

**THE NATIONAL ACADEMIES REPORT**  
***RESPIRATORY HEALTH EFFECTS OF AIRBORNE HAZARDS EXPOSURES***  
***IN THE SOUTHWEST ASIA THEATER OF MILITARY OPERATIONS***

Statement of

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before the  
Committee on Veterans' Affairs  
Subcommittee on Disability and Memorial Affairs  
United States House of Representatives

September 23, 2020

Chairwoman Luria, Ranking Member Bost, and members of the Subcommittee, thank you for the opportunity to testify today. My name is Dr. Sverre Vedal and I am Professor Emeritus in the Department of Environmental and Occupational Health Sciences at the University of Washington School of Public Health. I'm speaking to you today in my capacity as a member of a committee formed by the National Academies of Sciences, Engineering, and Medicine that recently completed a report addressing the respiratory health effects of airborne hazards exposures in the Southwest Asia Theater of Military Operations. Accompanying me is Dr. David Butler, who was the responsible staff officer for this effort.

The National Academy of Sciences was created more than 150 years ago through a congressional charter signed by Abraham Lincoln in order to serve as an independent, authoritative body outside the government that could advise the nation on matters pertaining to science and technology. Every year, approximately 6,000 Academies members and volunteers serve pro bono on consensus study committees or convening activities. The National Academies do not advocate for specific policy positions. Rather, they enlist the best available expertise across disciplines to examine the evidence, reach consensus, and identify a path forward. National Academies reports, proceedings and other publications are available via the web in PDF form without charge.

The National Academies have a long history of advising the federal government on the health effects of military service in general and on the effects of in-theater exposures resulting from military activities in particular. I have included a list of the National Academies reports related to health issues in Gulf theater-active duty personnel and veterans in the materials submitted for the subcommittee's attention.

I'd now like to address the National Academies most recent report on this topic.

More than 3.7 million U.S. service members have participated in operations in Iraq, Kuwait, Saudi Arabia, Bahrain, the Gulf of Aden, the Gulf of Oman, Oman, Qatar, the United Arab Emirates—a region known collectively as the Southwest Asia Theater of Military Operations—and Afghanistan since 1990. During and after the 1990–1991 Persian Gulf War, service members and veterans began reporting a variety of respiratory health problems. In response to the concerns raised, the U.S. Congress passed laws, including the Persian Gulf War Veterans Act

and the Veterans Programs Enhancement Act, mandating the study of health outcomes in Southwest Asia theater veterans. The Department of Defense (DoD) and the Department of Veterans Affairs (VA) have also undertaken their own initiatives to address questions that remain unanswered. As part of this work, in September 2018, VA requested that the National Academies form an ad hoc committee to study the evidence regarding respiratory health outcomes in veterans of the Southwest Asia theater conflicts. The study committee was asked to identify gaps in this evidence, potential research opportunities to address outstanding questions and generate answers, newly emerging technologies that could aid in these efforts, and organizations that VA might collaborate with to accomplish this work. I had the pleasure of serving on that committee, which was chaired by Dr. Mark Utell of the University of Rochester and which included experts in epidemiology, pulmonary medicine, pathology, exposure assessment, military and veterans' health, and toxicology.

Our committee's review of the research found that veterans may be exposed to a broad range of potentially hazardous airborne agents as part of their service in the Southwest Asia theater.

These agents include:

- dust and sand;
- emissions from burning oil wells and open burn pits;
- exhaust from vehicles and aircraft;
- indigenous biologic agents and allergens;
- depleted uranium particles liberated from munitions and armor;
- air pollution from local and regional industry, power generation, and agricultural activities;
- vapors, gases, dusts, and fumes from chemical agents used in military job tasks; and
- exposures that were specific to a particular wartime incident, such as the nerve agents released during the demolition of the Khamisiyah, Iraq, storage complex in 1991 and emissions from the Al-Mishraq, Iraq, sulfur plant fire in 2003.

One of these—exposure to airborne particulate matter—has received special attention because a growing body of literature suggests that it is associated with adverse respiratory and other health effects.

Exposures differed by conflict and varied by location and over time. For example, 1990–1991 Gulf War veterans were potentially exposed to smoke from oil-well fires set by retreating Iraqi forces, while veterans of post-9/11 conflicts may have been exposed to emissions from open burn pits. The susceptibility to health effects from these airborne hazards may have been influenced by factors common to military operations, such as temperature extremes, psychosocial stress, sleep deprivation, and noise.

Our committee developed a list of 27 respiratory health outcomes that might be associated with exposure to airborne hazards encountered in the Southwest Asia theater, based on its review of the scientific literature. These included excess mortality, cancer, asthma, chronic bronchitis, sinusitis, constrictive bronchiolitis, and other respiratory health outcomes that are of great concern to veterans. A complete list of the outcomes is provided in a table that accompanies this testimony.

Of these outcomes, none met the study committee’s criteria for sufficient evidence of an association. The evidence for respiratory symptoms—defined as chronic persistent cough, shortness of breath (also called dyspnea), or wheezing—met the committee’s criteria for limited or suggestive evidence of an association for veterans of both the 1990–1991 Gulf War and the post-9/11 conflicts. Research studies that have been considered in previous National Academies reports consistently reported associations between deployment and more prevalent self-reported respiratory symptoms in Southwest Asia theater veterans, and results from more recent studies agree with those findings. Many of the studies considered were limited by an inability to confidently rule out chance, bias, or confounding as an explanation for the results observed. However, these concerns—while serious—were consistent with a classification in the limited or suggestive category.

In addition, our committee concluded that there was limited or suggestive evidence of no association between in-theater exposures and changes in lung function in 1990–1991 Gulf War veterans. There was inadequate or insufficient information to evaluate this association in post-9/11 conflict veterans.

The committee found that there was inadequate or insufficient information to evaluate the association between service in the Southwest Asia theater and all of the remaining respiratory

health outcomes it examined. There are a variety of reasons for this that vary by the outcome under consideration. One prominent cause was the lack of good exposure characterization—information is often lacking on who was exposed, what they were exposed to, where and when and at what concentration, over what time period, and with what frequency. Another reason for this conclusion was the widespread use of self-reported health outcomes and exposures. In the military deployment setting, this can be an issue if, for example, those who have a respiratory health problem are more likely to recall airborne exposures than those who do not or, alternatively, if those who experienced airborne exposures are more likely to report a respiratory health problem. A third prominent issue was many of these studies did not account for the role of cigarette smoking, which is known to cause or exacerbate respiratory health problems.

It is clear that military personnel and veterans are experiencing respiratory health problems, and our committee wishes to emphasize that these findings do not mean that there is no association between service in the Southwest Asia theater and these conditions. Instead, the committee found that the available epidemiologic evidence does not allow a definitive determination to be made about any potential association.

We identified a number of gaps in the current information base regarding respiratory health outcomes in the population of veterans who served in the Southwest Asia theater. These can be grouped as gaps in knowledge concerning adverse respiratory health outcomes in theater veterans, in-theater airborne exposures, and the biologic and toxicologic effects of in-theater airborne exposures.

Based on its review, our committee developed three recommendations regarding these gaps:

- We recommended that VA establish an expert panel to advise it on issues related to the diagnosis of constrictive bronchiolitis in veterans and its possible relationship to military service.
- Our committee recommended that an updated analysis of mortality, and in particular, respiratory mortality, in Southwest Asia theater veterans be conducted.
- And we recommended that VA and DoD explicitly integrate research access considerations into their planning as they refine the implementation of their new interoperable electronic health record system.

There were several technologies, some newly emerging, that the study committee concluded could be used to advance our knowledge of the effects of airborne hazards exposures. These related to biomarker discovery and measurement, and innovations in the remote measurement and retrospective estimation of airborne pollutants via satellite data. Looking further into the future, we also identified technologies that might be brought to bear to gather information during active duty that would aid in the subsequent evaluation of airborne exposures and health outcomes. Among the technologies we highlighted were devices for measuring exposure in deployed environments, and wearable and portable devices to assess health outcomes.

Our committee was also asked to identify organizations that VA might partner with to advance its understanding of respiratory health effects in Southwest Asia theater veterans. A number of federal agencies, investigators in the United States and abroad, and other governmental and private-sector organizations are currently conducting research relevant to theater veterans' health or else have information that could improve the conduct of such work.

The Department of Defense already has extensive relationships with VA on issues related to occupational and environmental exposures for veterans and the committee recommended that VA continue and expand this partnership on environmental health issues, focusing on the free flow of information on exposures encountered during military service and on the health of personnel before, during, and after deployment and after transition to veteran status. This should include cooperation on identifying which respiratory health status information should be gathered during active duty for later use as baseline data in evaluating veterans' health for treatment, benefits, and research purposes.

To more fully understand any existing associations between service in the Southwest Asia theater and respiratory health effects, our committee emphasized that researchers should take a new approach that will allow them to better answer these questions. It is possible today to conduct high-quality research on this topic by improving exposure assessment, combining and analyzing existing data in innovative ways, better accounting for influences such as smoking habits, and standardizing the way outcomes are determined to make it easier to compare results.

While burn pit-related research will certainly be a part of this work, it will likely be challenging to attribute specific effects to only this exposure. The more important question is

whether deployment to the Southwest Asia theater—with all of the hazardous airborne exposures it entailed—may be responsible for adverse respiratory outcomes. Our report suggests a number of actions that address not only existing knowledge gaps but also steps that VA and other government entities can take to better understand the health problems that veterans face and provide them with the information they need.

This is only a brief summary of the committee's work—the complete report is available for free download in PDF format from the National Academies Press website: [nap.edu](http://nap.edu). I've also submitted a copy of the report highlights with my testimony today.

Thank you for the opportunity to testify. I would be happy to address any questions that you might have.

**Outcomes Addressed in the National Academies’  
*Respiratory Health Effects of Airborne Hazards Exposures  
in the Southwest Asia Theater of Military Operations* report**

**Non-Cancer Respiratory Disorders**

Upper airway disorders

Rhinitis  
Sinusitis

Vocal cord dysfunction  
Sleep apnea

Non-infectious lower airway

Asthma  
Chronic bronchitis  
Chronic obstructive pulmonary  
disease

Constrictive bronchiolitis  
Emphysema

Interstitial lung diseases

Acute eosinophilic pneumonia  
Idiopathic interstitial pneumonia  
Hypersensitivity pneumonitis

Idiopathic pulmonary fibrosis  
Pulmonary alveolar proteinosis  
Sarcoidosis

Infectious lower respiratory

Acute bronchitis  
Pneumonia

Tuberculosis

Respiratory symptoms

Chronic persistent cough  
Shortness of breath (dyspnea)

Wheeze

**Cancers**

Esophageal cancer  
Laryngeal cancer

Lung cancer  
Oral, nasal, and pharyngeal cancers

**Other Outcomes**

Changes in pulmonary function  
Mortality due to diseases of the respiratory system

## Reports Related to Gulf Theater Veterans' Health from the National Academies of Sciences, Engineering, and Medicine

Report Title	Year
Health Consequences of Service During the Persian Gulf War: Initial Findings and Recommendations for Immediate Action	1995
Health Consequences of Service During the Persian Gulf War: Recommendations for Research and Information Systems	1996
Adequacy of the Comprehensive Clinical Evaluation Program: A Focused Assessment	1997
Measuring the Health of Persian Gulf Veterans: Workshop Summary	1998
Gulf War Veterans: Measuring Health	1999
Gulf War and Health, Volume 1: Depleted Uranium, Sarin, Pyridostigmine Bromide, and Vaccines	2000
Strategies to Protect the Health of Deployed U.S. Forces: Detecting, Characterizing, and Documenting Exposures	2000
Gulf War Veterans: Treating Symptoms and Syndromes	2001
Gulf War and Health, Volume 2: Insecticides and Solvents	2003
Gulf War and Health: Updated Literature Review of Sarin	2004
Gulf War and Health, Volume 3: Fuels, Combustion Products, and Propellants	2005
Amyotrophic Lateral Sclerosis in Veterans: Review of the Scientific Literature	2006
Gulf War and Health, Volume 4: Health Effects of Serving in the Gulf War	2006
Posttraumatic Stress Disorder: Diagnosis and Assessment	2006
Gulf War and Health, Volume 5: Infectious Diseases	2007
Epidemiologic Studies of Veterans Exposed to Depleted Uranium: Feasibility and Design Issues	2008
Gulf War and Health: Updated Literature Review of Depleted Uranium	2008
Gulf War and Health, Volume 6: Physiologic, Psychologic, and Psychosocial Effects of Deployment-Related Stress	2008
Gulf War and Health, Volume 7: Long-Term Consequences of Traumatic Brain Injury	2009
Gulf War and Health, Volume 8: Update of Health Effects of Serving in the Gulf War	2010
Returning Home from Iraq and Afghanistan: Preliminary Assessment of Readjustment Needs of Veterans, Service Members, and Their Families	2010
Review of the Department of Defense Enhanced Particulate Matter Surveillance Program Report	2010
Long-Term Health Consequences of Exposure to Burn Pits in Iraq and Afghanistan	2011
Gulf War and Health: Treatment for Chronic Multisymptom Illness	2013
Chronic Multisymptom Illness in Gulf War Veterans: Case Definitions Reexamined	2014
Gulf War and Health, Volume 9: Long-Term Effects of Blast Exposures	2014

<b>Report Title</b>	<b>Year</b>
Considerations for Designing an Epidemiologic Study for Multiple Sclerosis and Other Neurologic Disorders in Pre and Post 9/11 Gulf War Veterans	2015
Gulf War and Health, Volume 10: Update of Health Effects of Serving in the Gulf War, 2016	2016
Assessment of the Department of Veterans Affairs Airborne Hazards and Open Burn Pit Registry	2017
Gulf War and Health, Volume 11: Generational Health Effects of Serving in the Gulf War	2018
Respiratory Health Effects of Airborne Hazards Exposures in the Southwest Asia Theater of Military Operations	2020

List current as of September 15, 2020

All National Academies reports are available for free download in PDF format via the National Academies Press website: [nap.edu](http://nap.edu).