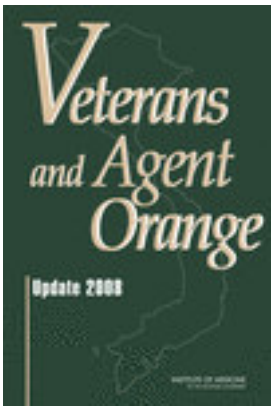

Veterans and Agent Orange: Update 2008

Committee to Review the Health Effects in Vietnam Veterans of Exposure to Herbicides (Seventh Biennial Update), Institute of Medicine

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The following citations are taken from the **IOM (Institute of Medicine). 2009. *Veterans and Agent Orange: Update 2008*. Washington, DC: The National Academies Press.**

Pages 29-30:

Increased Risk in Vietnam Veterans

When all the available epidemiologic evidence has been evaluated, it is presumed that Vietnam veterans are at increased risk for a specific health outcome if there is evidence of a positive association between one or more of the chemicals of interest and the outcome. The best measure of potency for the quantification of risk to veterans would be the rate of the outcome in exposed Vietnam veterans compared with the rate in nonexposed veterans, adjusted for the degree to which any other factors that differ between exposed and nonexposed veterans might influence those rates. A dose–response relationship established in another human population suitably adjusted for such factors would be similarly suitable.

It is difficult to quantify risk when exposures of a population have not been measured accurately. Recent serum TCDD concentrations are available only on subgroups enrolled in the Air Force Health Study (AFHS) (the Ranch Hand and Southeast Asia comparison subjects) and from VA's study of deployed and nondeployed members of the Army Chemical Corps. Pharmacokinetic models, with their own set of assumptions, must then be used to extrapolate back to obtain the most accurate estimates of original exposure available on Vietnam-era veterans. The absence of reliable measures of exposure to the chemicals of interest among Vietnam veterans limits the committee's ability to quantify risks of specific diseases in this population.

Although serum TCDD measurements are available for only a small portion of Vietnam-era veterans, the observed distributions of these most reliable measures of exposure make it clear that they cannot be used as a standard to partition veterans into discrete exposure groups, such as service on Vietnamese soil, service in the Blue Water Navy, and service elsewhere in Southeast Asia. For example, many TCDD values observed in the comparison group from the AFHS exceeded US background levels and overlapped considerably with those of the Ranch Hand subjects.

As explained in Chapter 1, the committee for *Update 2006* decided to make a general statement about its continuing inability to address that aspect of its charge quantitatively rather than reiterate a disclaimer in the concluding section for every health outcome, and this committee has retained that approach.

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

Page 46-47:

Exposure of Personnel Who Had Offshore Vietnam Service

US Navy riverine units are known to have used herbicides while patrolling inland waterways (Zumwalt, 1993; IOM, 1994), and it is generally acknowledged that estuarine waters became contaminated with herbicides and dioxin as a result of shoreline spraying and runoff from spraying on land. Thus, military personnel who did not serve on land were among those exposed to the chemicals during the Vietnam conflict. A particular concern for the personnel has been possible contamination of drinking water. Most vessels serving offshore but within the territorial limits of the Republic of Vietnam converted seawater to drinking water through distillation.

Higher than expected mortality among Royal Australian Navy Vietnam veterans prompted a study of potable-water contamination on ships offshore during the Vietnam conflict (Mueller et al., 2001, 2002). Specifically, the study investigated the potential for naval personnel to ingest TCDD and cacodylic acid in drinking water. The study focused on the evaporative distillation process that was used to produce potable water from surrounding estuarine waters. The study found that codistillation of dioxins was observable in all experiments conducted and that distillation increased the concentration of dioxins in the distillate compared with the concentration in the source water. The study also found that dimethylarsenic acid did not codistill to a great extent during evaporation and concluded that drinking water on ships was unlikely to have been contaminated with this herbicide. In a follow-up discussion of the study with its authors, it was noted that vessels would take up water for distillation as close to shore as possible to minimize salt content (Wells, 2006). On the basis of that study and other evidence, the Australian Department of Veterans Affairs determined that Royal Australian Navy personnel who served offshore were exposed to dioxins that resulted from herbicide spraying in Vietnam even if they did not go ashore during their tour of duty (ADVA, 2005).

The current committee engaged Steven Hawthorne as a consultant to review the Mueller et al. (2002) publication and to comment generally on the ability of organic compounds to codistill during the production of potable water. Hawthorne is an environmental chemist at the University of North Dakota's Energy and Environmental Research Center and has specific expertise in the study of organic emissions from water (Hawthorne et al., 1985). He affirmed the findings of the Australian study, citing Henry's law for an explanation of how contaminants with low water solubility would evaporate from water and noting that the distillation process would enhance the process by adding heat and reducing pressure (Hawthorne, 2008). No measurements of dioxin concentrations in seawater were collected during the Vietnam conflict, so it is not possible to ascertain the extent to which drinking water on US vessels may have been contaminated through distillation processes. However, it seems likely that vessels with such distillation processes that traveled near land or even at some distance from river deltas would periodically collect water that contained dioxin. Thus, a presumption of exposure of military personnel serving on those vessels is not unreasonable.

In its charge to the original *VAO* committee, the Department of Veterans Affairs asked the committee to include military personnel who served in inland waterways, offshore of the Republic of Vietnam, and in the airspace above the Republic of Vietnam. A presumption of exposure to Agent Orange and other herbicides used as defoliants applied to each of those groups as well as to those who served on land. In light of the findings of the Australian study regarding potential drinking-water contamination and those serving offshore, the presumption seems well founded.

Pages 564-565:

COMMITTEE RECOMMENDATIONS

As part of its charge, the committee was asked to make recommendations concerning the need, if any, for additional scientific studies to resolve uncertainties concerning the health effects of the chemicals of interest sprayed in Vietnam: 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and its contaminant 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), picloram, and cacodylic acid. This chapter summarizes the committee's recommendations.

Although great strides have been made over the last several years in understanding the health effects of exposure to the chemicals of interest and in elucidating the mechanisms underlying them, gaps in our knowledge remain. The scope of potential research on the chemicals is wide, and what follows in this chapter is not an exhaustive listing of future research that might have value. There are many additional opportunities for progress in such subjects as toxicology, exposure assessment, the conduct of continuing or additional epidemiologic studies, and systematic and comprehensive integration of existing data that have not been explicitly noted here. It is the committee's conviction, however, that work needs to be undertaken promptly, particularly to address questions regarding several health outcomes, most urgently tonsil cancer, melanoma, paternally-mediated transgenerational effects, and Parkinson's disease.

• **The current definition of *Vietnam service* is not supported by existing data.**

The evidence that this committee has reviewed makes a definition of *Vietnam service* limited to those who set foot on Vietnamese soil seem inappropriate. The ongoing series of hearings and appeals in the US Court of Appeals for Veterans Claims (*Haas v. Nicholson*) reflect this controversy. As discussed in Chapter 3, there is little reason to believe that exposure of US military personnel to the herbicides sprayed in Vietnam was limited to those who actually set foot in the Republic of Vietnam. Having reviewed the Australian report (NRCET, 2002) on the fate of TCDD when sea water is distilled to produce drinking water, the committee is convinced that this would provide a feasible route of exposure for personnel in the Blue Water Navy, which might have been supplemented by drift from herbicide spraying.

The epidemiologic evidence itself supports a broader definition of "service in Vietnam" to serve as a surrogate for presumed exposure to Agent Orange or other herbicides sprayed in Vietnam. For instance, the Centers for Disease Control and Prevention (CDC, 1990) study of selected cancers among Vietnam veterans found that the risk of the "classic AO cancer" non-Hodgkin's lymphoma was highest and most significant among Blue Water Navy veterans. More recently, the AFHS has demonstrated that TCDD concentrations in Vietnam-era veterans deployed to Southeast Asia, not just the "Vietnam veteran" Ranch Hand subjects, are generally higher than US background concentrations (although notably lower than in Ranch Hand sprayers themselves).

The committee notes that all previous VAO committees evaluating the epidemiologic evidence concerning exposure to the herbicides sprayed in Vietnam and the full spectrum of health outcomes have always considered information from naval Vietnam veterans to pertain to possible Agent Orange exposure. This committee considers that exposure assignment to be appropriate. No new studies considered in this update contained Navy-specific information, but such information has been factored into the evolving conclusions of VAO committees.

Given the available evidence, the committee recommends that members of the Blue Water Navy should not be excluded from the set of Vietnam-era veterans with presumed herbicide exposure.