATE MATTER

Definition

Particulate matter (PM) pollutants are a complex mixture of extremely small solid particles and liquid droplets in the air. When breathed in, these particles can reach deep into the lungs and cause various health effects. There are generally two size ranges of particles in the air that pose a health concern: (1) particles with an aerodynamic diameter less than or equal to 10 μm (PM_{10}) and (2) even smaller particles, ie, those with a diameter of less than 2.5 μm ($PM_{2.5}$). The smaller particles ($PM_{2.5}$) have become an increasing concern, since medical research shows that they are most likely the particles responsible for the harmful health effects attributed to PM. Many variables influence the nature and probability of health outcomes. The key variables are the size fraction and chemical composition of the PM, the concentration levels, the duration of exposures, and various human factors (including age, health status, habits, genetics, and existing medical conditions). These variables, combined with scientific data gaps, limit the medical community's ability to estimate health impacts to relatively healthy troops, especially because most studies have been on older or less healthy groups.

Sources of Particulate Matter Air Pollution

PM emanates from both natural and manmade sources, including windblown dust, fires, construction activities, factories, power plants, incinerators, and automobiles. In the United States, the European Union, and certain other industrialized regions of the world, fossil fuel combustion and vehicle emissions are the primary sources of these pollutants. In some deployment regions, notably southwest Asia, the PM levels are higher and the sources of PM are different.

Exposure Guidelines

Most studies relate PM exposure data to respiratory and cardiopulmonary health effects in specific susceptible general population subgroups, including young children, the elderly, and especially those with existing asthma or cardiopulmonary disease. In addition, studies of PM-related health effects are primarily conducted in the United States and European urban settings where the PM particle size and composition tend to differ substantially from those of PM found in deployment settings in southwest Asia. As a result, direct use of the available data to estimate health effects on troops in southwest Asia has been problematic. In the interim, the US Army Public Health Command (USAPHC) recommends the use of Military Exposure Guidelines (MEGs) described in Appendix E to assess the severity of potential short-term (acute) and long-term (chronic) effects. These MEGs are based on criteria from the US Environmental Protection Agency (USEPA) National Ambient Air Quality Standards and the USEPA Air Quality Index reporting system (adjusted to reflect the generally healthy military population). The MEGs are based on professional judgment reflecting the current consensus opinion of USAPHC subject matter experts. Because of the substantial scientific uncertainty in estimating acute and especially chronic health outcomes among relatively healthy troops exposed to unique PM compositions, these MEGs are protective estimates about which there is relatively low confidence. They should be considered as such in any PM exposure health effects risk estimates.

of heterogeneity in fuel (trash), and may include PM, metals, volatile organic compounds, and polycyclic aromatic hydrocarbons.[9] Thus, individual exposure to burn pit emissions likely varies by personnel activity patterns and locations relative to the burn pit site, as well as meteorological conditions.

To identify the potential health risks associated with exposure to PM, the Assistant Secretary of Defense for Health Affairs chartered the Joint Particulate Matter Work Group (JPMWG) in 2005. The group included individuals from the three services and other governmental organizations. The JPMWG determined that health outcomes related to PM exposures were plausible, but also noted that there were limited data available to answer fundamental questions. One of the recommendations in the JPMWG report was to conduct enhanced PM surveillance and to conduct epidemiological studies of potential adverse health effects of exposures to PM in the southwest Asia area of operation. Although the risk of various adverse health outcomes, largely respiratory and cardiovascular, becomes greater with increased exposure to PM, the health effects of exposure to PM in the relatively healthy active military personnel deployed in the Middle East had not been well studied at the time of JPMWG analysis.[8]

EXHIBIT 1-2

DEFINITION OF AN OPEN-AIR BURN PIT

The Department of Defense defines an open-air burn pit as "an area, not containing a commercially manufactured incinerator or other equipment specifically designed and manufactured for burning of solid waste, designated for the purpose of disposing of solid waste by burning in the outdoor air at a location with more than 100 attached or assigned personnel and that is in place longer than 90 days."[1]

Data source: (1) US Department of Defense. *Use of Open-Air Burn Pits in Contingency Operations*. Washington, DC: DoD; February 15, 2011. DoD Instruction 4715.19.

ENHANCED PARTICULATE MATTER SAMPLING PROGRAM

Subsequent to the JPMWG recommendation, enhanced PM sampling (EPMS) was conducted every sixth day at 15 locations throughout Iraq and Afghanistan for 12 months (from 2006 to 2007). The final report of this effort is available online (http://phc.amedd.army.mil/PHC%20Resource%20Library/Final%20EPMSP%20Report%20without%20appx%20Feb08.pdf). Associating population health effects to these samples was difficult. In a retrospective manner, the EPMS data was compared with in-theater administrative health data to examine health outcomes for individuals who were at the sampling locations. The number of acute events (eg, asthma admissions or myocardial infarctions) was small, so the study had limited power to identify an association between any of the PM measurements (PM 10-µm or 2.5-µm concentrations) and health outcomes.[10] EPMS data were also used to examine the association between time-weighted average PM 2.5-µm and PM 10-µm samples, and postdeployment respiratory and cardiovascular health outcomes with increasing quartiles of exposure. After adjustment for a number of confounding factors, no statistically significant increases in diagnostic rates were noted, but data were limited by potential exposure misclassification and a relatively short follow-up period.

In 2009, the US Army asked the National Research Council (NRC) to review the EPMS report and its conclusions. Specifically, the NRC was asked to consider the potential acute and chronic health implications, as well as the epidemiological and health surveillance data collected in conjunction with the sampling, and to make recommendations for characterizing health risk. According to the 2010 NRC review, "Although interpretation of the epidemiological and health surveillance studies was encumbered by uncertainties regarding the actual exposures, the small number of study subjects, and the limited amount of exposure data, the EPMS results clearly document that military personnel deployed in the Middle East … are exposed to high concentrations of PM and that the particle composition varies considerably over time and space."[10(p6)] The committee concluded that, "it is indeed plausible that exposure to ambient pollution in the Middle East is associated with adverse health outcomes."[10] It also included a number of recommendations for improving the ability to discern an association between PM levels and health outcome, most specifically by means of more frequent (daily) sampling. Additionally, the committee recognized that the exposures were to a "complex mixture of pollutants."

POTENTIAL HEALTH EFFECTS IDENTIFIED IN EARLY POSTDEPLOYMENT STUDIES

A growing number of medical studies have investigated potential associations between deployment-related environmental exposures and postdeployment chronic respiratory conditions in service members and veterans. Considering the known exposures for deployed individuals, certain respiratory or pulmonary responses, primarily acute, are plausible-based. Specifically, for respirable PM and chemical pollutants, including airborne material from burn pits, previous research indicates that PM exposures can be an irritant and result in acute inflammatory changes in the airways of the lungs with acute decrements in lung function. This, in turn, can lead to development of certain airway diseases (eg, asthma) or worsening of those airway diseases if already present.

Thus far, studies of service members and veterans who have been deployed have shown a variety of clinical findings for specific respiratory conditions ranging from no significant association between PM and cardiorespiratory outcomes to increased respiratory symptoms and a possible increased number of individuals diagnosed with

asthma.[11–13] One report suggests the finding of constrictive bronchiolitis (CB)—based on histology of lung tissue from open lung biopsy—in a high percentage of individuals who were evaluated for decreased exercise performance, but little evidence of other objective physiological or radiographic findings.[14] Reports of small numbers of individuals with severe respiratory symptoms, and some with CB, raise concerns regarding the completeness of case findings and appropriate diagnostic workups and resulting diagnoses. The lack of standard case definitions and medical codes may contribute to inconsistent research findings. Variability in the interpretation of radiological, pathological, and diagnostic testing results can also contribute to inconsistent findings of clinical conditions or disease.

To clarify this uncertainty, studies are either in progress or being planned to determine the prevalence of respiratory disease both after deployment and in comparison with nondeployed control groups. Routine clinical data are not sufficient to determine population levels of respiratory disease because neither the DoD nor the VA currently performs routine pulmonary medical monitoring, such as pulmonary function testing, on asymptomatic deployed service members. Chapter 8 (Pulmonary Function Testing—Spirometry Testing for Population Surveillance) and Chapter 9 (Discussion Summary: Recommendation for Surveillance Spirometry in Military Personnel) provide an in-depth discussion of the issues related to screening asymptomatic individuals. Researchers must contend with significant data gaps. It is difficult to evaluate the associations of exposures and health effects when an individual's exposures and potential confounding or contributing risks have not been characterized. Individual exposure data are limited in terms of type, frequency, and duration. Potential risk factors and risk modifiers (eg, smoking status and other personal behaviors, habits, activities, and unique susceptibilities) are not collected consistently, thus preventing the use of existing data to identify persons potentially at higher risk of adverse health outcomes.

HEALTH HAZARD EVALUATIONS OF OPEN-AIR BURN PITS

A notable burn pit existed at Joint Air Base Balad (JBB) in Iraq, the deployment location for many service members (more than 25,000 individuals during 2007 alone). The base generated large volumes of waste that was burned on site. Service members expressed concerns about the potential health risk associated with these operations. To assess exposures at JBB, DoD preventive medicine personnel conducted air sampling of emissions from the burn pit to measure PM, volatile organics, metals, polycyclic aromatic hydrocarbons, and polychlorodibenzodioxins/furans (dioxins and furans).[15] Sampling locations were selected to represent typical and maximum exposure levels for the general population. Samples were collected over multiple 24-hour periods to account for some of the operational and meteorological variabilities in exposure levels. One hundred sixty-three samples were collected, resulting in 4,811 individual analyte results. Data from the sampling effort were subsequently used in a quantitative screening human health risk assessment conducted by the Army and Air Force. Both noncancer and cancer risks were determined to be "acceptable" or "safe," utilizing the USEPA's methods and classification. A potential for short-term, reversible, noncancerous health effects and a "moderate" operational risk from PM were noted.[15(p13)]

The Defense Health Board (DHB), an independent committee comprised of experts from private industry and universities, reviewed the conclusions of the initial screening health risk assessment.[16] The DHB agreed with the conclusion that no long-term health effects should be expected as a result of exposure to dioxin or to the analytes measured and used in the risk assessment. However, that statement did not dismiss the potential for long-term health risk and did not specifically review PM. The DHB conclusions regarding long-term risk were limited by the short-term and intermittent nature of the sampling.

In 2009, to further address concerns that exposure to smoke produced by burn pit operations used to dispose of solid waste in the USCENTCOM contingency operations might be associated with acute and long-term health effects, the Assistant Secretary of Defense for Health Affairs tasked the Armed Forces Health Surveillance Center and the Naval Health Research Center to conduct expedient epidemiological studies using readily available data.[17] These studies were designed to assess whether a wide range of adverse health outcomes (respiratory and cardiovascular conditions, chronic multisystem illness, lupus erythematosus, rheumatoid arthritis, and birth outcomes for infants whose parents had been deployed) were potentially associated with deployment to a location where burn pit operations were known to have occurred. Based on those outcomes reviewed, it was determined that, "upon redeployment, service members from the USCENTCOM locations and the Korea cohort had either similar or significantly lower incidence rates of adverse health outcomes compared with the never-deployed continental US (CONUS)-based cohort, with the exception of 'signs, symptoms and ill-defined conditions' among the Arifjan cohort (a location with no burn pit)."[17(p3)] Comparisons of medical encounters

between the USCENTCOM camps in theater did show a higher proportion of respiratory-related medical encounters at JBB (a location with a burn pit), compared with the other three camps, possibly indicating an association between acute respiratory effects and deployment to JBB. However, these effects did not persist upon redeployment. The authors concluded that, "the epidemiological approach used in these studies found no evidence that service members at burn pit locations are at an increased risk for most health outcomes examined."[17(p4)] However, the authors recognized the limitation posed by the lack of individual exposure data, unmeasured confounders, and the limited duration of surveillance. The Armed Forces Health Surveillance Center intends to periodically extend this analysis to longer durations.

In 2009, continued OIF service member and veteran concerns were reflected in letters to the VA from Senator Daniel Akaka (D-HI) and Congressman Tim Bishop (D-NY), along with six co-signers, asking the VA to describe its plans to track and evaluate possible long-term health problems among troops exposed to hazardous materials from open-waste burn pits.[18] Consequently, the Veterans Health Administration Office of Public Health (OPH) requested that an independent scientific body, the National Academy of Sciences/IOM, review the long-term health consequences of burn pit exposure in Iraq and Afghanistan. The IOM Committee report, *Long-Term Health Consequences of Exposure to Burn Pits in Iraq and Afghanistan*,[9] was a special report requested by the VA and was not required by law. This report was specifically requested to address both the veterans' concerns and the uncertainties in the exposure assessments taken from field monitoring data. The OPH presented its Charge to the IOM Committee during the latter's first public session (Exhibit 1-3). The IOM study began in November 2009 and was publicly released on October 31, 2011.

To accomplish its task, the IOM Committee used a wide range of data sources, including peer-reviewed literature, government reports, raw environmental monitoring data, public comment, and other government documents. The IOM Committee first assessed the "types and quantities of materials burned during the time of pit use."[18(p25)] Then, the IOM analyzed air monitoring data collected at JBB during 2007 and 2009. The Committee examined "anticipated health effects from exposure to air pollutants found at JABB"[18(p25)] (noted as JBB in this chapter) and studies of health effects in similar populations with similar exposures, thus grading the quality of those studies as key or supportive. After synthesizing information on potential long-term health effects in military personnel potentially exposed to burn pits, the Committee then developed the design elements and feasibility considerations for an epidemiological study.

The IOM Committee's synthesis on potential long-term health effects of burn pit exposure resulted in two conclusions:

1. limited/suggestive evidence of an association between exposure to combustion products and reduced pulmonary function in the populations studied; and
2. inadequate/insufficient evidence of an association between exposure to combustion products and cancer, respiratory diseases, circulatory diseases, neurological diseases, and adverse reproductive and developmental outcomes in the surrogate populations studied.

The IOM Committee also suggested six recommendations for further research:

1. "A pilot [feasibility] study should be conducted to ensure adequate statistical power, … to adjust for potential confounders, to identify data availability and limitations, and to develop testable research questions and specific objectives.
2. An independent oversight committee … should be established to provide guidance and to review specific objectives, study designs, protocols, and results from the burn pit emissions research programs. …
3. A cohort study of veterans and active duty military should be considered to assess potential long-term health effects related to burn pit emissions in the context of other ambient exposures at the JBB.
4. An exposure assessment for better source attribution and identification of chemicals associated with waste burning and other pollution sources at JBB should be conducted … to help the VA determine those health outcomes most likely to be associated with burn pit exposures.
5. Exposure assessment should include detailed deployment information, including distance and direction individuals lived and worked from the JBB burn pit, duration of deployment, and job duties.
6. Assessment of health outcomes is best done collaboratively using the clinical informatics systems of the DoD and VA."[18(p126)]

Reduced pulmonary function, even if found in returning service members or veterans, would not necessarily equate to the presence of disease, but it might

EXHIBIT 1-3

CHARGE TO THE INSTITUTE OF MEDICINE COMMITTEE[1]

As part of its formal contract with the Institute of Medicine, the Veterans Health Administration developed the following charge for the Committee on Long-term Health Consequences of Exposure to Burn Pits in Iraq and Afghanistan:

- Examine the potential exposures and long-term health risks arising from exposure to smoke created by open burning of solid waste and other materials in Iraq and Afghanistan.
- Use the Joint Air Base Balad (JBB) burn pit in Iraq as an example.
- Examine existing literature that has detailed the types of substances burned and their byproducts.
- Examine the feasibility and design issues for a possible epidemiological study of veterans exposed at the JBB (and other) burn pit(s).
- Explore the background and use of burn pits in the military. Areas of interest may include the following:
  - where burn pits are located,
  - the frequency of use of burn pits and average burn times, and
  - whether materials being burned at Balad are unique or similar to burn pits located elsewhere.
- Recognize if relevant evidence is available from other conflicts (most notably the 1991 Gulf War), the Committee can use that information.
- Note that for evaluation of long-term risks, review a wide range of sources, such as the following:
  - epidemiological studies conducted either by or under the auspices of Veterans Affairs or the Department of Defense;
  - other available epidemiological literature where it exists on
    - the exposed population in question and
    - the populations exposed to similar hazards;
  - environmental studies of relevant hazardous air quality events;
  - relevant toxicological studies;
  - clinical and pathological studies of veteran patients who may have been exposed to environmental hazards from burn pits regardless of conflict; and
  - effects related to short-term peak exposures, as well as chronic exposures (ie, measured as a time-weighted average).
- Recommend research initiatives for Veterans Affairs and the Department of Defense to further study potential long-term health effects.

Data source: (1) Veterans Health Administration. *Committee on Long-term Health Consequences of Exposure to Burn Pits in Iraq and Afghanistan*. Paper presented at: Institute of Medicine's Public Meeting 1; February 23, 2010.

indicate that health effects are occurring. However, as noted previously, the lack of routine pulmonary surveillance in asymptomatic service member and veteran populations limits the ability to detect accelerated pulmonary function decline.

It is important to note that the IOM Committee recognized that burn pits may not be the main cause of long-term health effects related to Iraq and Afghanistan deployment. The report states that, "service in Iraq or Afghanistan—that is, a broader consideration of air pollution than exposure only to burn pit emissions—might be associated with long-term health effects, particularly in susceptible (eg, those who have asthma) or highly exposed subpopulations (eg, those who worked at the burn pit). Such health effects would be caused mainly by high ambient concentrations of PM from both natural and anthropogenic sources, including military sources."[18(p114)] The IOM Committee's report also suggests the need for health outcome studies of those who deployed regardless of burn pit exposure, "preferably another deployed population unexposed to burn pits but exposed to PM and other chemicals identified at JBB from other sources."[18(p125)] This statement from the IOM, in conjunction with VA and DoD assessments that a multitude of inhalation hazards may require study, is best captured by the term *airborne hazards* to define the scope of potential exposures and stakeholders' concerns.

CLINICAL ASPECTS IN THE EVALUATION OF RETURNING SERVICE MEMBERS AND VETERANS

The IOM Committee's conclusion that there was inadequate/insufficient evidence of an association between exposure to combustion products and cancer, respiratory diseases, circulatory diseases, neurological diseases, and adverse reproductive and developmental outcomes is a population-level finding and may not adequately characterize an individual's risk for adverse health outcomes. Individuals may have experienced exposures or may have co-occurring conditions or predispositions that place them at additional risk. Population-level studies may not have sufficient power to recognize these variations. Veterans and service members are returning from deployment with symptoms they did not have during their predeployment screenings. Both the DoD and VA recognize the importance of proper clinical evaluation and risk communication for these symptomatic individuals. It is also important to inform those service members and veterans who are not currently symptomatic (a majority of the population) of evidence-based risk so that they can make informed health decisions with the available evidence, such as improving their overall health through smoking cessation and other prudent, healthy lifestyle modifications.

After appropriate clinical workups of the symptomatic populations within the Military Health System and the Veterans Health Administration, analysis of healthcare operations data revealed a spectrum of diagnoses (asthma, vocal cord dysfunction, obesity, hypersensitivity pneumonitis, and sarcoidosis), as well as individuals with dyspnea on exertion without a recognized cause. Unexplained dyspnea on exertion is not a condition unique to OEF/OIF/OND deployment. Previous studies have documented this finding in nondeployed, active duty populations.[19] As noted previously in this chapter, some service members were diagnosed with CB by means of open-lung biopsy. This finding in individuals with a positive biopsy who demonstrated little abnormality on radiological and physiological screening tests (eg, pulmonary function tests) is of concern. These cases were initially associated with proximity to the sulfur mine fire that burned in Iraq in 2003, but later cases had no such history and were attributed nonspecifically to deployment.[20] A review of the pathological samples from these and other cases is ongoing and expected to be available in late 2013.

A working group of VA and DoD clinicians is developing standardized recommendations for primary care health providers who encounter service members and veterans who have endorsed respiratory symptoms as a result of deployment. Criteria are being developed for the evaluation and referral of some of these patients to appropriate medical specialists for further evaluation. In addition, processes are being cultivated to help identify the number of cases of certain respiratory conditions that have developed during and after deployment, and have presented in patients being treated by DoD or VA medical specialists.

DISCUSSION OF RECOMMENDATIONS BY THE INSTITUTE OF MEDICINE FOR FUTURE EPIDEMIOLOGICAL RESEARCH

The VA-sponsored IOM report published in 2011 provided six recommendations (listed in the previous section on Health Hazard Evaluations of Open-Air Burn Pits) for future epidemiological research that have significant cross-cutting implications for both the VA and DoD. These recommendations are further discussed in Chapter 33 (Discussion Summary: Work Group E—Strategic Research Planning) with planned and potential VA and DoD responses. In light of exposure and long-term health outcome uncertainty, long-term prospective studies are needed to establish a scientific evidence base for further analysis. It is critical to perform these studies in the veteran and service member populations because the studies available to the IOM were surrogate populations whose exposures and risk factors may not represent actual deployed populations and deployment conditions. Respiratory and cardiovascular outcomes deserve the majority of research focus because the current body of evidence for health effects of PM points to these organ systems and to the field PM measurements that routinely exceeded the standards of both the USEPA and the military.

The VA and DoD are collaborating on existing studies (eg, the DoD's Millennium Cohort Study and the VA's National Health Study for a New Generation of US Veterans), and the VA has proposed additional long-term prospective epidemiological studies of potential long-term health effects that may be associated with military service to include deployments. History has shown that not all health effects can be predicted. Therefore, it is essential to develop studies that monitor the overall health status of the study populations rather than restricting the methods to a small list of postulated outcomes. The VA and DoD also recognize that

there are concerns related to non-PM exposures (eg, gases containing carcinogens) and nonrespiratory outcomes (eg, cancers). Current exposure data suggest that gaseous exposure is not as ubiquitous as that of PM in OEF/OIF/OND and therefore requires different research methods. The VA and DoD continue to collaborate on current studies and the planning of additional studies to evaluate non-PM exposures and the health effects that may be associated with them.

DEPARTMENT OF DEFENSE AND DEPARTMENT OF VETERANS AFFAIRS ACTIONS

The VA and DoD have historically worked closely on environmental exposure-related health issues. Continuing this collaboration, the two departments developed an Airborne Hazards Joint Action Plan (included in this book as Appendix D) to improve the quality, efficiency, and effectiveness of postdeployment health services to veterans, service members, and military retirees with health concerns related to airborne hazards.[21] This plan was developed under the auspices of the Deployment Health Work Group, which is chartered under the joint Health Executive Council of the DoD and VA. The Airborne Hazards Joint Action Plan addresses not only the IOM Committee's conclusions and research recommendations on burn pits, but also the nonresearch operational matters necessary for the VA and the DoD to provide a comprehensive response. Focus areas in this plan include outreach, follow-up clinical care, population surveillance, and research aimed to improve the health of veterans and service members.

In November 2011, during the action plan's development phase, the VA OPH—with planning assistance from the US Army Public Health Command (Aberdeen Proving Ground, MD)—hosted a roundtable of invited subject matter experts from the VA, DoD, other federal agencies, and academia to collaboratively discuss the issue of airborne hazards and to explore possible "courses of action." Four subject areas were identified and discussed during the meeting: (1) trends in respiratory disease surveillance and their implications; (2) consideration of pulmonary function testing in service members; (3) case finding and workup of postdeployment respiratory disease; and (4) further research. Although the DoD and VA surveillance trends did not show high rates of respiratory disease in the postdeployment population, issues with surveillance using the *International Classification of Diseases, Ninth Revision, Clinical Modification*, codes were noted, and the potential merits of enhanced case findings were discussed.

As follow-up, the OPH and US Army Public Health Command held an Airborne Hazards Symposium in Washington, DC, on August 22, 2012. Through information sharing, this symposium advanced the issues identified during the previous roundtable. The symposium consisted of plenary sessions on relevant topics and working group discussions in seven specific areas:

1. diagnosis and workup of symptomatic individuals,
2. exposure characterization,
3. current epidemiology,
4. potential role of pulmonary function testing (spirometry) in surveillance,
5. strategic research planning,
6. clinical follow-up and registries, and
7. risk communication.

Of the many tangible outcomes from this conference, this book—developed from symposium presentations by a diverse group of scientific experts and with veteran perspectives—represents a compendium of what is currently known regarding the potential long-term health consequences of exposure to airborne hazards during OEF/OIF/OND deployments. This book presents a balanced, comprehensive approach to furthering the understanding of airborne hazards during deployments and other military operations, ultimately improving airborne hazard prevention, protection, and avoidance while improving healthcare and minimizing adverse health outcomes of our service members and veterans.

The DoD and VA are also coordinating closely to establish an Open Burn Pit Registry as required in Public Law 112-260 (Dignified Burial and Other Veterans' Benefits Improvement Act of 2012) that was enacted by President Obama on January 10, 2013. This law requires periodic outreach and requires the VA to work with an independent scientific organization to prepare a report on the activities of the secretaries. The VA will utilize the Open Burn Pit Registry to the maximum extent possible to improve understanding of the long-term health effects of deployment exposures, recognizing that the ability to determine robust scientific associations will be limited and given that participation in this voluntary health registry is self-selected. Unlike earlier environmental health registries that focused solely on in-person examinations, the planned Open Burn Pit Registry is a widely accessible self-assessment available through mobile Internet technologies. Optional in-person examinations will be available for symptomatic individuals and those who request an examination.

SUMMARY

Based on the available scientific and medical evidence presented in the IOM report—*Long-Term Health Consequences of Exposure to Burn Pits in Iraq and Afghanistan*—and other available scientific information, the Secretary of the VA made a determination (published in the *Federal Register* in February 2013) that the VA should further study the possible long-term adverse health effects of veterans of Iraq and Afghanistan who were potentially exposed to airborne hazards. This study was to include air pollution in general, as well as smoke from burn pits.[22] Specifically, the Secretary of the VA directed the Veterans Health Administration to conduct a longitudinal cohort study on all adverse effects related to military deployment to Iraq and Afghanistan (carefully considering the IOM's research recommendations). Realizing the importance of collaboration, the Secretary of the VA also sent a letter to the Secretary of Defense in late January 2013 describing the former's actions to date and highlighting the continued collaboration. The DoD and VA will continue their long-established clinical and research collaboration on this issue, specifically through the established joint work groups, to provide policy recommendations, clinical education, and outreach.

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