



## Agent Orange and Vietnam Veterans: A Review

Alvin L. Young

A.L. Young Consulting, Inc., Cheyenne, Wyoming

Lynda V. Alexander

### ABSTRACT

**Issue:** Approximately 3 million Allied personnel from the United States, Australia, New Zealand, and the Republic of Korea served in the Republic of Vietnam from March 1965 through March 1973 in what became known as the Vietnam-American War. In March 1978, a widely distributed documentary “Agent Orange: Vietnams Deadly Fog”, generated fear and anger in Vietnam veterans of that War who became aware that the tactical herbicide Agent Orange, a defoliant, had been deployed in combat operations to improve visibility in enemy controlled jungle and infiltration routes, and around base perimeters. One of the herbicidal components of Agent Orange (2,4,5-T herbicide) contained the contaminant 2,3,7,8-tetrachlorodibenzo p-dioxin (TCDD), a highly toxic chemical associated with industrial accidents and an alleged teratogen in forestry programs where the herbicide was widely sprayed for brush control and conifer release. Following the release of the documentary, thousands of Allied Vietnam Veterans overwhelmed Veterans Administrations claiming Agent Orange and the associated dioxin were responsible for numerous diseases, birth defects, and long-term health issues. Despite the passage of almost 50 years, science has not been able to answer the question of the health impacts of alleged environmental exposures to either the TCDD or the tactical herbicides on Vietnam veterans. Thus, at the heart of the issues the question remains, were Vietnam veterans ever exposed to Agent Orange and TCDD or was it the Vietnam experience that has impacted the long-term health of the Vietnam veteran?

**Background:** From March 1965 through April 1971, the United States Air Force and the US Army Chemical Corps sprayed approximately 74.2 million liters of tactical herbicides on 1.7 million hectares of the inland forests, savannas, and grasslands of South Vietnam. Contained within the 74.2 million L was 43.3 million L of the tactical herbicide known as Agent Orange that was contaminated with 130 kg of TCDD. Numerous research studies have been conducted in Vietnam, all alleging that the TCDD from Agent Orange was responsible for health issues among the Vietnamese. However, a careful assessment of the sources of TCDD in Vietnam indicated that significant quantities of TCDD were in the waterways and atmosphere due to the pollution from industries and open burning of municipal and industrial wastes, and not from Agent Orange.

**Human Studies:** The deployment of in-country medical support in the War by the Allied Forces was instrumental in saving lives. What was unexpected was that more casualties died from insect-transmitted diseases and other health related issues than from enemy bullets and bombs. The more than 50 health studies of Vietnam veterans by the four Allied nations confirmed that with two exceptions (the Air Force Health Study of veterans from Operation RANCH HAND, and health studies of US Army Chemical

## **Corps personnel) Vietnam veterans were never exposed to Agent Orange or TCDD. What the health studies did confirm**

Services for Science and Education – United Kingdom  
British Journal of Healthcare and Medical Research (BJHMR) Vol 11, Issue 03, June-2024

**was that the “Vietnam Experience” impacted the long-term health of the men and women who served in that war. Policy Considerations: The Congress of the United States, the Department of Veterans Affairs, and the Vietnam veteran simply refuse to accept the reality that little or no exposure to the herbicides or TCDD ever occurred in Vietnam. Instead, the Government continues to expand the lists of diseases and locations through the Agent Orange Act of 1991, and the PACT Act of August 2022. We concur that all Vietnam veterans deserve the best possible health care US and Allied nations can provide, and the recognition they are entitled to for having served in Vietnam. Perhaps the governments would have been fairer with a program of “Vietnam Experience” benefits rather than Agent Orange benefits.**

### **ISSUES**

There have been ongoing controversies about the use of tactical herbicides for defoliation and crop denial operations in the Vietnam-American War, 1962 – 1971. The tactical use of the herbicide known as Agent Orange has been the primary focus because of the toxic dioxin contaminant, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) subsequently found in the herbicidal formulation. Despite the passage of almost 50 years, science has not been able to answer the question of the health impacts of potential environmental exposure to either the TCDD or the tactical herbicides on Vietnam veterans. The challenges have been to separate the experiences of combat, physical injury, drugs, depression, post-traumatic stress disorder, and death from the potential exposure to diverse agents including herbicides, insect-transmitted diseases, and inhospitable environments that may have affected their health while in service or after discharge. Thus, it is important to understand who the Vietnam veterans were, the environmental conditions they encountered in Vietnam, the stress of combat operations, and the exposure to the chemical and biological diversity ever present during the war. All of these factors are integral to understanding the results of post-Vietnam veteran health studies.

### **DEFINING VETERANS**

The definition of “Vietnam Veterans” was defined by the United States Department of Veterans Affairs (DVA) as “active duty men or women who served in the Republic of Vietnam during the period beginning 28 February 1961 and ending May 1975.<sup>1</sup> During the period 1965 through March of 1973, approximately 3 million Allied personnel from the United States (US), Australia, New Zealand, Thailand, The Philippines, and the Republic of Korea (ROK) served in support and in combat operations in Southern Vietnam.<sup>2</sup> In 1955, the Republic of Vietnam (RVN) was formally established. By 1967, RVN had 341,000 men under arms, and by 1969, the RVN was fully mobilized with a combat strength of 1,050,000 personnel.<sup>2</sup> The number of combat forces to include the Communist Vietnam Guerrilla Forces (Viet Cong), and the People’s Army of Vietnam (PAVN), from The Democratic Republic of Vietnam, i.e., North Vietnam, likely exceeded more than two million men and women.<sup>2</sup> The Associated Press in April 1995 estimated that 1.1 million Viet Cong and NVA personnel died by the capture of Saigon in April 1974.<sup>2</sup> Data for deaths of Allied Forces (to include RVN) exceeded 320,000.<sup>2</sup>

### **ENVIRONMENTAL CHARACTERISTIC OF SOUTH VIETNAM**

The topography, climate, and vegetation favored the insurgency forces of the Viet Cong, and PAVN.<sup>3</sup> Nearly 60% of Vietnam consisted of mountains and plateaus rising to elevations of

2,500 m, while 40% of the country consisted of lowlands that were generally 4-5 m above sea level.<sup>3</sup> Strategically, almost the entire countryside of South Vietnam offered concealment to

enemy troops while presenting major obstacles to observation, penetration and movement by friendly forces.<sup>3</sup> High temperatures and humidity, and abundant rainfall stressed both military personnel and their maintenance of equipment and vehicles.<sup>3</sup> The jungles and swamps of Southern Vietnam were known as “walking nightmares” providing an environment of biting insects carrying malaria, dengue fever, and encephalitis, while rodents carried fleas and other pathogenic organisms. Allied military personnel suffered exposure to poison plants, snakes, giant centipedes, hornet stings, leaches, trench foot, and biting ants, in addition to enemy ambushes.<sup>4</sup> The dense upland forests (57%), grasslands and savanna (23%), agricultural and urban lands (18%), and coastal mangrove forests (2%) provided major obstacles to provide effective defenses to the 10 major Allied military bases.<sup>3, 5</sup> Fox reported that widespread vegetation hid the enemy, shut off friendly observation and fields of fire, neutralized fencing, and other defense barriers, slowed the movement and response of security forces, and nullified detection by sentry dog teams.<sup>5</sup> Thus, reducing the environmental conditions associated with “walking nightmares”, while controlling the noxious vegetation were major challenges to the RVN military and Allied forces.

## BACKGROUND

### Operation RANCH HAND in Vietnam

“Operation RANCH HAND” was the code name for the United States Air Force (USAF) aerial dissemination of chemical herbicides as a tactical weapon in South Vietnam, 1962-1971. The operation consisted of flying unarmed, unmarked, obsolescent aircraft (UC-123) at slow speeds and at tree-top level while attacking the enemy’s environment, i.e., dense vegetation.<sup>6</sup> At its peak, the RANCH HAND squadron consisted of 33 aircraft with a three-fold mission of defoliation, crop denial, and insect suppression.<sup>6</sup> The extensive histories of the RANCH HAND Operation were published in books by Buckingham, 1982, and Cecil, 1986.<sup>7,8</sup> Contrary to allegations that RANCH HAND was strictly a USAF project, both the US Department of Defense, the US Ambassador, and the Vietnamese Government (RVN) were intimately involved in the selection of targets for defoliation and crop denial operations.<sup>7,8</sup> This coordination required that proposed targets involve the affected Province Chiefs, their military advisors, and aerial survey missions over the targeted areas.<sup>7,8</sup> During its 10-year history, RANCH HAND aircraft sprayed ~ 1.71 million ha, approximately 10% of the vegetation in South Vietnam.<sup>9</sup>

Modified RANCH HAND aircraft flew 1,390 individual missions in Operation FLYSWATTER, dispensing 1.76 million L malathion insecticide from October 1966 through December 1971 as part of the disease control programs of the Command Surgeon General.<sup>10</sup> Because of intense enemy ground fire, defoliation missions required only a few minutes on targets. However, insecticide spray aircraft’s treetop level flights lasted as much as two very hazardous hours of flying. The success of these missions in controlling mosquitoes, and hence malaria, resulted in 14 major allied military bases and adjoining Vietnamese cities being sprayed routinely every 9 days, weather permitting.

In 2000, Colonel Walter J. Boyne, the former Director of the National Air and Space Museum,

Washington, DC, described the men and mission of RANCH HAND: *It was an unheralded mission, unfolding over ten long years. Even by the standards of the Vietnam War, it was politically sensitive, and national political leaders tended to recoil from discussing it. At its cutting edge were old, unarmed aircraft making low and slow flights, straight into enemy fire. They were unsung heroes. Neither those who flew on the missions nor those who supported them have received the*

3

URL: <http://dx.doi.org/10.14738/bjhm.113.16910>.

British Journal of Healthcare and Medical Research (BJHMR) Vol 11, Issue 03, June-2024

*credit deserved. The men of RANCH HAND accepted this, for they were an unusual breed, regarding anti-aircraft and casualties as badges of honor. They were never a spit-and-polish outfit.*<sup>11</sup>

### **Tactical Herbicides Used in Vietnam**

The commercial herbicides 2,4-dichlorophenoxyacetic acid (2,4-D), and 2,4,5-trichlorophenoxy-acetic acid (2,4,5-T) were both developed and formulated in the 1940s.<sup>12</sup> There have been more than 40,000 published studies over the past seventy years dealing with the chemistry, toxicology, and environmental persistence in soils and biological systems. Indeed, the safety records of the phenoxy herbicides have been thoroughly researched and documented. Despite their safety record in world agriculture for decades, their use in Vietnam as Agent Orange and other 2,4-D and 2,4,5-T formulated tactical herbicides, the public and Vietnam veterans have been concerned about the possible adverse effects on human health.<sup>12</sup> Approximately 24 million kg of 2,4,5-T and 28 million kg of 2,4-D were used for vegetation control in Vietnam between 9 January 1962 and 29 January 1971.<sup>6</sup> Much of the 2,4-D and 2,4,5-T were aerially sprayed as the n-butyl ester in the 43.3 million L of Agent Orange sprayed from March 1965 through April 1970 in defoliation operations.<sup>12</sup> Much of the toxicity in animals that had been attributed to 2,4,5-T later shown to be caused by the TCDD contaminant.<sup>12</sup> There has been a disconnect between perception and reality as to the hazards and human risks of 2,4,5-T. The half-life in the human body was between 18 and 24 h (unmetabolized), and between 10 and 20 days in the soil environment depending upon soil conditions.<sup>12</sup> The basic differences between 2,4-D and 2,4,5-T formulations sprayed in commercial operations in brush control programs worldwide were the use of the n-butyl formulation (higher volatility), and the application rate of 28 L/ha (~30 kg/ha) compared with ~2.4 kg/ha for use in forestry programs. Indeed, in 1975 8.2 million kg of mixtures of 2,4-D and 2,4,5-T were applied to pastures and rangelands in the US.<sup>12</sup>

The second most widely used tactical herbicide in Vietnam was Agent White.<sup>13</sup> Agent White was the only tactical herbicide that contained the commercial herbicide picloram, 4-amino-3,5,6-tri-chloropicolinic acid (Tordon®). Agent White was a water-soluble formulation containing a 1:4 mixture of the triisopropanolamine salts of picloram and 2,4-D (Tordon 101®), and there was no dioxin (TCDD) in the formulation.<sup>13</sup> The first shipment of White arrived in South Vietnam in January 1966, and by its final use by RANCH HAND in October 1971 approximately 21.8 million L had been sprayed on a broad spectrum of woody plants and in forest defoliation.<sup>13</sup> Because of its soil persistence, it was not recommended for use in crop denial operations. Due to its rapid excretion in the urine, picloram had low potential to accumulate in man during prolonged exposure. The US Institute of Medicine concluded that in humans, picloram was unlikely to be a carcinogen, mutagen, or teratogen.<sup>13</sup> Its low toxicity to mammalian and aquatic organisms (LD<sub>50</sub> 8200 mg/kg in rats) suggested

that the use of White in Vietnam likely resulted in the proliferation of native ground cover that favored the establishment of native fauna.<sup>13</sup>

The third most widely used tactical herbicide in Vietnam was Agent Blue, an organic arsenical as cacodylic acid and sodium cacodylate.<sup>14</sup> Approximately 6.1 million L of Agent Blue were shipped to and used in Vietnam between December 1965 through December 1970. The liquid Agent Blue was aerially sprayed in crop denial operations, especially against rice production, and for opening areas in savannahs and mangrove forests. In addition, Agent Blue was the tactical herbicide of choice for controlling grasses outside of base perimeters.<sup>14</sup> As an organic

4

Services for Science and Education – United Kingdom

Young, A. L., & Alexander, L. V. (2024). Agent Orange and Vietnam Veterans: A Review. *British Journal of Healthcare and Medical Research*, Vol - 11(3). 01-19.

arsenical, once in contact with the soil it was tightly bound within the soil matrix, making it immobile while slowly converting to volatile alkyl arsine and released into the atmosphere. In rice fields > 60% of the arsenic in Agent Blue was shown to be converted to alkyl arsine within 24 weeks.<sup>14</sup> However, in a publication in 2022, Olson and Cihacek argued that the arsenic in Agent Blue sprayed in the Mekong Delta of Vietnam likely contributed to the contamination of the food supply and ground water in nearby local populations.<sup>15</sup> Based on limited available studies, the Institute of Medicine concluded that cacodylic acid was likely not a carcinogen, mutagen, or teratogen in man.<sup>14</sup>

### **HUMAN EXPOSURE TO TCDD FROM THE USE OF AGENT ORANGE**

Following concerns by Vietnam veterans and the public, President Ronald Reagan in August 1981 elevated the issue of Agent Orange to a unit in the Executive Office of the President by forming the “Agent Orange Working Group (AOWG)”.<sup>16</sup> The assigned task of the Working Group was “to guide and monitor all Federal and International research into the possible adverse health effects of Agent Orange and similar chemicals on humans, with a particular focus on the health of veterans.”<sup>16</sup> For ten years, the Federal agencies of the US government committed vast sums of research funds and scientific expertise in addressing the health issues allegedly caused by exposure to Agent Orange and its associated dioxin (TCDD).<sup>17</sup> More than 50 major health studies were reviewed by the AOWG. The consensus by the AOWG was that the studies failed to find a relationship between adverse health outcomes and exposures to the components of the tactical herbicides used in Vietnam, including the contaminant TCDD.<sup>17</sup> Ignoring the outcomes of the studies, the United States Congress passed Public Law 102-4, the “Agent Orange Act of 1991.”<sup>18</sup> This legislation included a request that the National Academy of Sciences’ Institute of Medicine (IOM) conduct comprehensive reviews and evaluations of available scientific and medical information tying the health of Vietnam veterans who served in Vietnam to the alleged exposures to the herbicides/TCDD sprayed in Vietnam.<sup>18</sup> Periodic reviews by the IOM between 1994 and 2018 focused primarily on the TCDD contaminant and its toxicity and persistence in the human body.<sup>18</sup> The determination of exposure is a critical component of any health assessment. The IOM did not find evidence or findings of the likely levels of exposure by Vietnam veterans to the components of Agent Orange or the associated TCDD.<sup>18</sup> All of the IOM reports based the linkage between TCDD and human, i.e., veterans, diseases NOT on causality but on “statistical association”.<sup>18</sup>

If a veteran claimed exposure to Agent Orange while in service in a location where Agent Orange was sprayed, but the veteran was not involved in the actual loading or spraying of the tactical herbicide, or not in the area at time of spraying, that person might claim that he was

subsequently “exposed” to residues of Agent Orange and TCDD. The likelihood of actually acquiring a “dose” may be negligible because of the environmental fates of both the herbicides and the TCDD. Exposure to Agent Orange TCDD correctly means a situation for proximity and potential for intake, it does not mean the actual intake or absorption of a dose (in other words, exposure and dose are not equal).<sup>19</sup>

**Environmental Persistence and Fate in the Environment Relative to Vietnam** The US Agency for Toxic Substances and Disease Registry (ATSDR) suggested that the physical and chemical properties of 2,3,7, 8-TCDD would likely make the molecule essentially insoluble in water, bound to particulates and the organic matter in soils and sediments, and extremely stable under most environmental conditions.<sup>20</sup> Thus, burial in-place would likely be the

5

URL: <http://dx.doi.org/10.14738/bjhm.113.16910>.

British Journal of Healthcare and Medical Research (BJHMR) Vol 11, Issue 03, June-2024

predominant long-term fate of heavily contaminated soils. Erosion of surface soils to water bodies would likely be the predominant fate of aerial deposition of TCDD. The vapor pressure and low solubility however would suggest its volatilization half-life in various bodies of water would be ~ 16 to 32 days.<sup>20</sup>

### **Sources of TCDD in Vietnam**

Detail summaries of long-term field studies of 2,3,7,8-TCDD residues and human exposure were published in 2022.<sup>21</sup> These studies provide insight into the three major sources of human exposure in Vietnam: 1) it entered the environment as a result of the spraying or spillage of herbicides contaminated with TCDD; 2) it entered the environment from the improper handling of industrial and municipal wastes, especially from the manufacturer of chlorinated products; 3) it entered the atmosphere as a consequence of combustion sources.<sup>21</sup>

**Quantities of TCDD Contained in Tactical Herbicides Sprayed/Spilled in Vietnam** Agent Orange and other herbicidal formulations sent to Southern Vietnam 1962-1970 were purchased from US commercial chemical companies under Military Specifications established by the US Army Chemical Corps, Fort Detrick, Maryland.<sup>22</sup> The use of tactical herbicides was confined to combat operations by the US Army Chemical Corps and the US Air Force. They were not permitted to be used on military bases/installations because they were not registered for commercial use.<sup>22</sup> Civil Engineering Squadrons assigned to all US and Allied military bases purchased registered commercial herbicides and insecticides from the Defense Supply Agency (DSA).<sup>22</sup> Analysis of ~1,200 samples of Agent Orange or its component 2,4,5-T representing 90% of the Agent Orange purchased by DSA had a mean concentration of 1.88 mg/kg (~1.9 ppm).<sup>22</sup> A detailed analyses of the 2,4,5-T used in formulating Agent Orange confirmed that the only readily quantifiable dioxin was the 2,3,7,8-TCDD. Some samples contained trace quantities of penta- and hexa-dioxins.<sup>22</sup> Based on the above analytical data, the total estimated amount of the contaminant 2,3,7,8-TCDD associated with the 2,4,5-T-containing tactical herbicides sprayed or spilled in Vietnam was 130 kg. The analyses of RANCH HAND data (the HERBS Tape) suggested it was likely that 96 to 98 % of the TCDD was aerially sprayed over the jungle and mangrove swamps of Vietnam.<sup>23</sup> The remaining 2 to 4% (2 to 4 kg) of the TCDD from Agent Orange likely bound in soils surrounding where the herbicide was sprayed on base perimeters or spilled while loading aircraft. Leakage at sites where the tactical herbicide was stored or re drummed in 1970 is a contributing factor for these areas designated as “hot spots”.<sup>22,23</sup>

What was the likely fate of the TCDD in Agent Orange? In 1989, Arthur and Frea of The Ohio State University critically reviewed the scientific literature on 2,3,7,8-TCDD's properties and potential environmental fate.<sup>24</sup> They noted that in the presence of a proton donor, photodegradation may be the major environmental degradative mechanism for TCDD. Previous research had demonstrated rapid (within 6 h) photodegradation to dichlorination products when applied in a proton-donating herbicidal formulation (specifically Agent Orange) to soil, leaves, or glass plates and exposed to natural sunlight.<sup>25</sup> When aqueous suspensions of TCDD on glass plates were irradiated (no proton donor), no decomposition occurred.<sup>25</sup> This research suggested that negligible amounts of TCDD from Agent Orange would have been present within 24 h after aerial applications over jungle and mangrove swamps.<sup>22</sup> This conclusion suggests that allegations of large-scale dioxin pollution from spraying Agent Orange in Vietnam is without merit.<sup>26</sup> Indeed, examination of the dioxin and furan profiles indicated that the dioxin present was from other sources.<sup>26</sup>

6

Services for Science and Education – United Kingdom

Young, A. L., & Alexander, L. V. (2024). Agent Orange and Vietnam Veterans: A Review. *British Journal of Healthcare and Medical Research*, Vol - 11(3), 01-19.

**Quantities of TCDD from Municipal and Industrial Waste Waters in Vietnam** In 1995, the US established normal relations with the Socialist Republic of Vietnam (Vietnam). The early studies by US and Vietnamese scientists and public health experts focused on identifying many of the 17 congeners (7 dioxins and 10 furans) that accumulated in human fat and blood serum.<sup>21,27</sup> As previously noted, for Agent Orange the only readily identifiable congener was 2,3,7,8-TCDD, although there were trace quantities of the 1,2,3,7,8-PnCDD and 1,2,3,4,7,8-HxCDD.<sup>22</sup> However, numerous analytical studies of Vietnamese found that all 17 congeners were present in blood serum indicating that there were other additional sources of dioxins and furans in Vietnam.<sup>28</sup> Indeed, Dr. T.T. Mai, a member of the Vietnamese American Science and Technology Society of California noted that for Bien Hoa City significant water pollution resulted from untreated paper, plastic, electronic, textiles, and chemical industries, where dioxins, furans and PCBs were formed and discharged in rivers and waterways.<sup>28</sup> A 2022 research article on paper mill wastewater in Vietnam documented that approximately 300 pulp and paper mill factories have been established in Vietnam since 1920.<sup>29</sup> The paper industry contributes around 1.5% of Vietnam's gross domestic product; however it discharges volumes of waste into the environment.<sup>29</sup> Each ton of produced paper releases approximately 60 m<sup>3</sup> of wastewater that contains organic and inorganic compounds, suspended solids and metals, and xenobiotic compounds such as TCDD, other dioxins and furans.<sup>29</sup>

These sources of TCDD and other congeners of dioxins and furans are too often ignored in favor of concluding that the TCDD was from Agent Orange. One of the first analytical studies published in 1973 at the end of the Vietnam War concluded that TCDD-contaminated Vietnamese carp and catfish (bottom feeders) from the Song Sai Gon and Dong Nai Rivers was the result of spraying Agent Orange adjacent to the rivers.<sup>30</sup> The authors concluded: "We know of no likely route by which other isomers of TCDD might have been introduced into the Vietnamese environment."<sup>30</sup> Subsequently, in 1974 one of the same investigators examined the TCDD in mother's milk in samples collected 1970 and 1973 in a Vietnamese Village adjacent to the Dong Nai River.<sup>31</sup> Positive levels for TCDD from the mother's milk of ten Vietnamese women varied from 3 to 55 (mean 19.7) parts-per-trillion (ppt) in 1970 and mean of 5 ppt in 1973.<sup>31</sup> The author concluded that this rapid drop in three years was due to cessation of

spraying Agent Orange, discounting contaminated fish and other food sources from the Dong Nai River and adjacent agricultural fields.<sup>31</sup> In 2010, an article published in *Marine Pollution Bulletin* described studies of soil sediment cores collected from nine Central Vietnam coastal lagoons in 2005 and subsequently analyzed for PCDD/Fs.<sup>32</sup> The lagoons were selected for sampling to determine watershed contamination from areas sprayed with Agent Orange prior to 1970. Octachlorodibenzo-*p*-dioxin (OCDD) was the prevailing congener (~90%) indicating combustion as the main PCDD/F source to these coastal systems.<sup>32</sup> Although TCDD was either absent or present at very low concentrations, the authors suggested that natural formation, i.e., the chemistry of fire, was likely responsible for it. The authors concluded that their results supported the hypothesis of rapid degradation of the TCDD in Agent Orange soon after spraying.<sup>32</sup>

### **Quantities of TCDD from Combustion Sources in Vietnam**

Combustion of industrial and municipal waste and domestic trash has been and continues to be one of the most significant sources of PCDD/Fs in densely populated areas in Vietnam.<sup>33</sup> Studies have shown that a variety of PCDD/F congeners are emitted from different combustion sources, with 2,3,7,8-TCDD having relatively high concentrations in emissions from PVC-coated wire,

7

URL: <http://dx.doi.org/10.14738/bjhmr.113.16910>.

British Journal of Healthcare and Medical Research (BJHMR) Vol 11, Issue 03, June-2024

burning tires, and from industrial oil-fueled boilers.<sup>34</sup> Collection efficiency of municipal solid wastes in Vietnam has been reported highly variable ranging from 40 to 76% in larger cities to 20 to 40% or less in small towns.<sup>35</sup> Consequently, disposal of wastes into nearby rivers, lakes and at sites near homes as well as or burning, or burying the trash was widespread.<sup>36</sup> Burning of both municipal and industrial waste at landfills in Vietnam are a source of PCDD/Fs including 2,3,7,8-TCDD.<sup>36</sup> The 2003 UNEP report on “State of the Environment in Vietnam” noted that before 1975 old industries were not equipped for treating toxic emissions and 500 of approximately 700 of these factories were located within urban areas around Ho Chi Minh City (previously Saigon).<sup>35</sup> More recently, Vietnam has identified 200 major sites where burning of municipal wastes occurs and regulatory action is underway for pollution abatement.<sup>33</sup> Other sources of PCDD/Fs include vehicles using leaded gasoline throughout Vietnam which may contribute 10-100 g TCDD equivalents per year (projection from a Swedish Study).<sup>37</sup> Additionally, research has shown that PCDDs, including 2,3,7,8-TCDD, are present in the smoke and ash of cigarettes.<sup>38</sup> It was estimated that the daily intake of PCDDs by smoking 20 cigarettes was estimated to be 4.3 pg/kg body weight/day.<sup>38</sup> Moreover, recent epidemiological studies have suggested that the 2,3,7,8-TCDD from smoking may play a role in pathogenesis of rheumatoid arthritis.<sup>39</sup>

For the past 50 years, the Vietnamese government has mishandled industrial wastes and the burning of municipal wastes permitting significant quantities of dioxins, including 2,3,7,8-TCDD, and furans to be released into the atmosphere and waters of Vietnam. Compared to these sources, the TCDD and its fate from Agent Orange should have been of little concern. The exception would be the high soil concentrations found in the soil of airbases where the RANCH HAND aircraft were loaded, and the Agent Orange stored, i.e., “hot spots.”

To illustrate the confusion on sources of TCDD in food, in 2003 a market survey and sampling of foods were conducted and included fish, duck, chicken, pork, and beef.<sup>40</sup> Analyses for TCDD



levels in fish (0.19-66 ppt wet weight); duck (276-331 ppt wet weight); chicken (0.35-48 ppt wet weight) were found, but no TCDD in pork and beef.<sup>40</sup> The obvious explanation is that the animals who feed on seeds, insects, and food wastes on soil surface, i.e., ducks and chickens, or contaminated pond sediments (fish) came in contact with ash from the burning of industrial and municipal wastes. The ash contained the TCDD in a stable and basic form and not susceptible to photodegradation, i.e., the fly ash served as a reaction surface for dioxin generation during low-temperature incineration. The cows and pigs consumed vegetation where little or no ash was present, or no uptake from the contaminated soil. A similar study was published in 2014 allegedly documenting that an Agent Orange footprint was still visible in rural areas of central Vietnam more than 30 years after the last spraying of the herbicide.<sup>41</sup> The investigators focused on the TCDD levels in soils and sediments and in foodstuffs of the local inhabitants.<sup>41</sup> As with the previous study, the authors ignored other sources of TCDD. Again, local burning of household and municipal wastes produced ash containing TCDD. Unless thoroughly washed, the ash would adhere to the surface of the fruits, and vegetables, and those animals that consumed the surface soil, seeds and insects were contaminated. The consumption of these contaminated foods by the local residents resulted in TCDD residues in the human tissues.<sup>41</sup>

There are numerous references in the literature on the concentration of dioxins and furans in human breast milk samples. Dr. Muneko Nishijo, Kanazawa Medical University, Japan and his

8

Services for Science and Education – United Kingdom

Young, A. L., & Alexander, L. V. (2024). Agent Orange and Vietnam Veterans: A Review. *British Journal of Healthcare and Medical Research*, Vol - 11(3). 01-19.

colleagues recently published an article on dioxin congener patterns in breast milk samples from Vietnam and compared those with samples from other countries.<sup>42</sup> The Vietnam study consisted of 597 breast milk samples (collected between 2007 and 2015) from three areas sprayed with herbicides (presumably prior to 1971) including locations near “hot spots”, and 264 samples from three unsprayed areas of North Vietnam. All samples contained the 17 PCDD/F congeners that are typically found in most human tissues. The levels of these congeners were essentially consistent with samples from Italy, Germany, Spain, China, and Japan<sup>42</sup>. The authors focused on TCDD, Hexa CDD, HeptaCDD, HexaCDF, and HeptaCDF congeners found in both sprayed and non-sprayed areas, but typically found from industrial sources. Although the authors attributed these to herbicide sources in the sprayed areas, it is unlikely that they were associated with Agent Orange or other 2,4,5-T herbicides. In addition, even though the “hot spots” had high levels of TCDD at the time of spillage of Agent Orange, it is likely that much of it had degraded/volatized or tightly bound in the soil matrix after 40 years.<sup>43</sup> Understanding the chemistry and environmental fate of TCDD was critical to recognizing exposure to the Vietnamese and to the Allied soldiers serving in the Vietnam War.

### **HEALTH STUDIES OF ALLIED VIETNAM VETERANS**

As with all military conflicts/wars, the Vietnam War was a violent conflict where the types of severity of injuries were those typically inflicted by the weapons of war. However, the deployment of major Allied combat forces into South Vietnam found them unprepared for tropical military operations, insect-transmitted diseases, and other health related issues that accounted for more casualties than did enemy bullets and bombs.<sup>44</sup> Early in the War, the buildup of Allied combat and support forces required the rapid development and deployment of in-country medical support services in Vietnam.<sup>45</sup>

## Medical Support in Vietnam

In 1963, medical support was provided primarily through a US Navy dispensary in Saigon (now Ho Chi Minh City). Subsequently, "Station Hospital Saigon" was the only in-country hospital for Combat Advisory forces, and the limited Allied combat and support personnel.<sup>46</sup> The Hospital in Saigon consisted of a 100-bed inpatient facility including physicians, dentists, nurses, and hospital corpsmen. In January 1966, the US Navy Hospital Ship *USS Repose* arrived off the coast of Da Nang to support Marine and Army casualties in I Corps. In April 1967, the Hospital Ship *USS Sanctuary* arrived to continue medical support.<sup>46</sup> As Surgeon General Neal noted: "*As the numbers of combat and non-combat troops increase, so did the logistics of materiel, supplies, and the medical support services. Military hospitals, dispensaries and casualty staging units were established to care for the wounded. Military doctors, nurses, and technicians from many outstanding Allied hospitals and medical schools staffed these facilities*".<sup>46</sup>

The greatest drain on the strength of Allied combat and support efforts was the cumulative effects of diseases. Just over two of every three hospital admissions in Vietnam were due to diseases of military importance including malaria, viral hepatitis, diarrheal diseases, diseases of the skin, FUO (fever of undetermined origin) and venereal disease (primarily gonorrhea).<sup>45</sup> As the conflict raged on, the medical profession began to see the impact of substance abuse, infectious diseases, and the behavior changes associated with the stress of combat on the human body and psyche of the soldier.<sup>47</sup> Military doctors, dentists, nurses, and corpsmen were no exception to the mental stress of the threat of physical danger, and the handling of overwhelming casualties, only to be ignored by their government as well as ordinary citizens

9

URL: <http://dx.doi.org/10.14738/bjhm.113.16910>.

British Journal of Healthcare and Medical Research (BJHMR) Vol 11, Issue 03, June-2024

upon return to respective countries.<sup>2</sup> Most citizens of Allied nations were unaware that women, especially nurses, served in the Vietnam War.<sup>2</sup>

## Post-Vietnam Health Studies of Vietnam Veterans

Extensive health studies have been conducted by the United States, Australia, New Zealand, and South Korea of their Vietnam veterans.<sup>44</sup> The major reason for most of these studies was intended to validate veteran's allegations that exposure to Agent Orange and its associate dioxin was responsible for their illnesses. Additionally, Veteran Administrations were concern as to how the service in Vietnam and the stress of combat, were affecting the veterans, their families, and their future. From 1986 through 2012 at least 24 morbidity studies and 19 mortality studies have been published by the four nations.<sup>43</sup> The challenges for many of these studies that were titled "Agent Orange Studies" were the developments of exposure indices. Basically, there were three methods for assessing exposure: 1. The using of the "Exposure Opportunity Index Model"; 2. Assessing exposure through the use of Contemporary Military Records; and 3. The analytical determination of TCDD in blood serum or adipose tissue.<sup>48</sup>

**Assessing Exposure Using the "Exposure Opportunity Index Model"** In March 2003, a team of researchers from Columbia University published an article on how to use a Geographic Information System that was based on a relational database system of information obtained from the RANCH HAND records identifying aircraft flight paths, and the dispersal of herbicides.<sup>49</sup> Using the locations of military units and bases, the GIS could then be used to generate a quantitative exposure index that could account for quantity of herbicide sprayed,

distance, and environmental decay of dioxin.<sup>49</sup> The model was not used in the US Veterans Administration studies, but was used in the Korean studies of their veterans. The model was used by Vietnamese scientists claiming that large number of Vietnamese civilians had been directly exposed to the tactical herbicides.<sup>49</sup>

**Assessing Exposure Through the Use of Contemporary Military Records** In 2004, Young, Cecil, and Guilmartin examined contemporary military records as a means of assessing possible exposures of ground troops to Agent Orange during the War.<sup>50</sup> There were two categories of historical information: procedural information included the RANCH HAND extensive approval process that was intended to prevent the spraying of Allied troops and civilians. The second category was operational information that included geographic locations of the spray missions, the type and amount of herbicide sprayed, and report of hostile actions. Together, these sources of information were intended to ensure that friendly combat ground troops were not in a location to be sprayed by RANCH HAND aircraft.<sup>50</sup>

**Levels of TCDD found in Blood Serum or Adipose tissue in Vietnam Veterans** If the environmental fate of TCDD from Agent Orange rapidly photodegraded by sunlight, then it was likely that combat veterans who served in heavily sprayed areas of Vietnam received only minimal environmental exposure.<sup>51</sup> In 1988, the Centers for Disease Control and Prevention (CDC) compared the blood serum TCDD levels in 646 ground combat troops who had served in III Corps, a heavily sprayed area, against 97 veterans who did not serve in Vietnam. Military records and self-reporting suggested that combat veterans received significant TCDD exposure. However, the analysis of the blood serum revealed that both the combat veterans and the non Vietnam veterans had nearly identical levels of TCDD, ~ 4 parts per trillion (ppt).<sup>51</sup> These data confirmed that the perception of exposure and the reality of exposure were not the same.

10

Services for Science and Education – United Kingdom

Young, A. L., & Alexander, L. V. (2024). Agent Orange and Vietnam Veterans: A Review. *British Journal of Healthcare and Medical Research*, Vol - 11(3). 01-19.

In 1991, researchers with DVA teamed up with the US Environmental Protection Agency (EPA) to analyze selected adipose tissue from EPA's 8,000 archived tissues collected from the non institutionalized general population by EPA.<sup>52</sup> DVA identified adipose tissues from 36 Vietnam veterans, 79 non-Vietnam veterans, and 80 civilians. The geometric mean ( $\pm$  standard deviation) TCDD levels were 11.7 ( $\pm$  1.7), 10.9 ( $\pm$  1.7) and 12.4 ( $\pm$  1.9) pg/g (ppt) on a lipid weight basis, respectively.<sup>52</sup> When adjusted for age of individual, body mass index, and specimen collection year, the mean levels were not significantly different. For the adipose tissues from Vietnam veterans, DVA evaluated potential exposure to Agent Orange by military branch of service, military occupation, and troop location in relation to RANCH HAND spray tracts. The researchers concluded that exposure to Agent Orange while in service in Vietnam was unlikely.<sup>52</sup>

In 2001, Korean researchers with the School of Public Health, Seoul National University and the College of Medicine at Dongguk University selected blood serum from 154 non-Vietnam Korean veteran volunteers, and from 1224 Korean Vietnam veterans who had served in Vietnam during the period 1965 through 1970 and claimed direct exposed to Agent Orange.<sup>53</sup> The non-Vietnam cohort had a mean concentration of 0.30 ppt, and the Vietnam veteran cohort had mean TCDD levels that ranged from 0.66 ppt to 1.30 ppt.<sup>53</sup> The researchers concluded that their exposure to Agent Orange was likely minimal.<sup>53</sup>

## **Health Studies Conducted by United States Agencies**

With the establishment of the Agent Orange Working Group by President Ronald Reagan in August 1981, major research programs were initiated by three agencies of the US Government.<sup>16</sup> The CDC was tasked with conducting studies of US Army Vietnam veterans. The DVA was tasked with conducting morbidity and mortality studies of veterans who had served in either the Marines or the Army, including members of the Army Chemical Corps. The United States Air Force (USAF) initiated long-term studies of the veterans who had served in Operation RANCH HAND, 1962-1971.<sup>16</sup> A critical review of these health studies was published by Young; 2022.<sup>44</sup> A summary of these studies are noted below.

**Veteran Studies by the Centers for Disease Control and Prevention** The first study by CDC was conducted in 1988 and was the blood serum TCDD previously described.<sup>51</sup> In 2004, the CDC published a second study of veterans allegedly receiving environmental exposures to Agent Orange. This study was a 30-year post-service mortality study of a cohort of 9,324 male US Army veterans who had served in Vietnam, and whose presumption of exposure would have been acknowledged by DVA.<sup>54</sup> The Vietnam veteran cohort was matched with a cohort of 8,989 male non-Vietnam veterans. The study found that Vietnam veterans experienced higher mortality than non-Vietnam veterans from unintentional poisonings and drug-related causes. Death rates from disease-related conditions, including cancers and circulatory diseases, did not differ between Vietnam veterans and their peers, despite the increasing age of the cohort (mean age 53) and the longer follow-up (average, 30 years).<sup>54</sup>

The third major study by CDC was the Selected Cancer Studies, which were population-based, case-control studies examining the risks for non-Hodgkins lymphoma (NHL), Soft Tissue and other Sarcoma (STS), and Hodgkin's Disease (HD), nasal and nasopharyngeal cancers, and primary liver cancers among Vietnam veterans.<sup>55,56,57</sup> CDC selected 1776 controls for each of

11

URL: <http://dx.doi.org/10.14738/bjhm.113.16910>.

British Journal of Healthcare and Medical Research (BJHMR) Vol 11, Issue 03, June-2024

the three selected cancer studies and were matched to the cancer site for which they served as controls. The results of the three studies were that there were not consistent findings for STS, NHL, or HD when comparing Vietnam veterans to veterans who did not serve in Vietnam.<sup>55,56,57</sup> This was particularly true for marine populations and the development of NHL.<sup>55</sup> No association was found for these cancers and alleged exposure to Agent Orange and associated TCDD.

The fourth major study by CDC was the Vietnam Experience Study, a multidimensional assessment of the health of US Vietnam veterans.<sup>58</sup> A random sample of 7,924 Vietnam veterans and 7,364 non-Vietnam veterans underwent a comprehensive health examination, including medical examination, laboratory tests, and a psychological evaluation. The results showed few current objective differences in physical health between the two groups. Although the Vietnam veterans had lower sperm concentrations, the two groups had fathered similar number of children with no differences in frequency of birth defects.<sup>58</sup> Psychological problems common to Vietnam veterans included depression, anxiety, and combat-related post-traumatic stress disorder (PTSD).<sup>58</sup>

## **Department of Veterans Affairs Epidemiologic Studies**

In late 1981, the Veterans Administration (now DVA) launched a comprehensive program to address the concerns of the Vietnam veterans.<sup>44</sup> Over the years, DVA conducted six morbidity case-control studies of Vietnam veterans that did not provide evidence of an association between risks for STS, NHL, testicular cancer, or lung cancer.<sup>44</sup> The odds ratio for the risk of cancer did not significantly vary by branch of service, calendar year of service, or region of service in Vietnam. In addition to morbidity studies, DVA conducted four proportional mortality ratio (PMR) studies, one retrospective cohort mortality study of Vietnam veterans, three studies of the US Army Chemical Corps, three studies of Women Vietnam Veterans, and two studies of PTSD and risks of traumatic deaths among Vietnam veterans.<sup>44</sup> To summarize the results: mortality studies suggested an increase risks of deaths of Vietnam veterans compared to non-Vietnam veterans, especially due to motor vehicle accidents and PTSD-related suicides. Inconsistencies for cancers including lung cancer, laryngeal cancer, NHL, and skin cancers were found for US Army and US Marine Vietnam veterans.<sup>44</sup> The women Vietnam veteran studies found increases in pancreatic cancer and risks of birth defects in their children, but these conditions were not related to Agent Orange/TCDD exposure.<sup>44</sup>

Twenty-two US Army Chemical Corps units served in South Vietnam during the years 1965 to 1973. Approximately 2,900 men were responsible for the storage, preparation and spraying of tactical herbicides, including Agent Orange, around the perimeters of base camps using either ground sprayers or aerial spraying from helicopters. DVA investigators found that despite the very low levels of TCDD in their blood serum (mean of 4.3 ppt), the odds ratio for diabetes, heart disease, hypertension, and chronic respiratory conditions were significantly elevated ( $P>0.05$ ). The investigators, however, recognized that Chemical Corps personnel were exposed to other chemicals, other pesticides, environmental sources, and combat operations.<sup>44</sup>

Lastly, in 1978 the Agent Orange Registry was established primarily to identify all Vietnam veterans expressing concern about the possible adverse effects of Agent Orange.<sup>59</sup> The Registry became a database of self-selected veterans claiming exposure, and subsequently was then used by researchers to determine frequency of diseases caused by Agent Orange.<sup>60</sup> However,

12

Services for Science and Education – United Kingdom

Young, A. L., & Alexander, L. V. (2024). Agent Orange and Vietnam Veterans: A Review. *British Journal of Healthcare and Medical Research*, Vol - 11(3). 01-19.

these studies should be rejected as Agent Orange studies since there was no verification of exposure.

### **United States Air Force Health Study**

Beginning in 1980, USAF initiated the Air Force Health Study (AFHS), a twenty-year epidemiologic retrospective study of the 1,261 men of Operation RANCH HAND.<sup>61</sup> Blood serum testing of 888 men found TCDD levels ranging from 10 to 618 with a mean of 12.4 ppt. The statistical strength of the AFHS was in matching 5:1 the RANCH HAND cohort with a comparison cohort of 19,109 men who flew C-130 aircraft vs the RANCH HAND C-123 aircraft in Vietnam. Six examinations occurred over the 20 years involving RANCH HAND men and their matched controls.<sup>61</sup> Although the AFHS investigated 300 health endpoints, the study did not provide evidence of disease in the RANCH HAND veterans by their elevated levels of exposure to Agent Orange or its associated TCDD.<sup>61</sup>

### **Australian and New Zealand Epidemiologic Studies**

The Australian Department of Veteran's Affairs identified all 59,187 Vietnam veterans,

consisting of 41,087 Army veterans, 13,538 Navy veterans, and 4,570 Air Force Veterans.<sup>62</sup> The Vietnam cohort was matched to the National Cancer Statistics Clearing House database, compiled from throughout Australia. From 1982 through 2000 4,623 cancers were identified.<sup>62</sup> Australian Vietnam veterans had 18% more cancers than the Australian male community. The cancer rate varied by service branch with the Navy veterans having the most cancer, while Air Force veterans exhibited a 10% increase in cancer incidence. For this Vietnam veteran cohort there was an elevated increase in prostate cancer, lung cancer, and HD. Although considered an Agent Orange study, there were no measures of the level of exposure.<sup>62</sup>

In 2013, a cohort study of the mortality and cancer experience of New Zealand Vietnam War veterans was reported by the University of Otago and the Centre for Military and Veterans Health, University of Queensland.<sup>63</sup> Mortality and cancer incidences were determined in 2,783 New Zealand Vietnam veterans compared to a cohort from the New Zealand National Database. All cancer mortality rates were significantly reduced compared to National rates, and all cancer incidences were not significantly increased. However, the risks of mortality from cancers of the head and neck and of the oral cavity, pharynx and larynx were significantly increased, as was the incidence of chronic lymphatic leukemia.<sup>63</sup> This study was consistent with the Australian pattern of mortality and cancer incidence and was consistent with smoking and the healthy soldier effect.<sup>63</sup>

### **Republic of Korean Epidemiologic Studies**

In 2012, the Korean Vietnam Veterans Health Studies were initiated by the Asan Medical Center, Gangneung Asan Hospital, Seoul, ROK.<sup>64</sup> There were three studies conducted by the same research team. The first study of Korean Vietnam veterans found that the cancer incidence was significantly lower than the general male population, and it was lower in officers than enlisted soldiers. However, this latter cohort experienced higher incidence of T-cell lymphoma, prostate, colon, lung, bladder, and kidney cancers than the general population.<sup>64</sup> The second and third studies incorporated the GIS Exposure Opportunity Index Model using two different cohorts of 111,726 and 180,639 of Korean Vietnam veterans and the risk of disease prevalence from exposure to Agent Orange TCDD. The investigators concluded that exposure to the herbicides may have accounted for an increase in mortality from various disease even decades after

13

URL: <http://dx.doi.org/10.14738/bjhm.113.16910>.

British Journal of Healthcare and Medical Research (BJHMR) Vol 11, Issue 03, June-2024

exposure.<sup>64</sup> However, the Korean Blood Serum study for TCDD, noted earlier, concluded that exposure to Agent Orange TCDD was minimal.<sup>53</sup>

### **Brief Conclusion on The Allied Health Studies**

The morbidity, mortality and TCDD health studies conducted by four of the Allied Nations that provided military personnel during the Vietnam War confirmed that with two exceptions veterans were never likely to have been exposed to Agent Orange and its associated TCDD. What the health studies did confirm was that the “Vietnam Experience” has impacted the long term health of the men and women who served in that war!

### **HEALTH STUDIES OF THE VIETNAMESE**

Over the past three decades, research on the monitoring of TCDD, allegedly from Agent Orange, and the health of the Vietnamese people has been extensive<sup>65</sup> However, efforts to conduct valid large population-based epidemiologic studies of Vietnam’s veterans or civilians

was addressed in March of 2002 when a joint “*United States-Vietnam Scientific Conference on Human Health and Environmental Effects of Agent Orange/Dioxins*” was held in Hanoi. The conference co

sponsored by the US National Institute for Environmental Health Sciences, and the Vietnamese Ministry of Science, Technology, and the Environment.<sup>66</sup> To date, the Government of Vietnam has been unwilling to proceed with such scientific studies. It has been suggested that such research might discredit the main theme of its three-decade long propaganda campaign that Agent Orange/TCDD is to blame for a range of serious health problems, especially birth defects and intellectual disabilities.<sup>65</sup>

In 2018, the Institute of Medicine of the National Academy of Sciences evaluating reproductive outcomes in Vietnam veterans concluded that there was insufficient evidence (review of 200 scientific papers) to determine whether there was an association between exposure to the herbicides/TCDD resulting in spontaneous abortions, stillbirths, neonatal or infant death as well as birth defects, childhood cancers or other diseases in their children as they reach maturity in later generations.<sup>67</sup> The Department of Occupational Health, Hanoi Medical University in 2007 conducted a study of cancer mortality patterns during the 2-year period 2005-2006 from all 10,769 commune health stations throughout Vietnam.<sup>68</sup> The study identified 93,719 cancer deaths, where the three most common cancer sites for both men and women a total of 61,079 cases, and included 25,410 liver cancers, 22,209 lung cancers and 13,460 stomach cancers. The investigators concluded that the causes were likely due to the high prevalence of infections of Hepatitis B virus (HBV) and *Helicobacter pylori* (Hp), and from air pollution as an agent for lung cancer in Vietnam.<sup>68</sup> The Vietnamese Government, scientists, and civilians must come to terms with the extensive pollution as the source of their major health issues, and not on Agent Orange sprayed in a War more than 50 years ago.

### **THE MEDIA AND AGENT ORANGE AND TCDD**

The history of the past 50 years for the Vietnam veteran has suggested that the Agent Orange controversy has not been based on the use of tactical herbicides in Vietnam, but rather on the devastating human experiences of that war.<sup>2</sup> The release in 1978 of a CBS Documentary titled “Agent Orange: Vietnam’s Deadly Fog” resulted in thousands of articles on Agent Orange and health of Vietnam veteran where the media failed to search for the truth about the causes of their health.<sup>68</sup>

### **THE FAILURE OF GOVERNMENT POLICY AND COMMON SENSE**

As a consequence of The Agent Orange Act of 1991 and based on the Institute of Medicine’s review of the science, DVA has recognized certain cancers and other health problems as presumptive diseases associated with exposure to Agent Orange and other herbicides during military service. However, the 12 reports by IOM (1994-2018) ignored the issue of causality of disease and exposures. Over the past few years, the list of presumptive diseases continues to expand; currently 21 diseases/conditions are recognized for compensation and health care, included in that list are prostate cancer, hypertension, and Type 2 diabetes. Since the DVA does not require that Vietnam veterans to document exposure, the Department has expanded the locations with the passage of the PACT Act in August 2022 to include Vietnam Era veterans, and numerous locations outside of Vietnam. This is an example of the failure of common

sense. The Congress of the United States, the Department of Veteran Affairs, and the Vietnam veterans have simply refused to accept the reality that little or no exposures to the herbicides or TCDD ever occurred in Vietnam. By artificially focusing on Agent Orange, and not the Vietnam Experience, many Vietnam veterans are ignored because they do not have one of the twenty one diseases allegedly associated with Agent Orange. All our Vietnam veterans deserve the best possible health care the US and Allied nations can provide, and the recognition they are entitled to for having served in Vietnam.

## References

1. Office of Research & Development, VA Research on Vietnam Veterans. Department of Veterans Affairs, Washington DC, Accessed 2020.
2. Young AL, Alexander LV. History and Assessment of the War Environment on the Subsequent Health of the Vietnam Veteran. *Med Res Arch* 2023; 11 (3):1-24.
3. Young AL. The Military Use of Tactical Herbicides. IN: Young AL. The History, Use, Disposition and Environmental Fate of Agent Orange. Chapter 3:57-119, Springer Science +Business Media, LLC, New York, NY, 2022.
4. Young AL, Young KL. Agent Orange Use in Vietnam and Alleged Health Impacts: A Review. *Med Res Arch* 2017; 5(10): 1-20.
5. Fox RP. Air Base Defense in the Republic of Vietnam, 1961-1973. Office of Air Force History, United States Air Force, Washington DC, 1979. 278p.
6. Young AL, Project RANCH HAND: The Men and the Mission. IN: Young AL. Agent Orange: The Failure of Science, Policy, and Common Sense. Chapter 2:9-33. *Studies in History and Philosophy*, Vol 58. Springer Nature, Switzerland. 2022.
7. Buckingham WA, Jr. OPERATION RANCH HAND: The Air Force and Herbicides in Southeast Asia 1961-1971. Office of Air Force History, United States Air Force, Washington DC, 1982. 253p.
8. Cecil, PF. HERBICIDAL WARFARE: The RANCH HAND Project in Vietnam. Praeger Special Studies, Praeger Scientific, New York, 1986, 288p.
9. Westing AH. Anti-plant Chemicals. IN: Westing AH. Ecological Consequences of the Second Indochina War. Chapter 3: 24-45, Stockholm Peace Research Institute. Almqvist & Wiksell International, Stockholm, Sweden, 1976.
10. Cecil PF, Sr, Young AL. Operation FLYSWATTER: A War Within A War. *Environ Sci Pollut Res* 2008; 15(1): 3- 7.
11. Cecil PF, Sr, Young AL. Operation FLYSWATTER: A War Within A War. *Environ Sci Pollut Res* 2008; 15(1): 3- 7. URL: <http://dx.doi.org/10.14738/bjhm.113.16910>. *British Journal of Healthcare and Medical Research (BJHMR)* Vol 11, Issue 03, June-2024 11. Boyne WJ. RANCH HAND. *Air Force Mag* 2000; 83(8):8p.
12. Young AL. Update on History and Science of the Major Components of Agent Orange. IN: Young AL. Agent Orange: The Failure of Science, Policy, and Common Sense. Chapter 3:35-46. *Studies in History and Philosophy*, Vol 58, Springer Nature, Switzerland. 2022.
13. Young AL. Update on Picloram and Agent White. IN: Young AL. Agent Orange: The Failure of Science, Policy, and Common Sense. Chapter 4:47-60. *Studies in History and Philosophy*, Vol 58, Springer Nature, Switzerland. 2022.
14. Young AL. Update on Cacodylic Acid, the Major Component of Agent Blue. IN: Young AL. Agent Orange: The Failure of Science, Policy, and Common Sense. Chapter 5:61-81. *Studies in History and Philosophy*, Vol 58, Springer Nature, Switzerland. 2022.



15. Olson KR, Cihacek L. Agent Blue Spraying in the Mekong Delta during the Vietnam War: Fate of Arsenic Based Herbicide Weapon Used to Destroy Rice Crops and Mangrove Forests. *Open Journal of Soil Science* 2022; 12L: 253-294.
16. HHS News. Press Release - Announcement of the first meeting of the expanded Agent Orange Working Group, August 24, 1981. US Department of Health and Human Services, Washington, DC, 1981.
17. Young AL, Cecil PF, Sr. Agent Orange Exposure and Attributed Health Effects in Vietnam Veterans. *Mil Med* 2011; 176; 29-34.
18. IOM. Veterans and Agent Orange: Health Effects of Herbicides Used in Vietnam. Institute of Medicine of the National Academies. The National Academies Press, Washington DC, 1994, (including updates through 2018).
19. EPA. Exposure and Human Health Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin, and Related Compounds. EPA's Reanalysis of Key Issues Related to Dioxin Toxicity and Response to NAS Comments, National Center for Environmental Assessment. Cincinnati, Ohio, 2012.
20. ATSDR. Toxicological Profile for Chlorinated Dibenzo-p-dioxins. Agency for Toxic Substances and Disease Registry, Center for Disease Control and Prevention, Atlanta, GA, 1998.
21. Young AL. The Environmental Fate of the TCDD Associated with Agent Orange. IN: Young AL. Agent Orange: The Failure of Science, Policy, and Common Sense. Chapter 7:93-108. *Studies in History and Philosophy*, Vol 58, Springer Nature, Switzerland. 2022.
22. Young AL, Van Houten WJ, Andrews WB. 2nd Agent Orange and Dioxin Remediation Workshop, Hanoi, Viet Nam, 18-20 June 2007. *Environ Sci Pollut Res* 2008; 15:113-118.
23. Young AL, Giesy JP, Jones PD, Newton M. Environmental Fate, and Bioavailability of Agent Orange and Its Associated Dioxin During the Vietnam War. *Environ Sci Pollut Res* 2004; 11(6): 359-370.
24. Arthur MF, Frea JI. 2,3,7,8-Tetrachlorodibenzo-p-dioxin: Aspects of Its important Properties and Its Potential Biodegradation in Soils. *J Environ Qual* 1989; 18:1-11.
25. Crosby DG, Moilanen KW Wong A.S. Environmental Generation and Degradation of Dibenzodioxins and Dibenzofurans. *Environ Health Perspect* 1973; (5): 259-256.
26. Brodsky ES, et al. The Current Level of Dioxin Pollution in the Area of Large-Scale Spraying of Agent Orange. *Doklady Biol Sci* 2009; 429:526-530.
27. Schecter A, et al. Recent Dioxin Contamination from Agent Orange in residents of a Southern Vietnam City. *JOEM* 2001; 43 (5):435-438.

28. Mai TT. Letters to the Editor. RE: Food as a Source of Dioxin Exposure in the Residents of Bien Hoa City, Vietnam. *JOEM* 2004; 46 (5):415-416.
29. Bui, HN et al. Life Cycle Assessment of Paper Mill Wastewater: A Case Study in Viet Nam. *Water Sci Technol*, 2022; 85 (5):1522-1537.
30. Baughman RW, Meselson MS. An Analytical Method for Detection of TCDD (Dioxin): Levels of TCDD in Samples from Vietnam. *EHP* 1973; 5: 117-135.
31. Baughman RW. Tetrachlorodibenzo-p-dioxin in the Environment. High Resolution Mass Spectrometry at the Picogram Level. PhD Thesis in Chemistry, Harvard University, Cambridge, Massachusetts, Xerox Microfilm #75-22-930, December 1974.

32. Piazza P, et al. PCDD/Fs in Sediments of Central Vietnam Coastal Lagoons: in Search of TCDD. *Mar Pollut Bull* 2010; 60 (12): 2303-2310.
33. Young AL. A Review of Public Health in Vietnam: 50 Years after Agent Orange was sprayed. *Health Educ Public Health* 2019; 2 (2):170-180.
34. EPA. Exposure and human health assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and related compounds. National Academy of Sciences Review Draft. EPA/600/P-00/001Cb, 2003. Available online.
35. UNEP. State of the Environment in Vietnam. United Nations Environment Programme Report 2003. Available online.
36. Pham BQ, Nguyen VS, Dang DN. Environmental Pollution in Vietnam: Analytical Estimation and Environmental Priorities. *Trends Anal Chem* 1995; 14:383-388.
37. Rappe C, et al. Sources and Relative Importance of PCDD and PCDF Emissions. *Waste Manage Res* 1987; 225-237.
38. Muto H, Takizawa Y. Dioxins in Cigarette Smoke. *Arch Environ Health* 1989; 44 (3): 171-174.
39. Kobayashi S et al. A role for the aryl hydrocarbon receptor and the dioxin TCDD in rheumatoid arthritis. *Rheumatology* 2008; 47 (9): 1317-1322.
40. Schecter A, et al. Food as a Source of Dioxin Exposure in the Residents of Bien Hoa City, Vietnam. *JOEM* 2003; 45(8): 781-788.
41. Banout J, et al. Agent Orange Footprint Still Visible in Rural Areas of Central Vietnam. *J Environ Public Health* 2014;1-10.
42. Nishijo M. et al. Dioxin Congener Patterns in Breast Milk Samples from Areas Sprayed with Herbicide during the Vietnam War 40 Years after the War Ended. *Toxics* 2022; 10: 323-341.
43. Young AL, Newton M. Long Overlooked Historical Information on Agent Orange and TCDD Following Massive Applications of 2,4,5-T-Containing Herbicides, Eglin Air Force Base, Florida. *Environ Sci Pollut Res* 2004; 11(4): 209-221.
44. Young AL. Health Studies of Allied Vietnam Veterans. IN: Young AL. Agent Orange: The Failure of Science, Policy, and Common Sense. Chapter 9:127-169. *Studies in History and Philosophy, Vol 58*, Springer Nature, Switzerland. 2022.
45. Neal S. Vietnam Studies: Medical Support of US Army in Vietnam, 1965-1970. Department of the Army, Washington DC, 1991. 212p.

17

URL: <http://dx.doi.org/10.14738/bjhm.113.16910>.

British Journal of Healthcare and Medical Research (BJHMR) Vol 11, Issue 03, June-2024

46. Herman JK: Navy Medicine in Vietnam: Passage to Freedom to the Fall of Saigon. Naval History & Heritage Command, Washington Navy Yard, Washington DC, 2010. 60p.
47. Camp NM. US Army Psychiatry in the Vietnam War: New Challenges in Extended Counterinsurgency Warfare. Office of the Surgeon General, US Army Medical Department Center & School, Fort Sam Houston, Texas, 2015. 558p.
48. Young AL. Failure of Science and Common Sense. IN: Young AL. Agent Orange: The Failure of Science, Policy, and Common Sense. Chapter 13:239-259; Section 13.2 Exposure Assessment for Agent Orange in Vietnam. *Studies in History and Philosophy, Vol 58*, Springer Nature, Switzerland. 2022.

49. Stellman JM, et al. A Geographic Information System for Characterizing Exposure to Agent Orange and Other Herbicides in Vietnam. *Environ Health Perspect* 2003; 111 (3): 321-328.
50. Young AL, Cecil, PF Sr, Guilmartin JF Jr. Assessing Possible Exposures of Ground Troops to Agent Orange During the Vietnam War: The Use of Contemporary Military Records. *Environ Sci Pollut Res* 2004; 11(6): 349-358.
51. Center for Disease Control and Prevention (CDC). Serum 2,3,7,8-Tetrachlorodibenzo-p-dioxin Levels in US Army Vietnam-Era Veterans. *JAMA* 1988; 260(9): 1249-1254.
52. Kang HK, et al. Dioxins and Dibenzofurans in Adipose Tissue of US Vietnam Veterans and Controls. *Am J Public Health* 1991; 81(3): 344-349.
53. Kim JS, et al. A Study on the Correlation Between Categorization of Individual Exposure Levels to Agent Orange and Serum Dioxin Levels Among Korean Vietnam Veterans. *Korean J Prev Med* 2001; 34(1): 80-88.
54. Catlin Boehmer TK, et al. Post Service Mortality in Vietnam Veterans: a 30-Year Follow-up. *Arch Intern Med* 2004; 164: 1908-1916.
55. CDC. The Association of Selected Cancers with Service in the US Military in Vietnam. I. Non-Hodgkin's lymphoma. *Arch Intern Med* 1990; 150: 2473-2483.
56. CDC. The Association of Selected Cancers with Service in the US Military in Vietnam. II. Soft Tissue and Other Sarcomas. *Arch Intern Med* 1990; 150: 2485-2492.
57. CDC. The Association of Selected Cancers with Service in the US Military in Vietnam. III. Hodgkin's Disease (HD), Nasal and Nasopharyngeal Cancers, and Primary Liver Cancers. *Arch Intern Med* 1990; 150: 2495-2505.
58. CDC. Health Status of Vietnam Veterans. Volume I. Vietnam Experience Study. Center for Disease Control and Prevention/Public Health Service/US Department of Health and Human Services, Atlanta, GA, 1989.
59. Young AL, Flicker MR, Kang HK, Shepard BM. Health Surveillance of Vietnam Veterans Claiming Agent Orange Exposure. IN: Keith LH, Rappe C, Choudhary G (eds). *Chlorinated Dioxins & Dibenzofurans in the Total Environment*. Volume II, Chapter 14 Butterworth Publishers, London, pp167-179.
60. Chamie K, et al. Agent Orange Exposure, Vietnam Veterans, and the Risk of Prostate Cancer. *Am Cancer Soc* 2008; 113(6): 1-7.
61. Buffler PA, Ginevan ME, Mandel JS, Watkins DK. The Air Force Health Study: An Epidemiologic Retrospective. *Ann Epidemiol* 2011; 21: 673-689.
62. Wilson E, Horsley K, van der Hoek R. Cancer Incidence in Australian Vietnam Veterans. *Organohalogen Compds* 2004; 66: 3677-3682.

63. McBride D, Cox B, Broughton J, Tong D. The Mortality and Cancer Experience of New Zealand Vietnam War Veterans: a Cohort Study. *BMJ Open* 2013; 3: e003397.
64. Yi S-W. Cancer Incidence in Korean Vietnam Veterans During 1992-2003: The Korean Veterans Study. *J Prev Med Public Health* 2013; 46(6): 309-318.
65. Young AL. Health Studies of Vietnamese Veterans and Civilians. IN: *Agent Orange: The Failure of Science, Policy, and Common Sense*. Chapter 10:171-194. *Studies in History and Philosophy*, Vol 58, Springer Nature, Switzerland. 2022.

66. NIEHS. United States-Vietnamese Scientific Conference on Human Health and Environmental Effects of Agent Orange/Dioxin. Held in Hanoi, Vietnam, 3-6 March 2002. National Institutes of Environmental Health Sciences, Research Triangle Park, North Carolina, 2002.
67. IOM. Reproductive Health Effects and Effects on Descendants. IN: Veterans and Agent Orange: Update No. 11, Chapter 8: 365-432. Institute of Medicine, Washington, DC, 2018.
68. Young AL. The Media and Agent Orange. IN: Young, AL. Agent Orange: The Failure of Science, Policy, and Common Sense. Chapter 12: 223-237. Studies in History and Philosophy, Vol 58, Springer Nature, Switzerland. 2022.