A Dangerous and Deadly Paradox

From January 1962 onwards, herbicides were used by US and allied forces to strip the thick jungle canopy which helped conceal the enemy, destroy crops which the enemy might find useful, and clear tall grass and bush from around the perimeters of military camps. Most large-scale spraying missions were undertaken using fixed wing aircraft and helicopters, but vast quantities of herbicides were dispersed from boats and road tankers, as well as by ground personnel using knapsack sprays. After several scientific reports in 1969 concluded that one of the base chemicals used in Agent Orange could cause birth defects in laboratory animals, the US command suspended use of this herbicide in May1970, and ceased all herbicide spraying in Vietnam in January 1971.[i] As the post war seventies ebbed and flowed, concern about possible long-term health consequences of exposure to Agent Orange and other herbicides heightened, fuelled by medical reports from a growing number of Vietnam veterans, stating that they had developed various forms of cancer, or had fathered handicapped children, which they attributed to their wartime service, and exposure to the various herbicides used. [ii]

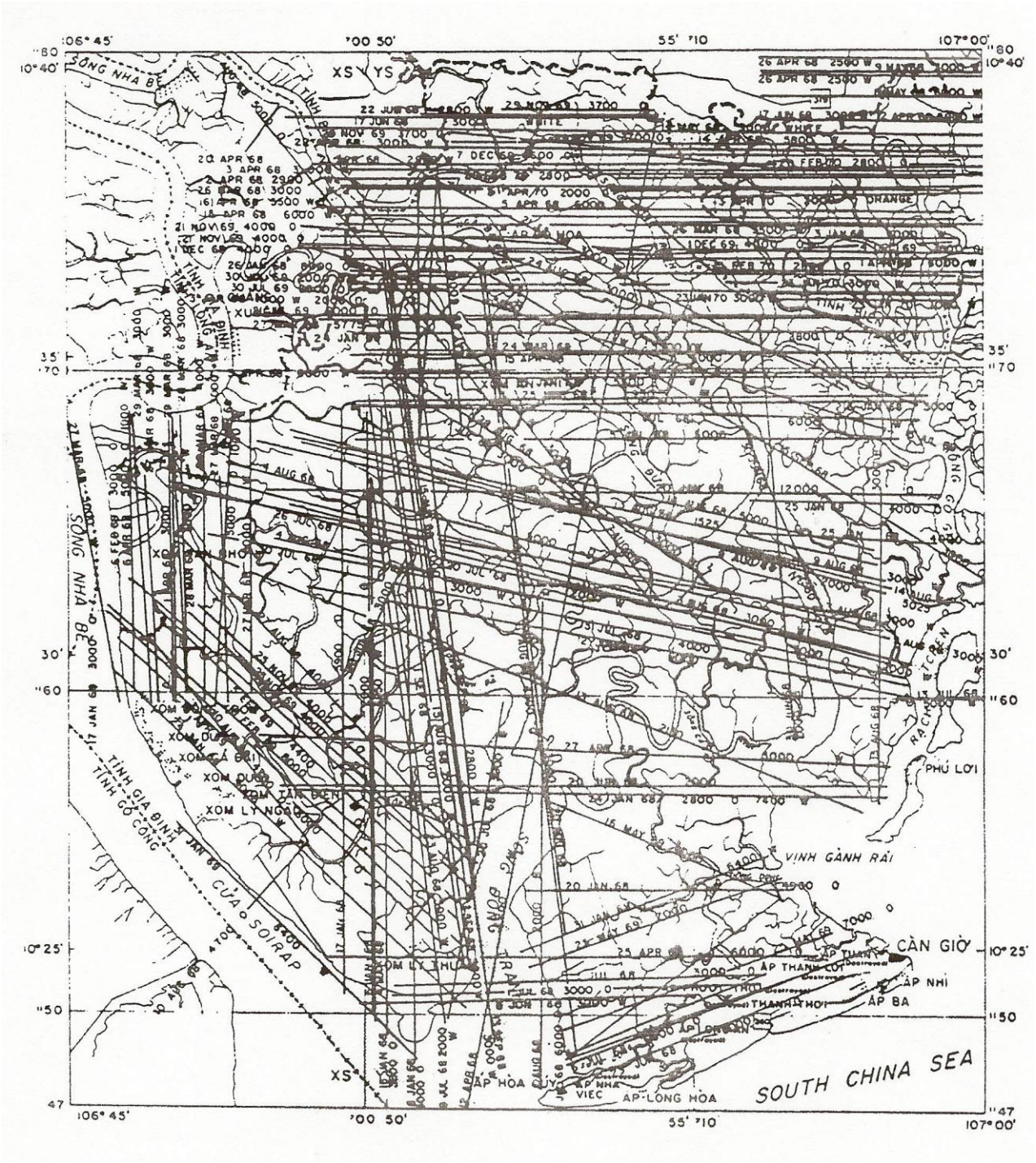
Results published by the Department of Veterans' Affairs (DVA) in 1997, reported that RAN veterans were experiencing a far higher mortality rate than other Australian Vietnam veterans. And yet, RAN personnel, being deployed in ships which were engaged in either patrol duties off the Vietnam coast, or transporting troops and supplies to and from Vietnam, were not deemed to have been at risk – paradoxically, they were. Specifically, it was held that there was little chance that RAN personnel could have been exposed to herbicide by spraying. However, 30 years after the withdrawal of Australian forces in Vietnam, herbicide exposure through the evaporative distillation processes used in naval ships while in Vietnamese waters was identified as the most likely

cause of a range of cancerous conditions, 'and an elevated mortality rate among RAN personnel, ***particularly RAN Logistic Support personnel***.'[iii]

The use of defoliants in Vietnam was the culmination of a discovery during the 1940s by Dr Ezra Kraus,[iv] a University of Chicago botanist, who found that certain acidic compounds could kill off various species of plants. Further experimentation by the US Army in the 1950s found that by combining these compounds would produce chemicals that could destroy most plant life almost instantaneously. What these scientists failed to fully realise, was that during manufacture, the highly toxic, **2,3,7,8 - tetrachlorodibenzo-*p*-dioxin** (TCDD) was also produced as a by-product.

In the latter part of 1960 and into the early months of 1961, South Vietnamese Government forces were beginning to lose control of rural areas, where Communist guerrilla forces were operating with a certain amount of impunity. The military, in consultation with their US advisers in Saigon, decided that the clearing of land in strategic places would deny cover to the enemy. Acting on information provided by his advisers on the armed forces Joint Chiefs of Staff Committee, US President John F Kennedy agreed to let the military conduct a series of experiments to test the effects of herbicide chemicals in Southeast Asia and to find a formula which would most effectively destroy dense jungle undergrowth and defoliate trees. The defoliation program in Vietnam began on 4 December 1961, after President Kennedy had authorised the Secretary of Defence to test the military effectiveness of this process in that country. In September 1962, the first major operation using chemical defoliants was used to clear enemy infiltration routes, and was carried out over the dense mangrove forests of the Ca Mau Peninsula, and the southern-most regions of the Mekong Delta.

In 1962, the US Air Force began implementing '*Operation Ranch Hand*'. Flying specially configured aircraft over the next nine years, they sprayed over 19 million gallons of herbicides over various parts of Vietnam in order to deny natural cover to enemy forces. The principal defoliant used was colloquially known as '*Agent Orange*', and, because it was being used on the enemy, the US authorities were not overly concerned about its after effects on their own and allied forces. According to Dr James Cleary, a former US chemical weapons scientist, 'we never considered a scenario in which our personnel would become contaminated with the herbicide, and if we had, we would have expected our government to give assistance to veterans so contaminated.'[v] The herbicide program reached its peak in 1967, when more than 1.6 million acres were sprayed, 85 per cent for defoliation, and 15 per cent for crop denial.[vi] South Vietnam was divided up into four military Corps zones, with Three Corps being the most heavily sprayed area in Vietnam, receiving about 53 per cent of all herbicide sprayed from 1965 to 1971. The Rung Sat Special Zone (RSSZ) was in Three Corps, located to the south and east of Saigon, through which the Long Tao Shipping Channel wound its way. It was also the most heavily sprayed area in the whole of South Vietnam. [vii]



Herbicide Spray Missions (1966-1967) in the Rung Sat Special Zone.

viii

The Commander US Naval Forces Vietnam (COMNAVFORV) defined the RSSZ as: 'The general area of operations bordered on the west by Long An and Go Cong Provinces along the Soi Rap River, on the north by Nhan Trach district of Bien Hoa Province, to the east by Phuoc Tuy Province, and to the south, by the South China Sea.' The RSSZ was centred about 20 miles south-

east of the city of Saigon. It was approximately 18 miles wide in an east-west direction, and 20 miles in a north-south direction.[ix] In April 1968, COMNAVFORV - Rear Admiral Veth USN - in a message to US Air Force (USAF) authorities at Bien Hoa airbase, congratulated the *Ranch Hand* crews and encouraged them to greater efforts in the RSSZ. The message headed 'Defoliation in RSSZ' read as follows:

> I am greatly appreciative of the many defoliation missions flown by *Ranch Hand* aircrews in the RSSZ. As you well know, a major concern in the RSSZ is the vegetation along the main shipping channel, the Long Tao. Your continuing efforts under difficult and hazardous flying conditions, in keeping this area and the inland areas in the RSSZ devoid of vegetation have contributed considerably in denying the enemy the protective cover from which to ambush slow moving merchant ships and US Navy craft. With the coming of the SW Monsoon season, and commensurate with your other in-country projects, I am hopeful that we can continue to keep pressure on the enemy in the RSSZ.[x]

As Commander US Naval Forces Vietnam from September 1968 until May 1970, Vice Admiral E R Zumwalt Jr. USN, requested and obtained permission to use Agent Orange defoliation along the banks of major and minor rivers and canals in Vietnam. He did so when US naval casualties were running at the rate of about seven per cent per month. In his later testimony, delivered before the House Veterans Affairs Committee, Zumwalt maintained that 'At that time, to the best of my knowledge, no one in the Vietnam theatre was aware that Agent Orange could have harmful effects on humans'.[xi] With the Army informing Zumwalt that they had seen no detrimental reactions, except for the occasional skin problems, coupled with the Pentagon's assurance that there were no adverse human effects, Zumwalt ordered its use along the rivers and canals. After all - in simplistic terms - it [*Agent Orange*] was being used against the enemy.[xii] It was generally agreed at the time that defoliation using Agent Orange served its purpose by denying the enemy cover, and reduced the incidents of ambushes on, and casualties to, US, Australian and other allied forces in Vietnam. Vice-Admiral Zumwalt, as COMNAVFORV, stated that the use of Agent Orange along narrow rivers and streams reduced the casualty rate

of US naval 'Brown Water' forces from seven per cent per month, to less than one per cent per month. Considering the information made available to Zumwalt, he would have probably continued to use it. It is known that the Admiral had been assured by the Pentagon that it was safe to use, and that the service chiefs were unaware of any detrimental effects on humans, other than the occasional skin rash and some cases of mild dermatitis.[xiii]

The troop transport and her escort ship(s) were often at anchor in Vung Tau Harbour, in waters now known to have been contaminated with herbicide residue from the spraying of inland and coastal areas. Due to the unknown nature of these dangers, the levels of risk to which RAN personnel were exposed to while at anchor in the port takes on a new dimension. In June 1965, the First Battalion of the Royal Australian Regiment (1RAR) arrived in Vietnam and was disembarked from *Sydney* at the port of Vung Tau. As noted previously, Vung Tau is situated at the end of a narrow peninsula 40 miles to the south-east of Saigon. The shores of the peninsula are made up of tidal mud flats and dense mangrove swamplands, with the Vung Tau anchorages being used by shipping while waiting to proceed up the narrow, twisting Long Tao shipping channel to the capital city port of Saigon. This river system traverses a swampland area which was designated by the US and South Vietnamese military authorities as the Rung Sat Special Zone (RSSZ). By the time *Sydney* and the first Army contingent arrived at Vung Tau in June 1965, the RSSZ had been continually sprayed by US Air Force fixed-wing aircraft since September 1962.[xiv]

At a Federation Naval Congress meeting in October 2001, Bob Auston, President of the HMAS *Sydney* and Vietnam Logistical Support Veterans Association (NSW), reported to those assembled that, 'Vietnam veterans are dying at a far higher rate than the national average.' Figures obtained by Auston from the Department of Veterans' Affairs *Mortality of Vietnam Veterans: The*

Veteran Cohort Study (1997), suggested that sailors who served in the sea transport and logistical support role - that is, *Sydney*, *Jeparit* and *Boonaroo*, and the ships that escorted the troop transport - 'were dying at a rate which was 45 per cent higher than the national average.'[xv] Auston further stated that:

> These are not figures just plucked from the air. We have had talks with Veterans' Affairs, and they have a committee doing a damn good job trying to find out why we're dying quicker. They don't know, we don't know. There are a lot of theories come up, asbestos, fuel oil, water, anything, but we really don't know why.[xvi]

Following the cessation of hostilities in Vietnam, many ex-Service organisations and individuals have claimed, and continue to claim, that their service in Vietnam has had adverse effects on their overall health and wellbeing. Initial studies into the health of Vietnam veterans were carried out in the 1980s, which suggested that no excessive health risks could be attributed to their service.[xvii] However, more recent studies have proposed that Vietnam veterans have excess incidence and mortality rates from several conditions, such as cancers and heart disease.

Of immediate interest to the original dissertation was the discovery of the statement, in a 1997 study into the Standardised Mortality Ratio (SMR) of Vietnam veterans, that 'Of the three services, Navy veterans had the highest overall mortality, and the only significantly elevated overall mortality.'[xviii] RAN personnel were mainly serving in ships engaged on interdiction and naval gunfire support duties offshore, or transporting infantry battalions and their equipment to and from Vietnam. These ships were usually fully provisioned in Australia before departure, or, as with the escorts to *Sydney*, supplied by the Royal Navy in Singapore. There was no official record of an Australian warship having ever been sprayed with herbicide. Therefore, the only other possible means of exposure of RAN personnel to Agent Orange and its contaminants was via their ship's water supply.[xix]

In 2002, the Government commissioned another study in response to the concerns expressed by Navy Veterans, following the 1997 Vietnam Veterans Mortality Study. This study had indicated an elevated mortality rate existed in former RAN personnel - more specifically, it was found to be predominately amongst those that had served in the *sea transport and logistical support role*.[xx] Where ships of the RAN engaged in the sea transport and logistical support role were concerned, run-off from defoliant spraying would have made its way into the Long Tao River, and then into the Baie de Gahn Rai. *Sydney* and her escorting destroyer or frigate always anchored in the northern end of the Vung Tau anchorage, adjacent to Can Gio, in order to allow the battalion to disembark while *Sydney*'s cargo handling crews unloaded their stores and equipment.

This anchorage position was a constant one, and was situated virtually opposite the mouth of the Long Tao Shipping Channel, where the Saigon River and its tributaries flow into the Baie de Gahn Rai.[xxi] It was while anchored in Vung Tau that the supply of potable water aboard these ships was distilled using evaporative distillation units. These waters are now known to have been highly contaminated with residue from the airborne spraying of defoliant chemicals in the RSSZ and nearby coastal areas. [xxii]

In December 2002, Danna Vale, Minister for Veterans' Affairs, in a Ministerial Media Release, stated that, 'The government had commissioned a study in response to concerns from Navy Veterans following the 1997 Vietnam Veterans Mortality Study which showed an elevated mortality rate among RAN personnel, *particularly RAN logistical support personnel*.'[xxiii] The Minister elaborated further by announcing that:

> Herbicide exposure through evaporative water distillation processes used on ships while in Vietnamese waters was identified as one potential cause. Tests by the National Research Centre for Environmental Toxicology have now shown that dioxins can pass through the evaporative distillation process. If contaminated water were used in this process, the study indicates it is likely that the consumption of drinking water exposed personnel to dioxin levels that

> exceeded safe levels proposed by the National Health and Medical Research Council.[xxiv]
>
> This is a matter of concern to the Government in fulfilling our commitment to care for those who served during the Vietnam War. It potentially affects not only Navy Veterans but those who served on Army small ships or travelled as passengers from Vietnam on HMAS *Sydney*.[xxv]

The 2002 study, carried out by the Queensland based National Research Centre for Environmental Toxicology (ENTOX), was assisted in their investigations by former RAN Warrant Officer Marine Technician Propulsion*, Ralph H Spooner.[xxvi] The study team identified potential exposure of RAN personnel to dioxins through potable water produced by the evaporative distillation process. By using a rotary evaporator unit found in laboratories - which were very similar in basic principles to evaporative distillation units used in *Sydney* and other RAN ships - the research team was able to demonstrate that, during the process of evaporative distillation of potable water from estuarine water, tainted with organochlorine pesticides and dioxins, these chemical substances co-distilled and became concentrated. Possible exposure to dioxins for Navy personnel through the ingestion and personal use of this type of potable water was estimated to have been at least one or two orders of magnitude above what were deemed acceptable standards in 2002-2003.[xxvii]

In *Sydney*, which regularly visited the Vietnam War zone, the water consumed by the ship's company - and others - had an unusual history. This water was often taken inboard from harbour anchorages, which received runoff from rivers and streams passing through areas which had been sprayed with the defoliants Agent Orange and Agent Blue. To make this water suitable for drinking and other purposes in the ship, the water was distilled on board.[xxviii] Further investigation by the ENTOX research team involved the construction of a scale model of a ship's distillation system similar to that used in *Sydney*. The ENTOX study's ultimate goal was to identify whether or not significant amounts of potentially harmful chemicals may have co-distilled into the drinking and

domestic water in *Sydney*, which was the only ship that transported Australian troops to and from the Vietnam War zone. The distillation plants fitted in the various ships of the time were all similar, and all operated on the same basic principles. In general terms, sea water was fed into an evaporator, where it was boiled by a combination of heating and reduced pressure (vacuum). The vapour was then condensed in condensers, from where it was pumped into feed water or fresh water tanks.[xxix]

The study was carried out in two phases. Firstly, the co-distillation of organic pollutants such as dioxins, in laboratory models of ships' water distillation units was examined. The results obtained in Phase One of the study demonstrated that:

- Co-distillation of organochlorine pesticides and dioxins was observable in all experiments conducted.
- In pure or saline water, between 75% and 95% of Agent Orange was co-distilled with the first 10% of water distilled. Therefore, distillation resulted in a very real increase in the contaminant concentration of the distillate.
- The tendency of several other organochlorines to co-distil was even greater than for that of Agent Orange.
- The co-distillation of compounds decreased with increasing levels of suspended solids in the water. This could be attributed to the increase in sorption (fugacity) in the source water. Nevertheless, even at relatively high levels of suspended solids, Agent Orange was enriched by almost a factor of four (4) in the distillate.
- Co-distillation of dioxins and organochlorines from water collected from the Brisbane River (water was added to known amount of chemicals of interest) demonstrated that the process is reproducible using estuarine water. In these samples, 48-60 per cent of the Agent Orange was co-distilled within the first 10 per cent of distilled water. [xxx]

Overall, Phase One of the study demonstrated that if source water is contaminated, co-distillation is a process which can result in the contamination of ship's water supplies with chemicals such as dioxin.[xxxi]

In Phase Two of this study, the investigations included the potential co-distillation of the Agent Blue component dimethylarsenic acid, which is now

known to be a potent carcinogen. Additional experiments were performed to evaluate the capacity for de-novo synthesis of dioxins from the main components of Agent Orange. The process of 'evaporated distillation' entailed heating of the source water using copper elements. It was shown that combustion of the components of Agent Orange had great potential to produce dioxins. Moreover, copper piping (which formed a vital component of the distillation unit) is a known catalyst for dioxin formation. [xxxii]

Finally, exposure calculations were carried out for personnel serving in RAN Ships. These calculations were based on several of the first analytical results from fish caught in the Vung Tau area during the early 1970s, and analysed at the time for the effects of exposure to Agent Orange. [xxxiii]

The results obtained in Phase Two of the study demonstrated that:

- Agent Blue did not co-distil at significant levels during evaporation. Therefore, the potable water produced in RAN Ships was unlikely to be contaminated with Agent Blue.
- Agent Orange exposure via potable water may have been substantial. It is likely that the consumption of drinking water alone resulted in exposure levels that significantly exceeded the recommended Total Monthly Intake (TMI) values for Agent Orange. [xxxiv]

Overall, the findings of this study demonstrated that the evaporative distillation of water not only fails to remove certain contaminants, such as dioxins in water, but actually results in their concentration in the distilled product. The study findings suggested that all service personnel - including soldiers and airmen who were passengers - in RAN ships employed in the *sea transport and logistical support role* may well have been exposed to biologically significant quantities of dioxins. This goes some way towards explaining some of the epidemiological findings for this study group.[xxxv] Regulations applying in *Sydney* and like ships stated that they were to produce potable water, mainly during the periods when the ship was in the turbid estuarine water. This estuarine water was of low purity, and could potentially damage the engines and

associated machinery if used in the ship's boilers. When in the comparatively pristine waters offshore, the distillation units were harnessed to produce feed water, primarily for use in the ship's boilers. Therefore, the potable water that was produced during periods spent in contaminated waters lasted for a significant portion of the return voyage to Australia.[xxxvi] Since the Vung Tau anchorage was in the near vicinity of large mangrove areas which were regularly sprayed with Agent Orange, it is highly likely that the dioxin contamination in these waters was much greater than those predicted in the Meselson and Baughman fish study data of 1971. In fact, Moore and Gaus confirmed in 2006 that the cumulative effect of the contamination in water storage tanks would result in very high concentrations. It would have taken months, perhaps years, to completely flush the system once the ship moved away from the contaminated waters of Vietnam.[xxxvii]

In December 2002, following the release of the ENTOX report, the Minister for Veterans' Affairs and Minister assisting the Minister for Defence, Danna Vale, instructed the Repatriation Medical Authority (RMA) to review its Statements of Principles (SOP) for veteran compensation claims for exposure to dioxin. The Minister also requested that the Department of Veterans' Affairs (DVA) undertake further research into the ENTOX study findings, in conjunction with the current Vietnam Veterans Mortality and Cancer Incidence Study.

The Government had commissioned this latter study in response to concerns from Navy veterans following the 1997 Vietnam Veterans Mortality Study, which showed an elevated mortality rate amongst RAN personnel, particularly those who served in the sea transport and logistical support role. At the time, herbicide exposure through the evaporative water distillation processes used on RAN ships while in Vietnamese waters was suggested as one potential cause. The subsequent tests and experiments undertaken by ENTOX have confirmed that dioxins can pass through the evaporative distillation process. The study also

indicated that the consumption of this water may have exposed personnel from all three services to dioxin levels far in excess of the safe levels proposed by the Australian National Health and Medical Research Council (NHMRC). [xxxviii]

The seven Statements of Principles (SOP), which the RMA has amended over the intervening years to include the consumption of potable water, now incorporates the following sub-paragraph under the sub-heading of 'Factors'. For example; the SOP for *Malignant Neoplasm of the Prostate* at sub-paragraph 5, Factors (b) states that one of the factors 'that must as a minimum exist before it can be said that a reasonable hypothesis has been raised connecting *Malignant Neoplasm of the Prostate* --- with the circumstances of a person's relevant service is:

- (i) on land in Vietnam
- (ii) at sea in Vietnamese waters, or
- (iii) on board a vessel and consuming potable water supplied on that vessel, when the water supply had been produced by evaporative distillation of estuarine Vietnamese waters, for a cumulative period of at least thirty (30) days, at least five years before the clinical onset of malignant neoplasm of the prostate, ---. [xxxix]

By direct comparison, a claim by a US Veteran for the very same medical condition - when viewed by the United States Department of Veterans' Affairs (VA), under the regulations contained in US Public Law 102-4 - is considered valid or otherwise, by virtue of what the US authorities term a *Presumptive Service Connection*. This, when applied to a US veteran's claim, presumes that:

> Any veteran who served in Vietnam between January 9, 1962 and May 7, 1975, and has one or more of the diseases on the list of presumptive conditions that the VA maintains is presumed by VA to have been exposed to herbicides and therefore that his or her disease is recognized for service connection if rated as 10 per cent or more disabling.[xl]

Section 3.313(a) of the US Code of Federal Regulations specifically defines service in Vietnam as including: 'serving in the waters offshore, or service in other locations if the conditions of service involved duty or visitation in Vietnam.' There does not appear to be any form of mandatory time limit imposed upon time in Vietnam, or amount of exposure required for one to

qualify for treatment or compensation for Agent Orange related illnesses in the United States. The only real stipulation is that the illness or disease is rated, through medical evaluation, as being at least ten per cent disabling.[xli] The following conditions are presumptively recognised in US Vietnam Veterans for service connection, from the Brief D No: and date indicated:

1. Chloracne (must have occurred within one year of exposure to Agent Orange), D2, as of May 19th 1993.
2. Non-Hodgkin's Lymphoma, D3, March 29th 1990.
3. Soft Tissue Sarcoma (other than osteosarcoma, chondrosarcoma, Kaposi's sarcoma, or mesothelioma, D4, May 18th 1990.
4. Hodgkin's disease, D6, February 03rd 1994.
5. Porphyria Cutanea Tarda (must have occurred within one year of exposure to Agent Orange), D7, October 21st 1991.
6. Multiple Myeloma, D8, June 09th 1994.
7. Respiratory cancers, including cancers of the lung, larynx, trachea and bronchus, D9, June 09th 1994.
8. Prostate cancer, D10, November 07th 1996.
9. Acute and subacute transient peripheral neuropathy (must appear within one year of exposure and resolve within two years of date of onset), D5, November 07th 1996.
10. Type Two Diabetes, D12, as of May 08th 2001.
11. Chronic Lymphocytic Leukaemia, D13, October 16th 2003.[xlii]

The US DVA have also recently recognised that the disease *AL Amyloidosis* as being associated with exposure to Agent Orange during military service. US DVA made this decision effective as of 7 May 2009.

12. AL Amyloidosis, D No. Yet to be assigned, but effective as of May 07th 2009.

By relying on a recent report from the highly respected and independent US Institute of Medicine (IOM), the Secretary of the US Department of Veterans' Affairs, Eric K. Shinseki also announced on 13 October 2009, that the US DVA has added a further three (3) medical conditions to its list of 12 illnesses associated with exposure by US service personnel to Agent Orange defoliant. The three newly recognised diseases are:

13. B cell Leukaemia, D No. Yet to be assigned, but effective as of October 13th 2009.
14. Ischemic Heart disease, D No. Yet to be assigned, but effective as of October 13th 2009.
15. Parkinson's disease, D No. Yet to be assigned, but effective as of October 13th 2009. [xliii]

By comparison, the Australian Repatriation Medical Authority (RMA) - under subsection 196B(2) and (8) of the '*Veterans' Entitlements Act*' (1986) - is required by law to be of the view that there is sound medical-scientific evidence that certain illnesses and diseases can be related to relevant service rendered by veterans ---, under the *Act.* The seven Statements of Principles (SOPs) which the RMA consider may relate directly to the consumption of potable water produced by evaporative distillation of estuarine Vietnamese waters, for a period of at least 30 days, and for at least five years before clinical onset, are:

- Non-Hodgkin's Lymphoma, (SOP 37/2003), August 12th 2003.
- Soft Tissue Sarcoma (excludes mesothelioma, Kaposi's sarcoma, malignant neoplasm of the bone or articular cartilage, and malignant neoplasm of the lymphopoietic and haematopoietic tissue), (SOP 13/2006), April 26th 2006.
- Hodgkin's Lymphoma, (SOP 28/2004), October 07th 2004.
- Myeloma, (SOP 55/2003), November 07th 2003.
- Malignant Neoplasm of the Prostate, (SOP 28/2005), September 19th 2005.
- Malignant Neoplasm of the Larynx, (SOP 1/2006), February 23rd 2006.
- Malignant Neoplasm of the Lung, (SOP 17/2006), April 26th 2006.[xliv]

According to two Australian scientists, Dr Norbert Ryan and Mr Robert Sartori, the Australian guidelines for a minimum of 30 days exposure to Agent Orange via drinking water, does not appear to make much sense at all. The two scientists question this and other stipulations further when they wrote:

> What was the concentration of dioxin in the water? How much water did the sailor drink during that time? The 30 day time period gives absolutely no idea of his level of exposure, and therefore should not be part of the stipulation. The US stance of no time limit when in Vietnam, and no specified level of exposure is warranted, because they realise that it is impossible to measure the level of exposure, and the time spent there with any surety, unless it was zero.[xlv]

When comparisons are carried out between the Agent Orange related illnesses promulgated by the two authorities, it can be seen that the US DVA recognises at least eight more medical conditions related to Agent Orange exposure and service in Vietnam than the Australian RMA. However, when closely examined, it is evident that the US Agent Orange Briefs group '*Respiratory*'

cancers together, as a single interrelated system, whereas the RMA has two separate SOPs, one for *Larynx* and another for *Lung*. It is also evident that the RMA does not have SOPs which reflect exposure to Agent Orange via evaporative distillation of estuarine Vietnamese waters for the medical conditions of *Type Two Diabetes, Chronic Lymphoid Leukaemia (CLL), A L Amyloidosis, B Cell Leukaemia, Ischemic Heart disease and Parkinson's disease.*

In contrast to this view, in January 2003, the US National Academy of Sciences' Institute of Medicine (IOM) concluded in the publication, '*Veterans and Agent Orange – Update 2002',* that there was sufficient evidence of an association between herbicides used in Vietnam and the medical condition of *Chronic Lymphocytic Leukaemia* (CLL).[xlvi] Yet, as recently as April 2008, the RMA declared that 'it does not propose to amend the SOP concerning *Chronic Lymphoid Leukaemia*, as the evidence available is not sufficient to justify an amendment to the SOP already determined'.[xlvii]

This is contrary to the views of the United States Department of Veterans' Affairs, which accepts that there is a valid connection between exposure to Agent Orange, and its by-products, and the consequential links to military/naval service in Vietnam. The comparable Australian authorities - the Department of Veterans' Affairs (DVA) and the Repatriation Medical Authority (RMA) - appear to be far more stringent and much less accommodating in their interpretations of the medical and scientific evidence relating to these and other illnesses connected to the exposure of veterans to Agent Orange.

Relating to the Australian guidelines, another question which needs to be raised is, what is the scientific basis for the figure of 30 days' exposure to Agent Orange and dioxin based contaminants via drinking water? The adoption of a rather lengthy exposure time of 30 days fails to take into account individual

physiological differences. It assumes that all those affected require exactly the same amount of exposure for the effects to be either fatal or disabling. If this assumption is correct, then it is neither fair nor is it equitable, and if it was based upon sound scientific evidence, it should have been stated as such, and the evidence cited.

In December 2002, Danna Vale, the Minister for Veterans' Affairs, in response to the ENTOX study mentioned above, agreed that her Department should undertake a third Vietnam Veterans Mortality Study, and an updated Cancer Incidence in Vietnam Veterans Study. At the direction of the Minister, the Repatriation Commission instructed the DVA to conduct these studies, which were then carried out with assistance from the Australian Institute of Health and Welfare (AIHW). According to Dr E J Wilson, an epidemiologist assigned to this important work, 'this study will undertake a ship-by-ship analysis for Navy and Army small ships and will be the first time a cancer incidence study has ever been undertaken on Navy and Air Force Vietnam veterans'.[xlviii] The findings - which were published almost three and a half years later, and are quoted only in part here - suggested that mortality amongst Navy Vietnam veterans was not significantly different from that of the wider Australian population. However, their mortality from cancer was 19 per cent higher than expected. More specifically, Navy Vietnam veterans had a higher than expected mortality from lung cancer by 39 per cent and melanoma by 56 per cent, whereas mortality from non-Hodgkin's Lymphoma was 48 per cent lower than expected. Mortality from mesothelioma was also higher than expected, albeit based on small numbers. Navy Vietnam veterans had the highest rate of cancer of all service veterans, higher than expected by 26 per cent, followed by Army Vietnam veterans, higher by 13 per cent. [xlix] (The pseudo variables - 'higher and/or lower than expected' - had no discernible value(s) attached to them, which tends to make the verbal comparisons rather meaningless.)

The principal goal of the original ENTOX (2002) study was to attempt an evaluation of exposure of RAN personnel - aboard ships deployed to Vietnam - by considering their consumption of contaminated water. The ENTOX study suggested that during the distillation process - which took part while the ship was at anchor - about five to ten per cent of the uptake water was distilled, and the remainder of the residual water was discharged back into the waters of the estuary as brine. Therefore, it is readily predictable that the uptake water at a later time that day may have held a higher level of contaminants, because it had been distilled and discharged to mix with the estuarine water. So, it was highly possible that distillation produced an even higher level of dioxins than the original source uptake water from the Vung Tau estuary.[l] During the course of the ENTOX study, it was determined that RAN personnel consumed an average of five litres of water per day, and that this direct consumption would lead to a daily body burden of dioxins of about 0.4 – 7ng/day.[li] The water was also used in food preparation, and as a direct result of the hydrophobic character of the dioxins, these also accumulated in the prepared food. The ENTOX researchers estimated that the total dioxin exposure due to water contaminated food was similar to that of the direct consumption of drinking water - in other words another 0.4 - 7ng/day - totalling 0.8 - 14ng/day from both.[lii]

The ENTOX research team also maintained that the consumption of contaminated water continued after *Sydney* and her escort(s) left Vietnam waters. The report estimated that in a 14 day period, the total body burden of dioxin through direct consumption of water - which originated from the distilling process in Vietnam waters - was between 10ng and 190ng. This was equivalent to 12-200 pg/kg body weight per day for a 14 day period for an average 80/90 kg adult. This compares with the US Environmental Protection Authority (EPA) figures quoted in the ENTOX report which concluded that a dioxin background contamination in the range of 0.5 – 2pg per kg of body

weight [liii] could pose a significant cancer risk. It should also be noted however that the US EPA guidelines were almost two orders of magnitude lower than the values set by the World Health Organisation (WHO) and many European communities who sets a maximum allowable daily intake of 2pg per kg of body weight. Australia's NHMRC has set a similar maximum allowable intake of 70pg per kg of body weight per month. According to the ENTOX report:

> In comparison, the exposure of the RAN members from water related sources may have been 12-200 pg/kg bw/day or 300 – 6000 pg/kg bw/month. This indicates that in addition to normal background exposure, RAN members may have received exposure which is one to two orders of magnitude above the acceptable intake values and at a level above the observed effect levels in experimental animals. [liv]

The ENTOX researchers (Moore and Gaus) also commented on the link between the ingestion of dioxin and cancer, noting that the capacity of dioxin to attach to fatty tissue causes it to remain in the body for a long period of time. Thus cancer caused by the presence of dioxins may not be evident in just a few years, but may manifest itself over a longer period.[lv]

There have been numerous health studies of Australian Vietnam veterans, but most have been hampered by relatively poor measures of exposure to dioxins, and by other methodological problems. In light of these complexities, many conclusions regarding the associations between exposure to Agent Orange, and diseases and illnesses in RAN veterans have been based upon studies of exposure in various occupational and environmental settings, rather than on research of the Vietnam veterans themselves. However, for older naval veterans, studies of the health and consequences of service have begun to generate some relevant findings.

A 1997 Department of Veterans' Affairs sponsored study into the mortality of Vietnam Veterans, came to the unfortunate conclusion that death rates for members of the RAN were far higher than for Vietnam Veterans who served in the Army or RAAF. This finding was the catalyst for further study undertaken

by the National Research Centre for Environmental Toxicology (ENTOX) in 2002. During the course of this research, it was discovered that ships in Vung Tau collected water which was probably contaminated with Agent Orange (Dioxin). To produce drinking water, the distillation plants in RAN ships converted brackish estuarine water into potable drinking water, a process which was later found to enhance the effects of Dioxin, and make it more potent as a carcinogenic agent.

The Dioxin was ingested orally through drinking water, the cooking process and steam inhaled from taking showers. And since Dioxin has the ability to adhere to pipe-work and storage tanks, the fresh water systems in RAN ships remained contaminated, and would continue to contaminate future fresh water supplies. The research also indicated that the consumption of this water exposed RAN personnel to Dioxin levels far in excess of the safe levels proposed by the National Health and Medical Research Council (NHMRC).

As a consequence of the findings of the ENTOX study, the Repatriation Medical Authority (RMA), from 2003 to 2006, has amended seven Statements of Principle to include the consumption of potable water as a factor which must exist before it can be said that a reasonable hypothesis exists, connecting certain medical conditions to a person's relevant service. By comparison, a claim by a US Vietnam Veteran for any of the fifteen medical conditions accepted by the US DVA, is considered valid or otherwise, by virtue of what is termed, a *Presumptive Service Connection*, which relies upon the Veteran being able to verify that he/she served in Vietnam, and that their condition is at least ten per cent disabling.

The RMA in Australia continues to disallow several medical conditions connected to service in Vietnam, and the consumption of contaminated potable water. These are conditions which have been recognised by the US DVA as

having a valid service connection. For example, Type 2 Diabetes, and Chronic Lymphocytic Leukaemia. The acceptance of these conditions by the US DVA is based upon sound scientific and medical research, undertaken in the USA and elsewhere, with which the Australian RMA does not appear to concur.

There is sufficient evidence contained in the ENTOX study to reach general or qualitative conclusions regarding association between Agent Orange exposure and various health outcomes in RAN Vietnam veterans. Unfortunately, following the ENTOX study there has been no attempt to accurately calculate the exposure data in Navy Veterans. Therefore it is difficult but not impossible to reasonably estimate the degree of increased risk of a specific disease or syndrome in these people, with a significant measure of validity and reliability.

By not using known information on the extent of exposure to dioxins and toxins in RAN Vietnam veterans, in conjunction with the quantitative information already available regarding the dose-time-response relationships for related health outcomes, estimation of the risks experienced by Navy Veterans exposed to contaminated water during the Vietnam War will remain uncertain. Because of these omissions and limitations in past studies, only generalised assertions have been made in this work regarding the risks incurred by RAN Vietnam veterans.

All these men risked long-term harmful effects simply by drinking plenty of water, and taking salt tablets as they had been instructed to, even though the water was never tested at the time for dioxin contamination. While RAN Captains minimised threats to their ship's companies from the enemy by leaving the port overnight, the greatest threat of all to sailors was unseen and unsuspected. Since 1982, many reports and peer-reviewed papers have been written by the DVA and its agencies, concerning studies on health issues affecting Australian Vietnam veterans. Of these, only one has been specifically

targeted at members of the RAN serving in Vietnam waters. At the time of writing, it does not appear that there will be a properly designed follow-up study carried out on this quite specific and very worrying topic, especially in light of the following.

In several comprehensive studies into herbicide exposure and the effects of TCDD, Hardell, Erikson and Axelson, of the Department of Oncology, Orebro Medical Centre, Orebro, Sweden, have noted that:

> The results of some of the epidemiological studies on cancer risks associated with exposure to these compounds have been manipulated and misinterpreted, particularly by the Australian Royal Commission on the Use and Effects of Chemical Agents on Australian Personnel in Vietnam. Furthermore, a book on Australian war history entitled Medicine at War, commissioned by the Federal Government, reiterates several of these misinterpretations, despite available contrary evaluations from Australian and US authorities. [lvi]

The book in question here is, '*Medicine at War*', by Brendan O'Keefe and F B Smith, which forms volume four of the nine volume series, which constitutes 'The Official History of Australia's Involvement in Southeast Asian Conflicts 1945-1975'.[lvii]As this publication is still being used as a reliable source of reference by the Department of Veterans' Affairs, despite the existence of more recent research which undermines many of its claims, it is hard to avoid the conclusion that the thousands of sailors who served in the sea transport and logistical support role, and the many thousands of passengers *Sydney* carried to and from the Vietnam war zone, deserve to be treated much better.

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[i] Graham A Cosmas, *MACV, The Joint Command in the Years of Withdrawal 1968-1973*, (Washington DC: United States Army, 2007), pp. 260-263.

[ii] US National Academy of Science, Institute of Medicine, *Veterans & Agent Orange: Health Effects of Herbicides Used In Vietnam*, (Washington DC: National Academy Press, 1994), p. 1

[iii] Danna Vale, Minister for Veterans' Affairs, Media Release VA169, *Vietnam Water Contamination Study Released*, 18 December 2002.

[iv] Dr Ezra Jacob Kraus, (1885-1959) Professor of Botany, Chicago University, from 1919 to 1947.

[v] Joel O'Kane, 'Agent Orange', *Daily Gleaner*, 8 June 2005.

[vi] Committee to Review the Health Effects in Vietnam Veterans of Exposure to Herbicides, *Veterans and Agent Orange: Health Effects of Herbicides Used in Vietnam*, Division of Health Promotion and Disease Prevention, Institute of Medicine, National Academy of Sciences, 1994, pp. 84-106

[vii] National Academy of Science, Institute of Medicine, *Veterans and Agent Orange – Health Effects of Herbicides Used in Vietnam*, 1994, pp. 104-105.

[viii] *Ibid.* p. 105.

[ix] COMNAVFORV/Naval Advisory Group (NAVADVGRP) Fact Sheet Six, *Rung Sat Special Zone*, April 1966.

[x] COMNAVFORV Message: *Defoliation in RSSZ*; DTG 021124Z, April 1968

[xi] Testimony of Admiral E R Zumwalt Jr. USN (Rtd), Chairman Agent Orange Coordinating Council, before the US House Veterans Affairs Committee, 4 August, 1993, p. 1.

[xii] Admiral E Zumwalt, Jr., Lt. E Zumwalt 3rd, with Pekkanen J, *My Father, My Son* (New York: Macmillan, 1986) pp. 47-48.

[xiii] Moon Collinson, 'America's Defence Monitor', *Transcript of Interview with Admiral E Zumwalt*, 26 July 1999. www.cdi.org/ADM/1251/Zumwalt.html 3 April, 2007.

[xiv] Jock McCulloch, *The Politics of Agent Orange: The Australian Experience* (Richmond: Heinemann, 1984) pp. 46-47.

[xv] Federation Naval Congress & Reunion – *Report of Proceedings*, October 2001, pp. 55-56.

[xvi] *Ibid*.

[xvii] E J Wilson & K Horsley, 'Health Effects of Vietnam Service', *Australian Defence Force Health*, Vol. 4, September 2003, pp. 59-65.

[xviii] Crane P J, Barnard D L, Horsley K D and Adena M A, 'Mortality of Vietnam Veterans: The Veteran Cohort Study', Department of Veterans' Affairs, 1997, p. 107.

[xix] E J Wilson & K Horsley, 'Health Effects of Vietnam Service', 2003, p. 62.

[xx] Ministerial Media Release, 'Vietnam Water Contamination Study Released', VA169, 18 December 2002.

[xxi] Admiralty Chart 1016 Song Sai Gon, anchorage points of HMAS *Sydney* and escorts, 1965-1972. Plotted by former Fleet Navigating Officer retired Commodore J S Dickson, from log books of all ships employed in the sea transport/logistical support role during this period.

[xxii] J F Muller, C Gaus, K Bundred, V Alberts, M R Moore & K Horsley, 'Co-distillation of Agent Orange and Other Persistent Organic Pollutants in Evaporative Water Distillation', Department of Veterans' Affairs: Undated, Un-paginated. (5 pages)

[xxiii] Ministerial Media Release, *Vietnam Water Contamination Study Released*, VA169, 18th December 2002.

[xxiv] *Ibid*.

[xxv] *Ibid*.

[xxvi]WOMTP* Ralph Hayden Spooner (1935-2000). Spooner was classed as a stoker-mechanic, and was competent in the use and running of machinery associated with the performance of both engine rooms and boiler rooms in all HMA Ships of the time. His vast experience in this role was of great benefit to the ENTOX study and the project report was dedicated to him on completion.

[xxvii] Eileen J Wilson & Keith Horsley, 'Health Effects of Vietnam Service', Australian Defence Force (ADF) Health, Vol. 4, September 2003, p. 62.

[xxviii] A Report to the Department of Veterans' Affairs, The National Research Centre for Environmental Toxicology (ENTOX), *Examination of the Potential Exposure of RAN Personnel to Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans Via Drinking Water*. 12 December 2002, p. 10.

[xxix] ENTOX, p. 11.
[xxx] ENTOX, pp. 5-6.
[xxxi] ENTOX, pp. 6-7.
[xxxii] *Ibid.*
[xxxiii] *Ibid.*
[xxxiv] *Ibid.*
[xxxv] ENTOX, pp. 6-8.
[xxxvi] ENTOX, p. 35.
[xxxvii] Record of Interview by Cdr. J B Wells USN (Rtd) Attorney at Law, with Professor M Moore of Queensland Health Scientific Services (QHSS), and Dr C Gaus, Research Fellow, National Research Centre for Environmental Toxicology (ENTOX), 3 July 2006, p. 5. Moore and Gaus are two of the original authors of the 2002 ENTOX Report mentioned in some detail above.
[xxxviii] Media Release: The Hon Danna Vale, 'Vietnam Water Contamination Study Released'. VA169, 18 December 2002.
[xxxix] Revocation and Determination of SOP concerning Malignant Neoplasm of the Prostate, Instrument No: 28 of 2005. 19 September 2005.
[xl] US Dept. Veterans' Affairs, 'Agent Orange Review' Vol. 23, No. 1, October 2005.
[xli] *Ibid.*
[xlii] US DVA, 'Agent Orange Review', Vol. 23, No. 1, October 2007, p. 3. Agent Orange Briefs (11) D2 to D10 inclusive, and D12 – D13 also refer dated between 1990 and 2003.
[xliii] US DVA, 'Agent Orange: Diseases Associated with Agent Orange Exposure', Office of Public Health, http://www.publichealth.va.gov/exposures/agentorange/diseases.asp 13 March 2010. Bridget M Kuehn, 'Agent Orange Effects', *Journal of the American Medical Association*, JAMA, 2010, Vol. 303 (8): p. 722. http://jama.ama-assn.org.ezproxy.lib.monash.edu.au/egi/content/full/303/8/722-b 14 March 2010.
[xliv] RMA Statements of Principle (7) in accordance with the VEA 1986 dated between 2003 and 2006.
[xlv] Dr Norbert J P Ryan, Senior Scientist, Bacteriology, Victorian Infectious Diseases Reference Laboratory (VIDRL) and Robert Sartori, Senior Scientist, Hortico-Yates Chemicals, 24 June 2009.
[xlvi] U.S. National Academy of Sciences' Institute of Medicine (IOM), *Veterans and Agent Orange*, Update 2002, pp. 366-376. U.S. DVA 'Agent Orange Review', Vol. 19, No. 2, July 2003. U.S. DVA 'Agent Orange Brief' D13, 16 October 2003.
[xlvii] K. Donald Chairperson RMA: 'Declaration under Subsection 196B (9) of the Veterans' Entitlements Act 1986', concerning Chronic Lymphoid Leukaemia, 14 April 2008.
[xlviii] ADF Health, Vol. 4, September 2003, p. 65.
[xlix] Australian Government, DVA, AIHW, 'Australian Vietnam Veterans, Mortality & Cancer Incident Studies, Overarching Executive Summary', 2005, un-paginated.
[l] Comments by John B Wells, Appendix A: p. v.
[li] The symbol ng = nanogram(s) concentration per day. A nanogram = one trillionth of a gram.
[lii] *Ibid.*
[liii] The symbol pg = picogram(s). A picogram = one billionth of a gram.
[liv] ENTOX, p. 36. Note that pg/kg bw/day = picogram per kilogram of body weight per day or 360-6000 picograms per kilogram of body weight per month.
[lv] *Ibid.*
[lvi] Hardell L, Eriksson M & Axelson O, 'Agent Orange in War Medicine; an Aftermath of Myth', *International Journal Health Services*, 1998:28(4):pp. 715-24.

[lvii] Brendan O'Keefe & F B Smith, *Medicine at War* (Sydney: Allen & Unwin, 1994).