COMMENTS ADDRESSING

THE EXTENT AND PATTERNS OF USAGE OF AGENT ORANGE AND OTHER HERBICIDES IN VIETNAM (Stellman *et al*., Nature 422:681-687; April 2003)

BY

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The Nature article has obvious ramifications to US Viet Nam veterans, in that more herbicide with a higher concentration of dioxin was released over troops in specific Ranch Hand target areas.

In addition, the article is very significant from the perspective of past, present, and future impacts on the Vietnamese population. Local inhabitants have been "associated", through these many decades, with a higher volume of defoliants and concentration of dioxin than was originally estimated. The Vietnamese have been exposed to these higher levels during the actual spraying, and on a regular basis for the past 30+ years, primarily, we firmly believe, through contact with former US and RVN military infrastructure. The greater impact of these new data I direct at the Vietnamese people; they continue to be exposed to, and are confronted with, the potential effects of dioxin today; this is not an historical problem.

The increased estimates of dioxin in the herbicides and volume of herbicides used, effectively increase the quantity of pure TCDD dioxin (one of the two most toxic members of the dioxin family) released over southern Viet Nam to perhaps over 600 Kg, much greater than the 170 Kg that has been quoted extensively since the war. The highest concentrations of TCDD, at present, are suspected to exist on "hot spots" - these being site-specific lands highly contaminated with TCDD.

New data presented by Stellman *et al.* raise the profile of the Hatfield hot spot theory, which was proven to be in effect through a process of quantification and validation studies in the Aluoi Valley of central Viet Nam, and, we suspect, operational throughout southern Viet Nam (Dwernychuk *et al*., 2002; Chemosphere 47: 117-137).

The Ranch Hand bases at Bien Hoa and Da Nang are prime examples of what we categorize as major hot spots, given recent dioxin data from these locations. Schecter *et al.* (2001; J Occup Environ Med 43: 435-443) reported a TCDD concentration in soil samples collected from the Bien Hoa base up to 1.2 million parts per trillion. Vietnamese scientists have reported soil toxicity levels from the Da Nang base in the several hundred thousand parts per trillion ranges. To place these levels in context, typical urban soils in the United States are less than 10 parts per trillion TCDD (Nestrick *et al*., 1986; Chemosphere 15: 1453-1460).

We feel strongly that hot spots, in general, are the most critical sites that must be removed from the exposure profile of the local Vietnamese population. US troops have been out of the country for decades, with many veterans suffering health problems from suspected exposure to TCDD-contaminated defoliants; Vietnamese continue to be exposed on a daily basis, many suffering similar maladies as US veterans.

Stellman *et al.* allude to the existence of potential hot spots based on a graphical representation of volumes of various defoliants aerially sprayed over southern Viet Nam between 1961 and 1971. These hot spots probably existed at the time of spraying, and relate to potential exposure levels of US troops who may have been on maneuvers in specific areas of southern Viet Nam during actual Ranch Hand spray operations. The Stellman *et al.* configurations of sprayed volumes have a higher probability of relevancy to historical contaminant levels, rather than to contaminant levels that may exist today. However, in-country validation studies would be necessary to confirm the existence of hot spots based on updated spray configurations.

Hot spots labeled by Hatfield are those that exist today; that is, soils that continue to support very high levels of the contaminant due to significantly higher levels of TCDD loading during the conflict. A point of significance is that Hatfield hot spots are sites that were <u>not</u> specifically targeted by routine operations of Ranch Hand aircraft.

Hatfield has shown quantitatively that aerially sprayed regions of the Aluoi Valley do not retain high levels of TCDD, given years of tropical rains, erosion, etc. The decades and forces of nature have reduced actual concentrations of TCDD in soils when the herbicide was originally dispensed from aircraft during planned spray missions. Where Agent Orange and other defoliants were spilled, loaded onto aircraft, applied by truck-mounted sprayers, etc., thereby effecting a dioxin loading to soils that was significantly higher than that resulting from aerial applications, these areas, we suspect, continue to exist as dioxin hot spots or "dioxin reservoirs" to this day. Hatfield reported the highest concentration of TCDD in soils collected from <u>within</u> the boundaries of a former US Special Forces base studied in the Aluoi Valley. Soils originated from areas once serving as the formal camp for personnel, and site of various buildings within the Special Forces camp.

Hot spots (e.g., former US and RVN military installations, crash sites and load-jettison sites of spray planes) must be the focal points of studies to determine where remediation should be directed, with urgency, thus removing them from the exposure equation for perhaps hundreds of thousands of Vietnamese. In addition to being appropriate locations for the implementation of environmental and remediation strategies, these areas are probably the most logical sites for undertaking comprehensive epidemiological and human health investigations, including appropriate interventions.

A sidebar to former military installations serving as dioxin hot spots is the fact that these sites were undoubtedly "hot" during the conflict, as a result of defoliant storage, spillage, containment of tank wash from C-123 spray planes, and general handling procedures.

This scenario suggests that <u>any</u> US troops stationed on these installations may have been exposed to dioxin, not only those serving in Trail Dust or Ranch Hand operations. On March 15, 2000, Dr. Linda Schwartz (Major USAF [Ret.]), subsequent to learning of the Hatfield studies, outlined this potential bias in the Ranch Hand health investigation to the US House of Representatives, the Committee on Government Reform, the SubCommittee on National Security, and Veterans Affairs and International Security. Dr. Schwartz is an Associate Research Scientist at Yale University School of Nursing. More recently (May 2003), Dr. Schwartz was appointed Commissioner of the US Department of Veterans' Affairs.

An important footnote to the Stellman *et al.* hot spot and volumetric configurations is the qualifier they submit which reveals their estimates of escalated defoliant volumes do not include herbicides sprayed by RVN forces, and by US Army and Navy forces by trucks, boats, hand sprayers, and helicopters. They also state that in excess of 400,000 litres of Agent Pink, with a very high TCDD content over that which was determined in Agent Orange, cannot be accounted for when procurement records were scrutinized. In addition, Stellman *et al*. suggest that some of the new 200 spray missions they uncovered may have, in fact, dispensed Agent Pink and not Orange, the defoliant logged into flight records. Given that Agent Pink was much more highly contaminated with TCDD than Orange, the true loading of TCDD to the Vietnamese environment could conceivably be substantially higher than that now suspected on the basis of recently uncovered defoliant records. To what extent these uncatalogued volumes of defoliants have compounded and compromised health issues of US veterans, and continues to compromise the health and wellbeing of the Vietnamese population, remains unknown.

The Nature article, in general, with its statistical revelations and highlighting of incomplete data records, should fuel heightened health concerns for both US veterans who were exposed to these defoliants, and the Vietnamese who continue to deal with TCDD, and its consequences, throughout their daily lives, and potentially for many years into the future.

Dwernychuk, L. W., *et al.* 2002. Dioxin reservoirs in southern Viet Nam – a legacy of Agent Orange. *Chemosphere* 47: 117–137.

Schecter, A., *et al*. 2001. Recent dioxin contamination from Agent Orange in residents of a southern Vietnam city. *J Occup Environ Med* 43: 435–443.

Nestrick, T. J., *et al*. 1986. Perspectives of a large-scale environmental survey for chlorinated dioxins: overviews and soil data. Chemosphere 15: 1453-1460.