

Examining the Impact of Exposures to Toxic Chemicals
on Veterans and the VA's Response

Statement of

Kenneth S. Ramos, M.D., Ph.D.

Associate Vice President for Precision Health Sciences,

Arizona Health Sciences Center

University of Arizona

and

Chair,

Institute of Medicine Committee on Veterans and Agent Orange, Update 2014

National Academies of Sciences, Engineering, and Medicine

Before the

Committee on Veterans' Affairs

U.S. Senate

September 29, 2015

Good morning, Mr. Chairman, Senator Blumenthal, and members of the Committee. My name is Dr. Kenneth Ramos. I am Associate Vice President for Precision Health Sciences at the University of Arizona and a Professor of Medicine in the Division of Pulmonary, Allergy, Critical Care and Sleep Medicine at the Arizona Health Sciences Center. I also act as Director of the Center for Applied Genetics and Genomic Medicine and am Director of the College of Medicine M.D.-Ph.D. Program. Previously, I held faculty positions at the University of the Sciences in Philadelphia, at Texas Tech University Health Sciences Center, Texas A&M University, and at the University of Louisville School of Medicine. I am currently serving as chair of the committee that is preparing the last update in the Veterans and Agent Orange (VAO) series of Institute of Medicine (IOM) reports mandated by the Agent Orange Act of 1991 (PL 102-4) and renewed in the Veterans Education and Benefits Expansion Act of 2001 (PL 107-103). Today I will be talking about the VAO series of reports, but I will begin by discussing another IOM report that attempted to assess the exposure of Blue Water Navy (BWN) Vietnam veterans to Agent Orange.

In 2010, an IOM committee completely separate from the VAO committees was tasked to study whether the Vietnam veterans in the BWN experienced exposures to herbicides and their contaminants that were comparable with those of the Brown Water Navy Vietnam veterans and troops on the ground in Vietnam, with a focus on Agent Orange and dioxin exposures. The committee was asked to compare the possible routes of exposure of BWN veterans on ships and of ground troops in Vietnam, and the potential mechanisms of herbicide exposures (such as water exposure from contamination of potable water, air exposure from spray drift, and food and soil contamination). It was also asked to compare the risks of long-term adverse health effects in ground troop veterans, BWN veterans, and other "era" veterans, and to review any studies that

addressed adverse health effects specifically in BWN veterans. I will focus on the exposure aspects of the resulting 2011 report *Blue Water Navy Vietnam Veterans and Agent Orange Exposure*, but first I should note that, just prior to the initiation of this committee's work, the VAO committee for *Update 2008* had made a statement about the BWN controversy (based on a less extensive review of details of exposure estimation and its understanding that the BWN Vietnam veterans had previously been included) to the effect that available scientific information did not support making a decision to exclude them from coverage under the Agent Orange Act.

The BWN committee gathered information on how Agent Orange had been used in Vietnam and the quantity and geographic range of its application. The committee also considered data on the magnitude of dioxin contamination of Agent Orange. After reviewing information on releases of Agent Orange to the environment, the committee explored its fate and transport in air, fresh and marine water, sediment, soil, and food to assess the plausibility of Agent Orange and dioxin exposure of military personnel who did not actually handle the herbicide themselves. The committee attempted to identify any monitoring data on dioxin had been gathered during or shortly after the Vietnam War. The committee also considered fate and transport models that could be used in conjunction with the limited available data to examine the plausibility of exposure of ground troops and BWN veterans to the chemicals. The committee attempted to determine where BWN ships were during the war, their missions, how close they came to the Vietnamese coast, and the activities conducted aboard the ships by the sailors.

Many data sources and methods were identified and pursued by the committee, including published peer-reviewed literature, models for assessing the environmental concentrations of Agent Orange and dioxin, anecdotal information from veterans and other interested parties on veteran experiences during the war and afterwards, and such other information sources as written

and published accounts of the war (including memoirs), government documents, and ships' deck logs.

To determine whether BWN personnel had exposures to dioxin comparable with those of ground troops and Brown Water Navy personnel, the committee sought to determine whether there were plausible exposure pathways between releases of Agent Orange (specifically, the spraying of Agent Orange during the Operation Ranch Hand missions) and the three populations.

The committee considered using a mathematical model to estimate likely dioxin concentrations based on Agent Orange inputs to the environment, but it found that input data and, importantly, data with which to evaluate model performance, were not available. The committee did make the assumption that Agent and dioxin would have entered waterways from riverbank spraying or as runoff from soil, particularly in the Mekong delta area that was heavily sprayed and that experienced frequent flooding. The amount entering the rivers would be highly diluted by river flows.

The concentration of dioxin in marine waters would be reduced to a great extent by dilution in river water and by dispersion in air, as well as by further dilution in the coastal waters. Given the total lack of monitoring information conducted during or shortly after the war and the variability and uncertainty in the fate and transport information on dioxin as it pertains to Vietnam, the committee concluded that it is not possible to estimate the likely concentrations of dioxin in marine waters and air at the time of BWN deployment.

The committee was also tasked with comparing exposures among three military populations that served in Vietnam: troops on the ground, Brown Water Navy personnel, and BWN personnel. Since the 1970s, IOM committees and other groups have attempted to reconstruct Vietnam veterans' potential exposure to Agent Orange and dioxin. Given the lack of exposure

data on ground troops, the uncertainty of exposure models, and the limited knowledge about exposure among BWN veterans, the committee concluded that it was not possible to make quantitative exposure comparisons among the three military populations of interest to the VA. Therefore, the committee evaluated the *plausibility* of exposure of the three populations to Agent Orange and dioxin via various mechanisms and routes. Several plausible exposure pathways and routes of exposure to Agent Orange–associated dioxin in the three populations were identified. Plausible pathways and routes of exposure of BWN personnel include inhalation and dermal contact with aerosols from spraying operations that occurred at or near the coast when BWN ships were nearby, contact with marine water, and uses of potable water prepared from distilled marine water.

Large US Navy ships—such as aircraft carriers, cruisers, and destroyers—had their own distillation systems to produce potable-water and distribution systems that included water-treatment processes. The issue of distillation of marine water is important because the VAO committee for *Update 2008* found that BWN veterans could have been exposed to dioxin via contaminated potable water. This conclusion was based on an Australian Department of Veterans Affairs report that determined that Royal Australian Navy personnel who served offshore in Vietnam were exposed to Agent Orange–associated dioxin because the distillation systems aboard the ships were thought to be able to concentrate the dioxin in marine water into the potable water during the evaporative process. If Agent Orange–associated dioxin was present in the marine water, distilled potable water would be a plausible pathway of exposure for BWN veterans.

The 2011 committee concluded that, qualitatively, ground troops and Brown Water Navy veterans had more plausible pathways of exposure to Agent Orange–associated dioxin than did

BWN veterans. But one exposure mechanism was specific to BWN ships: possible dioxin contamination of potable water from onboard distillation plants. However, without information on the dioxin concentrations in the marine feed water, it is impossible to determine whether BWN personnel were exposed to Agent Orange–associated dioxin via ingestion, dermal contact, or inhalation of potable water.

In the course of their work over 20 years, VAO committees have only found a single epidemiological finding specific to BWN veterans. Non-Hodgkin lymphoma was among the selected cancers addressed in CDC’s 1990 case-control study assessing the role of Vietnam service as a risk factor. As shown in the table below from VAO *Update 2012*, BWN veterans have been found to have a higher incidence of non-Hodgkin lymphoma than other naval Vietnam veterans and had the highest, most significant risk across all branches of service for this adverse health outcome.

	Deployed Veterans	Odds Ratio (95% Confidence Interval)
US CDC Selected Cancers Study —case-control study of incidence of non-Hodgkin lymphoma (Dec 1, 1984–Nov 30, 1989) among US males born 1929–1953	99	1.5 (1.1–2.0)
Army Vietnam veterans	45	1.2 (0.8–1.8)
Marine Vietnam veterans	10	1.8 (0.8–4.3)
Air Force Vietnam veterans	12	1.0 (0.5–2.2)
Navy Vietnam veterans	32	1.9 (1.1–3.2)
Blue Water Navy Vietnam veterans	28	2.2 (1.2–3.9)

Although this does not address the question of dioxin exposure directly, this disease is considered a signature cancer of dioxin exposure, and so this health outcome alone is presumed by VA to be service-related for BWN veterans.

Ultimately, the BWN committee, like the VAO committee for *Update 2008*, was unable to state with certainty that BWN personnel *were or were not* exposed to Agent Orange and its associated dioxin. Owing to a lack of data on environmental concentrations of Agent Orange and Agent Orange–associated dioxin and an inability to reconstruct likely concentrations, as well as the dearth of information about relative exposures among the ground troops and Brown Water Navy personnel and BWN personnel, it is impossible to compare actual exposures across these three populations. Thus, the judgment of both these IOM committees was that **exposure of BWN Vietnam veterans to Agent Orange–associated dioxin cannot reasonably be determined and no future scientific research is likely to provide additional information that would resolve the issue.** Whether or not the claims of BWN veterans are to be processed like those of other Vietnam veterans is ultimately a policy decision.

In fact, the paucity of reliable information on toxic exposures that military personnel may experience has been a problem not just with respect to the BWN situation. One of the three tasks assigned by the Agent Orange Act for each health effect evaluated by a VAO committee was to determine “the increased risk of disease among those exposed to the herbicides during service in the Republic of Vietnam during the Vietnam era.” After several updates that remarked individually for each of the dozens of health outcomes reviewed that such risks could not be calculated due to the lack of exposure information, VAO committees eliminated the individual sections in favor of a generic statement at the beginning of their reports. (This is an example of a legislative requirement that remained inconsistent with reality, even after two more decades of

scientific progress.) IOM committees assessing the possibility of health consequences in other veteran cohorts (e.g., Gulf War, Operation Iraqi Freedom, etc.) have lamented the lack of information collected during or immediately after a deployment that might shed light on the frequency, duration, and intensity of the exposures that veterans experienced. In the case of Agent Orange, great efforts have been made to gather exposure estimates retrospectively, such as gathering blood sample from Air Force veterans who served in Operation Ranch Hand and modeling an exposure opportunity index for individual veterans based on melding information abstracted from records of spray missions and troop movements. The results of these exposure estimation efforts have largely proven to be frustrating; at best they have provided a very rough estimate of potential exposure for a particular group of services members. In response to repeated recommendations from VAO and other IOM committees, DOD has been attempting to develop ways to avoid repetition of this situation going forward, but anticipating what should be collected in various circumstances is exceedingly challenging. For example, collection of biologic samples from each service member before and after deployment might be ideal for some exposures such as depleted uranium, but useless for those that leave no detectable marker in a person. Unfortunately, I do not expect data will become available from past conflicts that will permit more accurate reconstructions of those exposures nor that the actual exposure of individual service members is ever likely to be known.

In addition to highlighting the difficulty of obtaining useful exposure data on veterans, the production of the series of VAO reports has been a constructive learning experience in other respects. Theoretically, the procedure set out in the Agent Orange Act and adopted in other instances when troops have possibly experienced toxic exposures might be expected to anticipate health problems that might ultimately prove to be more prevalent in a particular set of veterans.

In practice, however, the approach of culling results from existing epidemiologic studies for adverse effects characteristic of the “suspect” toxic agent in a given situation and then periodically iterating the procedure for more recent findings has been fraught with challenges and conveyed a sense of delayed response to the veterans. The process is contentious and time-consuming, and the underlying rationale is somewhat circular. Although answers prior to the manifestation of harm in veterans would be desirable, a shift in emphasis toward monitoring the veterans themselves more closely might ultimately be more definitive. Unfortunately, an improved approach is not readily apparent, especially not one that would smoothly transition from established procedures.

Renewing the biennial AO updates may not be the optimal way to move forward, but extending it temporarily would at least ensure continuity to the monitoring of the health status of Vietnam veterans as they continue to age and a guaranty of periodic consideration of their situation. Production of one more VAO update after the one currently nearing release would provide time to re-evaluate the current process of identifying and assessing possible service-associated health problems in veterans and their families for compensation. Before legislating changes for which the scientific basis may be premature, this could be an opportunity to define a process that would be more coherent across various military situations.

Thank you asking me to join you today. If you would like additional clarification of any of the points I raised, I would be happy to answer your questions.

References

CDC (Centers for Disease Control and Prevention). 1990. The association of selected cancers with service in the US military in Vietnam. I. Non-Hodgkin's lymphoma. *Archives of Internal Medicine* 150:2473–2483.

IOM (Institute of Medicine). 2009. *Veterans and Agent Orange: Update 2008*. Washington, DC: The National Academies Press.

IOM. 2011. *Blue Water Navy Vietnam Veterans and Agent Orange Exposure*. Washington DC: The National Academies Press.

IOM. 2014. *Veterans and Agent Orange: Update 2012*. Washington, DC: The National Academies Press.