

The Secret Toxic Legacies of Chemical Warfare: Agent Blue Use during the 2nd Indochina and Vietnam Wars in Laos, Cambodia, and Vietnam (1961 to 1971)

Kenneth R. Olson

Emeritus Professor of Soil Science, NRES, ACES, University of Illinois, Urbana, Illinois

Email: krolson@illinois.edu

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Abstract

During the 2nd Indochina War which started in 1959, the United States Central Intelligence Agency (CIA), Air America, and the Air Force waged a secret and unconventional air war in Laos from Udorn Air Force base located in Thailand and across the Mekong River from Vientiane, Laos. Starting in 1961, four years before the official start of the American-Vietnam War, Agent Blue, the arsenic-based herbicide used to kill rice and other food crops, was used extensively in Laos, Vietnam and to a lesser extent in Cambodia. During the secret 2nd Indochina War and the Vietnam Civil War the public knew little about the use of Agent Blue. After the official start of the American-Vietnam War in 1965, the United States media news reports, about chemical warfare were dominated by the story of Agent Orange and its devastating impacts. The public knew very little about the previous use of Agent Blue in both wars. The first known media pick up of the Agent Blue (arsenic based) and Agent Pink, Agent Green, and Agent Purple (all three contain 2, 4, 5-T and *unknown amounts of dioxin TCDD*) was in May of 1964. Jim G. Lucas, a Scripps-Howard staff reporter submitted an article that was published as an editorial in Washington Post on May 26, 1964. The next news reference to this chemical weapon was a Letter to the Editor published in the New York Times titled “Agent Blue” in Vietnam by Arthur H. Westing in (1971). The use of herbicides, including Agent Blue in Laos during the 2nd Indochina War, was kept a secret until 1982, when a draft of Buckingham’s study of Operation Ranch Hand was made public. Much about the U.S. war effort in Laos is still classified. In a 2014 issue of the VVA Veteran magazine, Loana Hoylman published an article on “Today’s Blue Arsenic in the Environment”. The first refereed journal article on this topic, “The Fate of Agent Blue, the Arsenic-Based Herbicide, Used in South

Vietnam during the Vietnam War” was published in 2020 in the Open Journal of Soil Science by Kenneth R. Olson and Larry Cihacek. In 2021 the Asia Times (print) and VietnamVeteranNews (radio podcast) picked up the Agent Blue story. During the early 2020s, Olson published six additional refereed journal articles on Agent Blue, cacodylic acid, and arsenic. The primary objective is to determine why no major news organization in the United States, including the New York Times and Washington Post, have never investigated Agent Blue use during the 2nd Indochina and Vietnam wars? Why did the use of Agent Blue story, used to destroy Laotian and South Vietnamese civilian food (rice) sources and production sites, received only very limited coverage by US print media news organizations during the last 64 years?

Keywords

Laos, Vietnam, 2nd Indochina War, Vietnam War, Agent Blue, Arsenic, Cacodylic Acid

1. Introduction

In 1959, the United States Central Intelligence Agency (CIA) operation, against the Pathet Lao insurgences and Viet Mien military troops and supply route, began (Figure 1). The Hô Chi Minh Trail was developed after the North Vietnam government and military decided to reunify South and North Vietnam. The People’s

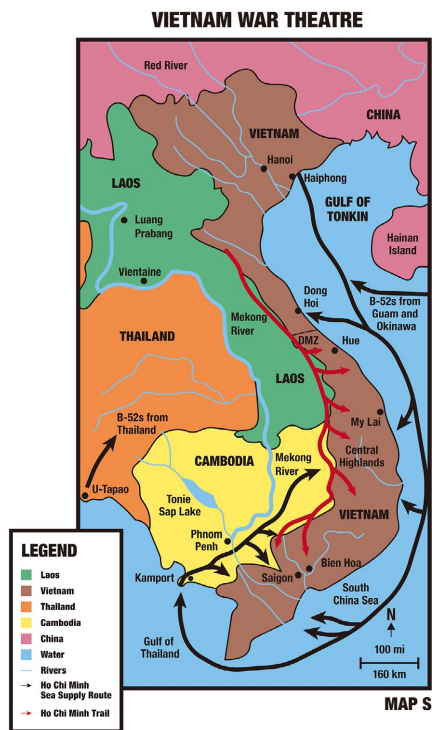


Figure 1. Map of Ho Chi Minh Sea route and the Ho Chi Minh Trail in Laos and Cambodia. Map by Cruz Dragosavac.

Army of Vietnam (PAVN) then connected the old trails leading from North Vietnam panhandle southward into eastern Laos, Cambodia (Figure 2), and South Vietnam. Starting from Hanoi, the primary trail turned southwest into Laos and eastern Cambodia before branching into South Vietnam. Beginning in 1960s, the volume of traffic on the network of trails expanded significantly, but it still took more than a month's march by foot and bicycle (Figure 3), to travel from North to South Vietnam. Hồ Chí Minh Trail traffic was impacted repeatedly by Royal Lao-tian Air Force (RLAF), which was supported by US Air Force tactical herbicide spraying (Operation Ranch Hand program), and US Air Force bombing runs.

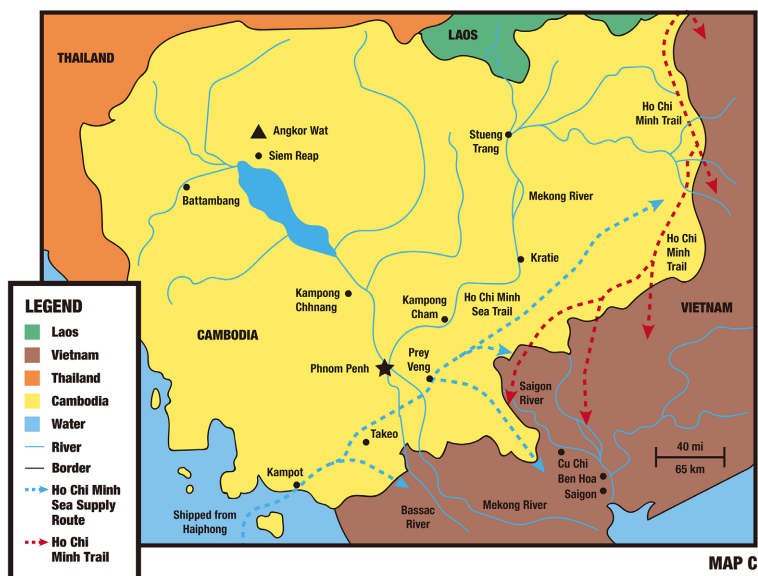


Figure 2. Ho Chi Minh trail pathways through Cambodia to Vietnam. Map by Cruz Dragosavac.



Figure 3. PAVN troops fording a stream with crude underwater bridge from North Vietnam on the Ho Chi Minh trail in the 1960s. Reprinted with permission from editor of Open Journal of Soil Science.

In May of 1964, Jim G. Lucas, a Scripps-Howard staff reporter submitted an article related to the miscalculation that cause the destruction by defoliant of food crops in the friendly South Vietnam village (Mekong Delta) that was published as an editorial in Washington Post on May 26, 1964 [1]. The reaction from the Pentagon was immediate. The same day the Joint Chiefs sent a message to Admiral Felt and General Harkins along with an outline of the Lucas story. Two days later Saigon's initial reply confirmed the Lucas story was "basically true but not the whole truth". A follow-up report on June 3rd, suggested Ranch Hand aircraft had not sprayed Cha La and there was no plant damage.

The next source of Agent Blue information was two letters published by the New York Times. One was titled "Agent Blue" in Vietnam by Arthur H. Westing (July 12, 1971) [2] who stated "Our nation's food-destruction program in South Vietnam, although not secret, has received only scant attention. The acceptability of food destruction as a means of warfare requires an immediate and searching re-evaluation by the Congress, the Pentagon, and ultimately, the White House". The other Letter to the Editor by John D. Constable and Matthew Meselson (August 4, 1971) [3] suggesting the Arthur H. Westing letter needed emendation. This blip of attention to Agent Blue with no investigative follow-up then disappeared. Forty-three years later, Loana Hoylman published an article on "Today's Blue Arsenic in the Environment" in a 2014 issue of the VVA Veteran magazine [4]. Once again, the national media did not pick up the story. Why?

The primary objective is to determine why no major news organization in the United States, including the New York Times and Washington Post, ever investigated Agent Blue use in the Vietnam War? How can this secret use of Agent Blue to destroy civilian food (rice) sources and agricultural production sites never be covered by US news organizations in 64 years? In 2020, Kenneth R. Olson and Larry Cihacek published the first refereed journal article on this topic, "The Fate of Agent Blue, the Arsenic Based Herbicide, Used in South Vietnam during the Vietnam War" in the Open Journal of Soil Science [5]. Using new primary source data, they reconstructed the paper trail of these "Made in America" chemical weapons, and developed an updated chemical research framework, whereupon the Agent Blue story was finally picked up in the international print media including the Asia Times.

2. Background

2.1. Camp Detrick, Biological Weapons Laboratory

In 1942, biological warfare scientists at Camp Detrick, Maryland [6], began investigating the possible uses of defoliant herbicides, based on Dr. Arthur W. Galston's scientific discoveries, while working with TIBA [7]. The U.S. Department of Army's Chemical Corps Biological Laboratories initiated a major program in 1952 at Camp Detrick, Maryland [7] to develop both the herbicide formulations and aerial spray equipment for potential deployment in the Korean Conflict. The Agent Blue precursor reagent, cacodylic acid, was invented at Fort Detrick in 1957 [8].

2.2. CIA Secret Spraying Tactical Herbicides on Ho Chi Minh Trail

Since 1961, the CIA and RLAFF had been secretly spraying tactical herbicides on the Ho Chi Minh Trail in Laos (**Figure 4**). Eventually, the People's Republic of Vietnam (PAVN) military figured out that the aircraft, being used to spray Agent Purple (starting in 1961), Agent Blue (starting in 1961), and Agent Orange (starting in 1965), were flying out of Udorn Air Force Base in Thailand (**Figure 5**). This

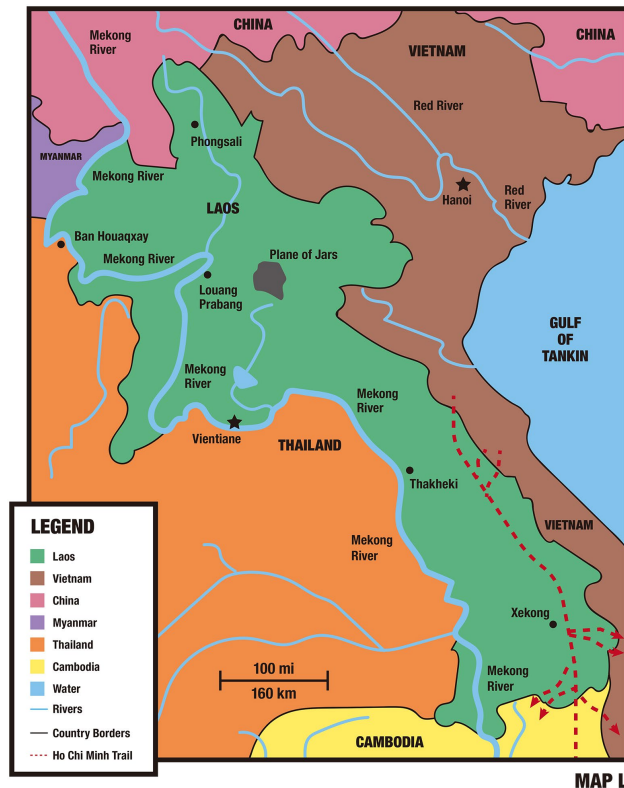


Figure 4. Laos map with Ho Chi Minh Trails in southern Laos. Map by Cruz Dragosavac.



Figure 5. Udorn Royal Thai Air Force base.

base was located only 80 kilometers south of Vientiane (Laos) and the international boundary the Mekong River. This was an attempt by the PAVN to stop the years of spraying of the Ho Chi Minh Trail with tactical 2, 4, 5-T herbicides contaminated with dioxin TCDD and the arsenic-based Agent Blue herbicide. The spraying was being used to eliminate the food supply adjacent to the Ho Chi Minh Trail, reduce the vegetative cover to expose the enemy, and to enable bombing of the exposed PAVN soldiers using the Ho Chi Minh Trail to infiltrate South Vietnam [9].

2.3. Targeted Tactical Herbicide Spraying in Cambodia

In contrast to the widespread spraying of herbicides in Laos and South Vietnam over a long period, the targeted defoliation in Cambodia resulted in a major international incident. From April 18-May 2, 1969, French and Cambodian-owned rubber tree plantations in Kampong Cham Providence were sprayed with tactical herbicides [9]. At the time, the United States had no diplomatic relations with the Cambodian government of then—Prince Norodom Sihanouk. The spraying caused substantial damage. Both U.S. Government and independent inspection teams confirmed that 69,200 ha were sprayed (7% of Kampong Cham province), 9880 ha of rubber tree plantations were seriously affected. These rubber losses represented a loss of 12% of the country's export earnings. The mystery surrounding the attack had to do with who exactly carried it out. Cambodia was officially neutral in the Vietnam War, although the eastern part of its territory had been subject to infiltration by both guerrillas on southern portions of the Ho Chi Minh Trail and US Special Forces ("Operation Daniel Boone"). The United States did not admit to using tactical herbicides. The available evidence points to Air America, the primary CIA air contractor [9]. It is unclear who carried out the spraying over these plantations. It occurred at the time that CIA led spray missions were flown by Air America aircraft. Once the extent of the damage in Kampong Cham became apparent, Cambodian authorities made a formal complaint to the U.S. It was not the first time. Cambodia had made allegations of chemical warfare against the US beginning in 1964. "*An American Quaker who was in Cambodia at the time noted, as shared by representatives of the American Friends Service Committee, Joe and Dave Elder, noted, however, that the mechanism for compensating farmers for spray damage appeared to be well-established and routine.*" [10] Apparently, similar incidents had happened previously. When any U.S. response was given, it was always to deny that any such attacks occurred. In 1969, the Cambodian government filed a claim for \$12.2 million in damages. There never was any acceptance of responsibility by the U.S. However, the U.S. made plans to pay the claim by 1972, to promote "broader interests" [9]. Anecdotal and unsubstantiated reports from residents of Mondulkiri and Ratanakiri provinces in northeast Cambodia had alleged that herbicides were sprayed in these regions during the war. There were also reports in southern Cambodia (HERBS database) of tactical herbicide spraying in the Prey Veng and Svay Rieng [9].

Unlike South Vietnam and Laos, Cambodia was not systematically sprayed;

however, the HERBS database [9] does show spray records of missions conducted in Cambodian territory. There were also incidences of spray drift of herbicides that carried over from the Ho Chi Minh Trail, which was on the Cambodian side of the border with South Vietnam. Large-scale U.S. operations in Cambodia would not begin until the April 1970 covert invasion. A declassified memo from the U.S. Embassy in Saigon stating that “Past experience shows [Cambodian] protests [of chemical warfare] are not always accurate” begs the question of which protests were, in fact, true” [9].

2.4. Agent Blue Use in the Mekong Delta by RV Military and US Air Force’s Operation Ranch Hand

Olson [1] noted that “the use of tactical herbicides in Southern Vietnam was begun in 1961 as an initiative of Republic of Vietnam (RV) government. Part of the RV government’s policy was to move the rural population into “strategic hamlets” that could be more easily secured and defended than the existing villages. This also allowed the destruction of the rice crops, a potential North Vietnamese Army (NVA) food source, to discourage NVA activities. The RV government insisted that Agent Blue be used to destroy the rice crop in southern Vietnam and President Kennedy finally gave the okay for testing Agent Blue on the food crops. In the early 1960s the RV program known as Khai Quang RV Program was designed to eliminate food crops.” [9]

“The United States Department of Defense (DOD) and United States Department of Agricultural (USDA) Operation Ranch Hand records for tactical herbicides including Agent Blue sprayed in southern Vietnam during the Vietnam War (1961-1971) are very detailed, rather complete, and publicly available. The same is not true for tactical herbicides sprayed by the RV during the Khai Quang program which was supported by the U.S. Army, U.S. Navy, and Central Intelligence Agency (CIA) in the Mekong Delta. During the Vietnam Civil War, Agent Blue, in powder form, was shipped to Port Saigon, via the Saigon River, and transported to the Tan Son Nhut Air Force base during the Vietnam Civil War. After the official start of the American-Vietnam War (1965-1973), the tactical herbicides were re-routed to Bien Hoa Air Force base (1965 to 1971).”

“Agent Blue was sprayed by the RV military for three years before the official start of the American-Vietnam War in 1965. Few, if any, RV military, US Army, US Navy, and CIA spray records exist from 1962 to 1965. The RV military and US military (Army and Navy) spray equipment included hand and backpack sprayers, sprayers mounted on Brown Water Navy boats, on Army track vehicles and Army land-based helicopters and helicopters based on the decks of Blue Water Navy ships. Some of these spray missions were a military secret and spray records were classified or if kept were not maintained. Agent Blue containing cacodylic acid had a short half-life and degraded to water-soluble arsenic, which was released into the surface water and/or leached into the groundwater. Once the water-soluble arsenic leached into the Vietnam Mekong Delta groundwater, the arsenic-rich water was pumped back to the surface by tens of thousands of tube wells for urban and agricultural use.”

“DoD has consistently claimed that United States spraying of Agent Blue was done in the Central Highlands and not in Mekong Delta so there were no records or very few DoD

Agent Blue spray records available for the delta for the entire 10-year period (1962-1971) to be found. It is a known fact that the goal of the South Vietnamese government (RV) and military was to eliminate the North Vietnam Army (NVA) and Viet Cong (VC) food supply and to implement the Hamlet strategy. Most of the rice was produced in the Mekong Delta not the Central Highlands, which does have Operation Ranch Hand Agent Blue spray records. The US government, CIA, and military records were either not kept or they were not maintained. The additional RV spray program, from 1962 to 1965, is supported by the documented mass migration from rural South Vietnam to hamlets or to Saigon slums. However, Vietnam War Archive no. 2 in Ho Chi Minh City may have the spray records of the RV military, assisted by the US Navy, US Army, and CIA to implement the hamlet strategy and these records need to be electronically preserved. Vietnamese correspondence between President Diem's administration and the President Kennedy administration is shelved in loose binders at the Vietnam War Archive number 2 in Ho Chi Minh City (personal observation during an October 2022 visit to Archive number 2).” [1]

3. Results

3.1. Use of Thailand Air Force Bases to Spray and Bomb the Ho Chi Minh Trail in Cambodia and Laos

Ranch Hand aircraft utilized bases in Thailand throughout the Vietnam War (Figure 6). Operation Ranch Hand used UC-123s that were launched from airbases in

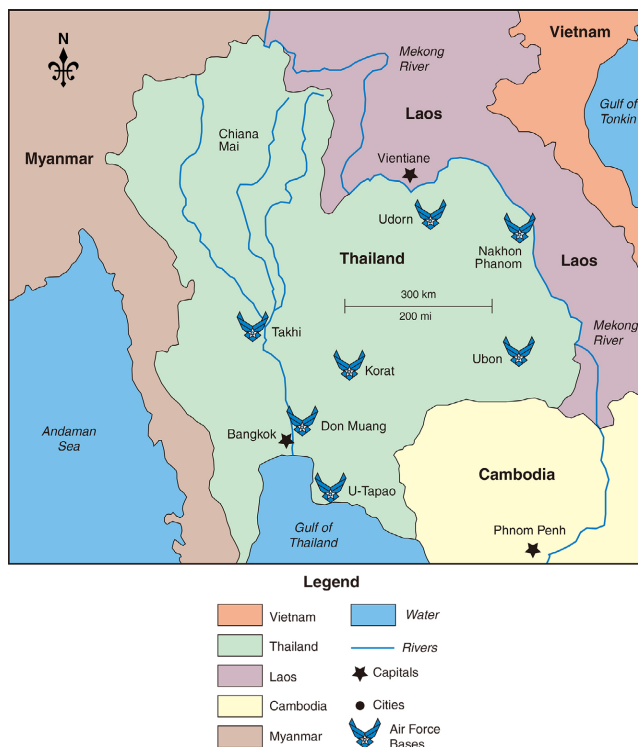


Figure 6. The location of seven of the eight Thai Royal airbases in Thailand that were used by the US Air Force. Tactical herbicides with dioxin-TCDD and arsenic were shipped to, handled, and temporarily stored at these airbases. Map by Mic Greenberg. Reprinted with permission from editor of Open Journal of Soil Science.

Thailand including Ubon, NKP, Udorn, and Takhli on numerous occasions to conduct missions against targets in Laos, Cambodia, and Vietnam [11].

In August 1963, the Thailand government requested spraying service assistance from Ranch Hand to address its locust problem. From December 29, 1968, to January 2, 1969, Ranch Hand aircraft (US Air Force) flew Agent Orange missions, out of Udorn Royal Thai Air Force base in support of the United States secret War in Cambodia and Laos [9]. On January 17, 1969, seven Ranch Hand aircraft flew to Ubon to conduct an attack on a special CIA-selected target in Laos [11] [12]. From February 2 to 5, 1969, in addition to the CIA classified spray missions, Ranch Hand aircraft flew Laos's missions. Udorn was again utilized on August 31, 1969 to conduct an operation in which Ranch Hand aircraft flew 28 sorties, using five UC-123s during a seven-day period, from Thailand (**Figure 6**) to target Lao-tian food crops with Agent Blue. Agent Blue, the arsenic-based herbicide used to kill rice, was the herbicide weapon of choice when the goal was to eliminate the PAVN food supply [11]-[13].

In the beginning, Agent Blue was sprayed by the RV military for four years before the official start of the American-Vietnam War in 1965 [1] [8]. Few, if any, RV military, US Army, US Navy, and CIA spray records exist for this period. Vietnam War veterans, historians and scholars have reported the spraying of 3.2 million liters (468,008 kg arsenic) of Agent Blue on rice paddies and mangrove forests in the Mekong Delta and Central Highlands by the RV military with the support of the US Army, US Navy, and CIA. The Institute of Medicine estimated that 3.2 million liters (468,000 kg arsenic) were sprayed during the RV Khai Quang (food denial) program [14]. This was in addition to the U.S. Air Force's Operation Ranch Hand spraying of the tactical herbicide Agent Blue primarily by C-123 aircraft. The Operation Ranch Hand missions-maintained location and quantities of herbicides sprayed (over 4,712,000 liters (664,392 kg) arsenic) from 1961-1971. The Institute of Medicine estimated a total of 7.8 million liters (1,132,400 kg arsenic) of Agent Blue was applied to southern Vietnam landscape from 1961 to 1971 [14]. This total includes both the 1962 to 1965 RV Khai Quang program with the assistance of the CIA, US Army, and US Navy, and the part of the total Agent Blue applied by US Air Force Operation Ranch Hand from 1962 to 1971 [1]. This is a mind-boggling amount of highly toxic chemicals to be sprayed over the Mekong Delta's rice fields, which were a prime rice-growing region in Vietnam, for a decade. So, what has happened to all these chemical warfare agents during the last 60 years? Why was the use of Agent Blue, the arsenic-based herbicide, used during the Vietnam War to kill the rice, not reported by the US News media?

Since this chemical warfare began, the southern Vietnam environment and Vietnamese living in the Mekong Delta have bio-accumulated arsenic from both natural and anthropic sources via their drinking water (groundwater from tube wells) and food supply, which has increased their risk of chronic poisoning over time. Arsenic is water soluble, has no half-life, and is toxic. A synthesis and

analysis of publications and records documents the South Vietnam and United States (US) militaries contribution to arsenic levels and as well as its present-day persistence in the Vietnam Mekong Delta groundwater. As both the Vietnamese rice farmers and US military personnel who were exposed to Agent Blue can attest, poisoning the water you drink or the local food you eat is not a good idea.

3.2. Agent Blue Use in Vietnam Civil War by Republic of Vietnam (RV) Military and US Air Force's Operation Ranch Hand

In the fall of 1961, RV President Diem's government suffered from a formidable political breakdown. The NVA and VC, with the support of local guerrillas, controlled the Mekong Delta Region. The number of guerrilla attacks tripled in the month of September of 1961 [9]. Morale at the Saigon headquarters was shattered by seizure of Phuoc Thanh, a provincial capital only 90 km away. The NVA and VC only controlled the capital for a few hours, however, the public beheading of the province chief affected RV moral. The NVA and VC soldiers left town before RV troops arrived. The deteriorating situation, lead to another high round of decision-making in Washington, DC on Vietnam.

A paper entitled "Concept of Intervention in Vietnam" was discussed at a meeting of the US State Department and DOD secretaries [9]. Deputy Under Secretary of State Johnson outlined the "concept" for introducing United States forces into South Vietnam, and perhaps Laos, under the Southeast Asia Treaty or United Nations umbrella. The military objective would be to secure South Vietnam's borders and prevent the infiltration of men and supplies from North Vietnam. Such a mission would require only 22,800 men. A supplemental note suggested that a "clean up" of the NVA and VC threat would require about 40,000 US troops and as many as 128,000 might be needed if North Vietnam and China intervened. Defoliation operations were one of several proposed supplemental actions, and it was suggested that defoliation operations could be carried out immediately while decisions on committing combat troops were being made.

The original October 10, 1961, Johnson paper proposed that the US aircraft be used to conduct a "major defoliant spray program in South Vietnam". However, the US aircraft would carry South Vietnamese markings and pilots would wear civilian clothes. The next day, another supplemental note, rephrased the defoliation proposal differently.

"Carry out defoliant spray operations, using hired commercial planes (presumably CIA)". These operations would initially be experimental, designed to prove out and further develop the capability to use defoliant sprays to clear off jungle access routes [9]. On October 11, 1961, National Security Council meeting with President Kennedy dealt with the Johnson paper. The President deferred a decision on the major question of sending large numbers of American troops to South Vietnam as well as on the defoliation option [9]. The defoliation option development started previously on September 23, 1961. A joint State-Defense message stated that emer-

agency actions were needed to support the Diem government and suggested that defoliation be included in an operational program and delivered without delay.

The combat Development and Test Center developed a massive operational program at the same time. The plan had four goals [9]:

- 1) Stripping the Cambodian Laotian and Stripping the Cambodian-Laotian-North Vietnam borders of foliage to remove protective cover from the NVA and VC reinforcements [9];
- 2) Defoliating a portion of the Mekong Delta area known as “Zone D” (Ca Mau) in which Viet Cong have numerous bases [5] (**Figure 7**) and (**Figure 8**);
- 3) Destroying abandoned manioc groves which Viet Cong use as food source [5]; and
- 4) Destroying mangrove swamps within which the Viet Cong used as a food source [5].

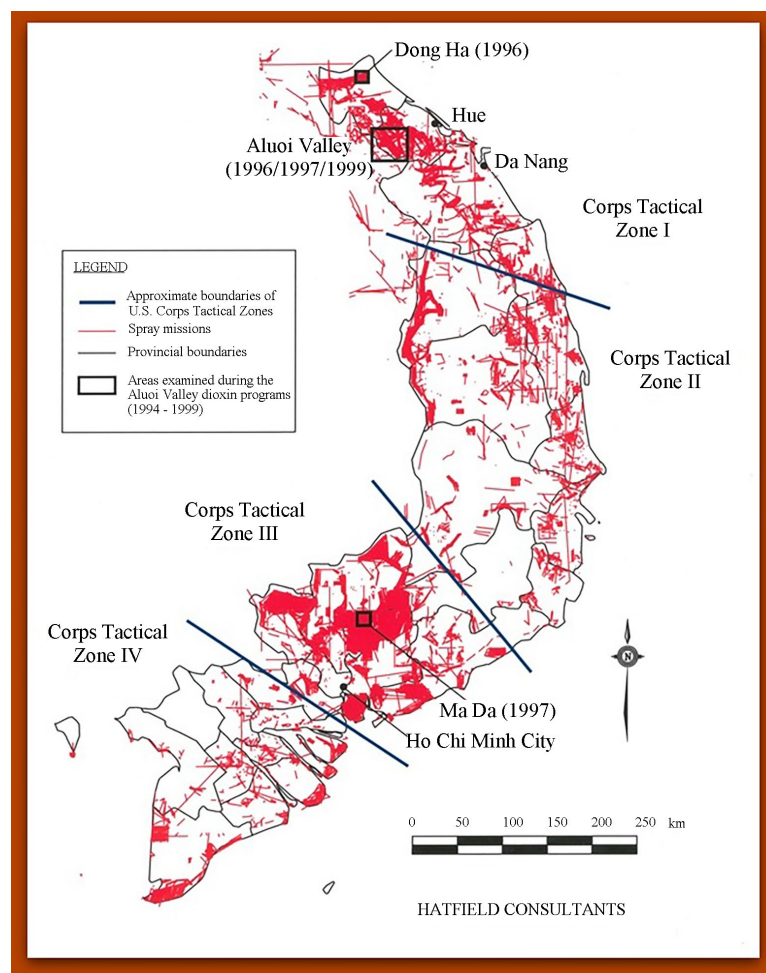


Figure 7. Operation Ranch Hand tactical herbicide spray mission in South Vietnam including the Mekong Delta. Photo Credit: Hatfield Consultants.

While the Deputy under Secretary Johnson plan was not immediately implemented, over time all four goals were addressed, including Laos, Cambodia, and North Vietnam borders. The crop destruction component of the plan and modified versions gave the Joint Chiefs of Staff a cause for concern. The Joint Chiefs of

Staff opinion that conducting aerial defoliant operations against abandoned manioc (tapioca) groves or other food growing areas was sensitive. Therefore, care must be taken to ensure that the United States did not become the target of charges of employing chemical or biological warfare. International repercussions against the United States could be most serious. In that connection, it is recommended that the operations be covered concurrently with a publicity campaign as outlined by Task Force Vietnam in Saigon [9].

President Kennedy was concerned regarding the marking to be used on US defoliation aircraft and the nationality of the crews who would fly the missions. The Deputy Under Secretary Johnson noted again that the food denial operation could be carried out by South Vietnamese Air force and crews. In addition, he mentioned the possibility of placing South Vietnamese markings on the aircraft (presumably, Air Force C-123s and having them flown by “cover” air crews (presumably CIA). Secretary Johnson did not believe such measures would be effective in hiding the US role and recommended against it. However, eventually this approach was used in South Vietnam, Laos, and Cambodia for both food denial and defoliation.

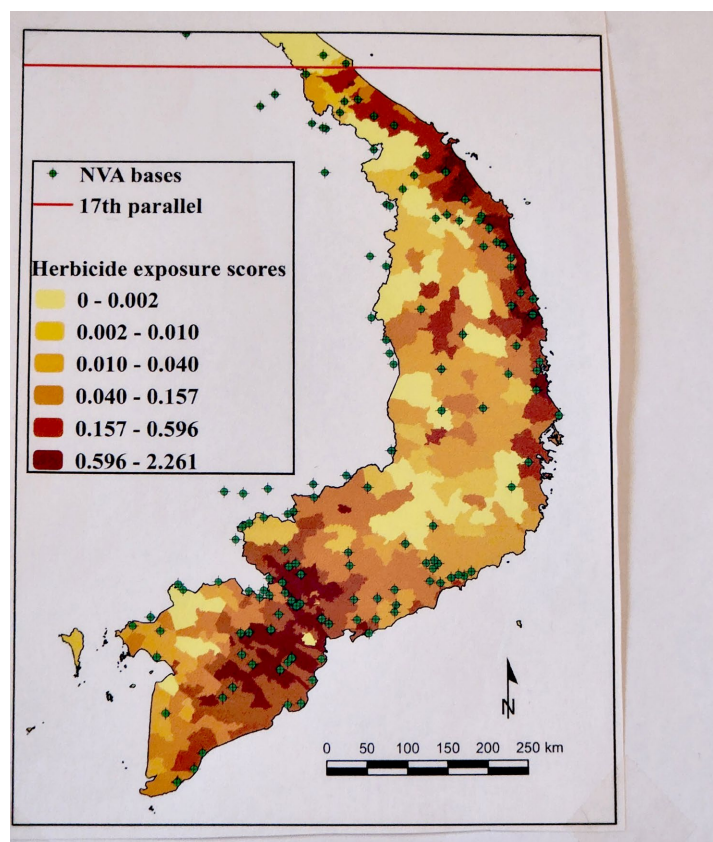


Figure 8. Distribution of herbicide exposure scores and location of North Vietnamese Army bases in Southern Vietnam. The modified figure shows the distribution of herbicide exposure scores and locations of NVA bases. Reprinted with the permission of the editor of the Open Journal of Soil Science.

DOD Deputy Under Secretary Gilpatric presented President Kennedy two possible alternative decisions [9]: “To avoid the use of the material wholly on grounds of net adverse local reaction, and particularly of worldwide disapproval. On this, we have no clear judgment since it depends on factors that can best be assessed by the Department of State. To go ahead with a selective and carefully controlled program starting with the clearance of key routes, proceeding thereafter to food denial only if the most careful basis of resettlement and alternative food supply has been created, and holding Zone D (Ca Mau) and the border areas until there is a realistic possibility of immediate military exploitation.”

The clearance of key routes, proceeding thereafter to food denial only if the most careful basis of resettlement and alternative food supply has been created, and hold Zone D (Ca Mau) and the border areas until the US military has a realistic possibility of immediate exploitation.

The DOD preferred the 2nd option. Secretary of State, Dean Rusk, told President Kennedy, “*That use of defoliants does not violate and is an accepted tactic of war*” [9]. He cited the British crop-spraying operations in Malaya as a precedent. Rusk expressed the view that: “Successful plant-killing operations in Vietnam, carefully coordinated with an incidental to larger operation, can be substantial assistance in the control and defeat the NVA and VC.” On November 30, 1961, President Kennedy accepted the joint recommendation for a limited initial defoliation program restricted to transportation routes (presumably the Ho Chi Min Trail in Cambodia and Laos).

At the time of President Kennedy’s decision was one of many that required his immediate attention, including Laos. In support of the pro-Western factions the United States almost sent troops to Laos in 1961. Many of the important decisions regarding South Vietnam were made, in part, in response to the more serious situation in Laos.

In South Vietnam, Cambodia and Laos, the US government and military opted to use tactical herbicides instead of the introduction of ground troops. At a meeting of the Joint Chiefs of Staff on Nov. 27, 1961, Secretary McNamara told the Chiefs that South Vietnamese would conduct crop destruction missions (food denial) using their own helicopters and that the US Air Force aircraft and crews would fly defoliation mission to remove jungle cover [9].

On December 3, 1961, US Ambassador Nolting in Saigon continued to recommend Ranch Hand aircraft carry civilian marking and their crews wear civilian clothes. The anticipated political problems with the International Control Commission (ICC) established under Geneva Accords of 1954. ICC had authority to inspect shipment of military equipment entering South Vietnam. A shipment of 7.5 mt of cacodylic acid (Agent Blue in dry powder form) and 75,000 liters of Agent Pink and Agent Green herbicides for use in crop destruction had already arrived unannounced in Saigon by military aircraft and had bypassed ICC inspection. Ambassador Nolting was concerned that when a future shipment of herbicides (chemicals) by commercial ship co-signed to MAAG could not be fit under existing ICC credits or justification of title. He suggested it be a civilian cargo

consigned to US Operations Mission (USOM) in South Vietnam which would exempt them from ICC inspection. Civilian aircraft and crews were to maintain consistency with “civilian” chemicals [9]. It also appears logical that the US Air Force’s Operation Ranch Hand would probably not keep civilian records of the RV chemical (food denial missions) use and application. This could account, in part, for the lack of Operation Ranch Hand spray missions (**Figure 9**) in the Mekong Delta since the RV military, with the assistance of the US Army and US Navy, sprayed the food crops in the Mekong Delta using their own helicopters and spray equipment. They could also purchase commercial herbicides, similar to Agent Blue, to bypass ICC inspections.



Figure 9. Agent Orange and other color-coded herbicides were sprayed by low flying aircraft over the Vietnam jungle and rural landscapes and subject to small arms fire from the ground. Most of these herbicides had short-half lives of hours, days, and a few weeks; And vegetation regrowth required additional applications. Picture taken by US Army Flight Operations Specialist 4 John Crivello in 1969. Reprinted with permission from Editor of Open Journal of Soil Science.

Future arrivals of US personnel and equipment would not be announced by the South Vietnamese government to the ICC. Also, the US would not admit that Geneva Accords were being violated. On December 4, 1961, the Secretary of Defense met with Joint Chiefs of Staff and set December 25 as the target date for beginning defoliation operations. Delays encountered in shipping chemicals to South Vietnam resulted in the final target being missed. Seventy-six thousand liters of Agent Pink and Agent Green herbicides and three hundred and eight thousand pounds of cacodylic acid (Agent Blue in powder form) were already in Saigon. The herbicides were sent for use in RV crop destruction operations but could not be used since the 1961 rice crop had already matured in the target area. However, RV military used Agent Blue on the rice crops starting in 1962. This suggests that the RV had access to Agent Blue powder before the official spray start date of December 25, 1961, and may have used it in the food denial program.

Ranch Hand sprayed herbicides along 46 km of canals on Ca Mau peninsula. Eight sorties dispersed, 28,000 liters of chemicals, including Agent Blue, mixed with water, were flown in region IV Corps. Between June 6 and 9, 1963, a target on the Ca Mau peninsula received a handful of spray sorties in January of 1964 (Figure 9). In February, Ranch Hand returned to the peninsula and sprayed a wide canal located on southern tip of South Vietnam along the Gulf of Thailand. The Navy ships protected the aircraft. Ranch Hand targets during March and April 1964 were also on Ca Mau peninsula.

On July 6, 1963, US Marine Major General V. H. Krulak, after a visit to South Vietnam, observed that Vietnamese forces already possessed the necessary chemicals, sprayers and helicopters and thus had the capability to conduct defoliation and crop-destroying herbicide missions on their own, without the consent of the United States (and had been for almost 2 years). Only by a “gentlemen’s agreement” did the Vietnamese recognize an American veto over the use of herbicides and associated equipment. The Olenchuk report noted that 533 ha of crops had been destroyed manually by RV military in III Corps (north of the Mekong Delta) during May, June, and July of 1963 [9].

A mission flown by Ranch Hand along the Bay Hap River in the Mekong Delta on April 22, 1964 resulted in allegations of crop damage near the model strategic hamlet of Cha La. Preliminary discussions between RV and US officials to arrange for aerial defoliation of rivers and canals controlled by NVA and VC in An Xuyen Province had taken place on December 1963 [9]. These officials rated a 38 km segment along Bay Hap River as the priority for spraying because the VC continually ambushed or harassed convoys traveling to the outposts of Cha La and Thuan Hung. At a March 4, 1964 meeting, Vietnamese officials certified the authorized limits of target around Cha La by their signatures and official seals on a special 1:4000 scale aerial photograph. Ranch Hand flew against the complex of targets on April 22, 1964.

In May of 1964, Jim G. Lucas, a Scripps-Howard staff reporter submitted an article related to the plant damage that occurred at Cha La and it was published as an editorial in Washington Post on May 26, 1964.

“The miscalculation that caused the destruction by defoliant of food crops in the friendly South Vietnam village (Mekong Delta) has again called into question the wisdom of using such herbicide agents at all in this kind of war. The sort of unselective and non-discriminatory warfare simply is not suited to the pursuit of guerrilla infiltrators. We are burning the barn to get at the rats. The employment of the devices of chemical warfare even in enemy country where the inevitable hardships fall upon the enemy’s civilian population, is open to all sorts of ethical doubts. Their employment is a civilian war, where the consequences are visited upon a civilian population, we are trying to defend is folly compounded. Their consequences of employment by error and miscalculation are simply terrible. But we can avoid the rest of the errors, in the employment of these (chemical) weapons but not using them at all in an environment which they are totally unsuited.” [9]

The reaction from the Pentagon was immediate. The same day the Joint Chiefs

sent a message to Admiral Felt and General Harkins along with an outline of the Lucas story. Two days later Saigon's initial reply confirmed the Lucas story was "*basically true but not (the) whole truth*". A follow-up report on June 3rd, suggested Ranch Hand aircraft had not sprayed Cha La and there was no plant damage at Cha La. On June 9, 1964, a RV official visited Cha La and paid indemnification without an investigation (US official recommendation) to 57 residents of the village and surrounding area for their claimed loss of 5569 coconut and areca nut trees. It appears that to keep the media in the dark, relative to US participation in the food denial program, there was no official investigation, and the villages were quickly paid for damages.

The use of herbicides, including Agent Blue, was not documented until Buckingham, W. A. (1982) book, "Operation Ranch Hand: The Air Force and Herbicides in South East Asia" was published by the Air Force Office. Buckingham documented some of the United States methods used to divert attention from The RV Agent Blue food denial program and prevent the story from being picked up by the US media including:

(1) Before late 1964, America was reluctant to allow South Vietnamese (RV) to conduct chemical crop destruction operations and even more reluctant to participate. Secretary McNamara at a March 10, 1964 meeting, reconfirmed the decision to keep the United States out of direct involvement in the RV chemical crop destruction (food denial) program. General Maxwell Taylor, soon to be Ambassador to South Vietnam, supported the McNamara decision. However, after he became Ambassador, he changed his mind. RV military refused to use their helicopters to spray two potentially lucrative targets, VC food productive areas in Phuoc Long Province and Zone D. Ambassador Taylor then order Ranch Hand to destroy these food crops using the Farm Gate concept. That meant Ranch Hand aircraft would carry temporary South Vietnam marking for these missions and crews would be "*ostensibly under the control of South Vietnamese aircraft commander*" [9].

(2) On October 3, 1964, Ranch Hand began its first crop destruction project called "Big Patch". The Ranch Hand spray planes flew 19 sorties between October 3 and 13 against fields near War Zone D [9]. During November and December, the C-123s flew 15 crop destruction sorties in Phuoc Long Province as part of operation "Hot Spot". The ground fire was heavy on both projects. The spray planes took 40 hits from small arms fired from the ground. Despite the resistance, 3050 hectares of food crops alleged to have been destined for VC consumption were sprayed. MACV rated Ranch Hand operations against the food crops as highly successful [9].

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3.3. North Vietnamese Army and Viet Cong Bases in the Mekong Delta

Tactical herbicides, including Agent Blue and Agent Orange were sprayed around suspected NVA and VC areas (Figure 8) in southern Vietnam [5] to improve visibility and destroy the enemy food supply [9]. The intensity of spraying was greatest in the proximity to NVA’s bases that were identified by the U.S. Intelligence during the Vietnam War [5] (Figure 8). Between 1962 and 1971, the U.S. Air Force sprayed 50 million liters of tactical herbicides [15] across the Republic of Vietnam (RV). In addition, the U.S. Navy and U.S. Army sprayed both Agent Blue and Agent Orange on the rice paddies and mangrove forests of the RV. However, these spray missions were either not recorded, were classified or the records were not maintained. These spray missions of the U.S. Navy and Army also contributed to the dioxin TCDD and arsenic levels in the Mekong Delta.

It is estimated that up to 366 kg of pure dioxin TCDD and 1,100,000 kg of pure arsenic were sprayed in the operations areas as many as 4.8 million Vietnamese civilians were subsequently exposed [16]-[18]. The tolerable daily dioxin TCDD intake is defined by WHO to be between 1 and 4 pg (picograms) per kg of body weight (one pg equals 10^{-15} kg). Numerous biological and epidemiological studies have shown robust medical linkages between herbicides exposure to dioxin TCDD or arsenic and a range of health problems. Among the most comprehensive Veterans and Agent Orange research and reports was one conducted by the National Academies of Science, Engineering and Medical. This report was updated annually and led to the Agent Orange Act of 1991 [19].

The first tactical (rainbow) herbicide delivered to Tan Son Nhut Air Base, RV, in early 1962, was Agent Blue. The herbicide was in powder form (ANSAR 138) then mixed with water for spraying. This process often resulted in spills of Agent Blue and its main ingredient cacodylic acid, both of which have short half-lives. Unfortunately, the compounds were degraded to water-soluble arsenic and released

into the surface water, soil, and groundwater.

Records [9] (Figure 10) indicate that 42% of the herbicide used in southern Vietnam prior to 1965 was the herbicide Agent Blue. Agent Blue was used to destroy the rice crop, with the active ingredient cacodylic acid containing arsenic. However, there are limited publicly available US Air Force records and no Navy, CIA and Army records of the Agent Blue defoliation (Figure 11) spray missions



Figure 10. The Republic of Vietnam and United States printed correspondence is kept at Vietnam War Archive number 2 in Ho Chi Minh City. Reprinted with the permission of the editor of the Open Journal of Soil Science.



Figure 11. Repacking herbicide barrels and recovering buried barrels leaking into the ground. Reprinted with permission from editor of the Open Journal of Soil Science.

or crop (food denial) areas sprayed in the Mekong Delta prior to 1965 and few records after that date. The stated US and RV government and military goal, prior to 1965, was to eliminate the food supply of the enemy (NVA) by destroying the South Vietnamese rice crop just prior to harvest (**Figure 12**). Most of the rice crops were grown in the Mekong Delta and not the Central Highlands. So why would the U.S. Air Force spray records (Operation Ranch Hand) primarily reflect (**Figure 7**) the Agent Blue spraying in the Central Highland? Apparently, the Agent Blue sprayed by the RV military on food crops (food denial) in Mekong Delta with the assistance of the U.S. Army, CIA and U.S. Navy was not included as part of the U.S. Air Forces Operation Ranch Hand defoliation mission. The Air Force kept and maintained their own spray mission records.



Figure 12. Rice residue in dried-out fields similar to the rice paddies sprayed with Agent Blue in the 1960s and 1970s. Reprinted with permission from editor of the Open Journal of Soil Science.

The goal of the US Air Force's Ranch Hand spraying program was to defoliate the jungle, including the stream banks on the canals, waterways and rivers to prevent ambushes and to expose the NVA and VC and their base camps (**Figure 8**). There were at least 26 NVA and VC base camps in the Mekong Delta. Most were in mangrove forests surrounded by rice paddies and adjacent to a waterway. Agent Purple was used to defoliate the forest and Agent Blue was used to destroy rice crops (1962-1965). It took almost two weeks for a leaf drop to occur, after a forest was sprayed with Agent Purple, Agent Pink, Agent Green and/or Agent Blue. These two tactical herbicides were sometimes combined (Agent Orange was not available for use until 1965) to speed up the defoliation process. The RV food denial program (Khai Quang), including Agent Blue spraying and subsequent burning of the rice residue (to eliminate the seeds) by the RV and US militaries significantly reduced the capacity of the Vietnamese living in the Mekong Delta to feed

themselves or NVA and VC soldiers.

Some of the rural Vietnamese in South Vietnam supported the NVA and VC soldiers while others did not. However, the NVA and VC soldiers had weapons and could take the rice if not freely provided by local farmers. As a result, during the early 1960s many of the rural Vietnamese in South Vietnam were without a stable food supply. Nearly 2 million Vietnamese living in both the Mekong Delta and Central Highlands were forced to re-locate into slums of Saigon or hamlets as part of a RV Strategic Hamlet (Khai Quang) project (easier to defend the rural population if concentrated in urban areas or hamlets). All the southern Vietnam rural providences lost population during the Vietnam War (1955-1975). This is because of population shifts (hamlet strategy) and civilians being killed during the war.

The US Army, Blue Water Navy and Brown Water Navy continued to spray the Mekong Delta stream banks (**Figure 9**), rice paddies and mangrove forests after the U.S. government officially entered the Vietnam War in August of 1964. Once again, Mekong Delta Agent Blue spray records were either not kept, were classified, or not maintained. In 1965, Agent Blue (arsenic), along with Agent Orange (with 2, 4, 5-T with unknown amounts of dioxin TCDD) replaced Agent Purple, were also used in combination by U.S. Air Force as part of Operation Ranch Hand, to defoliate the mangrove forests used by the NVA and VC base camps in the Mekong Delta (**Figure 8**). This deforestation exposed the stream banks and shoreline to soil erosion and destroyed the livelihoods of the local woodcutters.

The total amount of Agent Blue shipped to Vietnam was more than the Operation Ranch Hand C-123s (**Figure 13**) and helicopters were sprayed, according to the official Operation Ranch Hand records for the Vietnam War (from 1962 to 1971).



Figure 13. C-123s Fairchild Provider aircraft that was used during the Vietnam War to spray tactical herbicides. Reprinted with the permission of the Editor of the Open Journal of Soil Science.

In South Vietnam, Agent Blue was used as a contact herbicide for grassy plant control and rice destruction. More than six million liters of Agent Blue (known as Phytar 560-G), manufactured at the Ansul Chemical Plant on the Menominee River (**Figure 14**) in Wisconsin and Michigan, were sprayed as part of the DoD and USDA herbicide program called Operation Ranch Hand (1962 to 1971). These Air Force spray records indicate that over 664,392 kg of Arsenic (As) was sprayed on South Vietnam, Laos, and Cambodia. This does not seem to include the Agent Blue (468,000 kg of As) in powder form that was mixed with water and sprayed on and adjacent to NVA and VC base camps and adjacent lands in the Mekong Delta (**Figure 8**) and/or the Central Highlands. Agent Blue was sprayed by the RV military, with the support of U.S. Army, Brown Water Navy, Blue Water Navy, and CIA, primarily between 1961 and 1965.



Figure 14. Aerial view of the former Ansul company chemical plant on Menominee River in Marinette, Wisconsin (L) and Menominee, Michigan (R). The Menominee River flows into Green Bay. Published with copyright permission from Editor of Open Journal of Soil Science.

The RV military food denial program was extended from the start of the American Vietnam War in 1965 to the end of the Vietnam War in 1975. Commercial herbicides similar to Agent Blue were shipped to the RV military to bypass the ICC inspections. Why no US Navy and Army spray records? The U.S. Navy and Army did not seem to keep spray records, and if they did, they were not maintained or classified. Most of the U.S. Air Force Operation Ranch Hand spray was applied in South Vietnam (**Figure 7**) as part of the defoliation program in remote areas of the jungle to defoliate and expose enemy positions.

The purpose of the RV military food denial program conducted with the U.S. Army, CIA and U.S. Navy support was to eliminate the local food supply (primarily rice) in South Vietnam so the rural Vietnamese could not feed themselves or the NVA and VC soldiers. Agent Blue was applied by Ranch Hand on the perimeters of NVA and VC base camps (**Figure 7**) and (**Figure 8**) and more selectively in more populated areas of the Central Highlands and the Mekong Delta. The RV spray

equipment used on fields included hand and backpack sprayers and sprayers on helicopters and vehicles. The US Navy and Army assisted using backpack and handheld sprayers on Brown Water Navy boats and from military vehicles (Army) (Figure 15) and from military land-based helicopters (Figure 16) and some on Blue Water Navy ships. While it was easy to explain the US Operation Ranch Hand defoliation objective to the press and the public, it was not so easy to explain why the U.S. government and military were eliminating the local food supply and starving of the rural Vietnamese living in South Vietnam. Since the RV military ran the food denial (Khai Quang) program, they had to explain it by calling it the hamlet strategy to protect the South Vietnamese from the NVA and VC.



Figure 15. Tactical herbicides sprayed from a M113 Armored Tracked Personnel Carrier, Reprinted with the permission of the editor of the Open Journal of Soil Science.



Figure 16. Tactical herbicides being sprayed by a helicopter on mangrove forests. Reprinted with the permission of the editor of the Open Journal of Soil Science.

The elimination of the local food supply was primarily done by the Republic of Vietnam (RV) to force the rural Vietnamese to move to hamlets, which would be easier for the RV military to defend them since located in loyal areas. However, the U.S. military's attempts to assist the RV military in destroying the local Vietnamese food supply was not considered by US media and public to be a noble mission. Perhaps that elimination of the local food supply (RV food denial program) was part of the reason. The Army, CIA and Navy when assisting the RV military did not keep spray records or classified them or if recorded, were not maintained and shared with the media or public. Most of the U.S. media focus during the Vietnam Civil War (1962 to 1965) was on US Air Force's Ranch Hand program of defoliation of the jungle to expose the enemy.

To the credit of the U.S. Air Force, they did keep excellent spray mission records, as part of Operation Ranch Hand; however, the total tactical herbicides applied the records did not seem to include Agent Blue and commercial formulations applied by the RV military with or without the assistance of US Blue Water and Brown Navy, CIA, and U.S. Army. Lacking these spray mission records it is hard, after more than 50 years, to locate areas where Agent Blue was applied to destroy the rice crops, especially in the Mekong Delta. Therefore, it is difficult (nearly impossible) to overlay the arsenic spikes in the Mekong Delta groundwater with the spray and application mission records of the RV military, US Navy, CIA and US Army (**Figure 7**). It is not clear why the Air Force could keep spray mission records and maintain them, and the US Army, Navy and CIA could not.

Agent Blue was sprayed primarily on the mangroves, rice paddies, and the surrounding forest of the Central Highlands and Mekong Delta in southern Vietnam. Agent Blue was also used in Laos and Cambodia, along the Ho Chi Minh trail, to kill food crops including upland rice to deprive the North Vietnamese communist and insurgent troops of a food source [9] [20]. The Agent Blue was applied at the average rate of 2.831 kg As/ha to the rice paddy and forest areas. Many areas were sprayed only once while other areas received four or more applications. The forest and mangrove areas were usually sprayed at a different rate than the rice paddies. Unable to control the insurgent's access to their food supplies or eliminate their grassroots village support, the RV military with US military (Army and Navy) support response was simple: "*If you cannot control it, kill it*" [9] [20].

Arsenic has no half-life and is water-soluble. Once it leaches into the groundwater, it can be pumped back to the surface by hundreds of thousands of tube wells (**Figure 17**), constructed after 1975 to supply freshwater needs of rice paddies, shrimp ponds and to meet household and drinking water needs of the 20,000,000 Vietnamese living on the Mekong Delta or the Central Highlands. Most of the anthropic arsenic remains in the southern Vietnam environment to this day. The primary loss of anthropic arsenic from the southern Vietnam landscape would have occurred when Agent Blue spray drifted into or was sprayed

directly on rivers and on adjacent stream banks. Surface runoff waters, with water-soluble cacodylic acid and arsenic components into the Mekong Delta Rivers, flowed into the South China Sea or the Gulf of Thailand (**Figure 18**). However, most of the Agent Blue was utilized to destroy rice crops and arsenic, with no half-life, has remained in the rice paddy root zone soils and/or leached into the groundwater only to be returned to the soil surface by tube wells, for urban and agricultural use.



Figure 17. Tube wells in the Mekong Delta. Reprinted with the permission of the editor of the Open Journal of Soil Science.

3.4. Agent Blue, the Arsenic Based Herbicide Used to Destroy the Rice Crop

During the Vietnam War, Agent Blue $[(\text{CH}_3)\text{AsOOH}]$ was sprayed for the primary purpose of destroying rice and other food crops (**Figure 19**). As part of the RV and U.S. government and military strategy to destroy the food supply of both the communist insurgents and the southern Vietnamese living in rural areas as part of the Diem government's "Strategic Hamlet" program [20]. Agent Blue, a mixture of two As compounds, cacodylic acid and sodium cacodylate, was the most effective of all the tactical (Rainbow) herbicides in killing rice. Arsenic has been a known poison since the Middle Ages. During the Vietnam War, the U.S. government, DOD and USDA ignored warnings of thousands of scientists of its hazards and sprayed Agent Blue on rice paddies, mangroves, bamboo groves (**Figure 20**) and U.S. military base perimeter fences. This resulted in

exposure, of Vietnamese civilians, NVA and VC infiltrators and the U.S. military personnel who were stationed (boots on the ground) in in the Mekong Delta, to Arsenic.

Spraying and dumping of Agent Blue by the U.S. Navy and Army to desiccate rice plants before maturity added massive quantities of water-soluble As to the soil root zone and the surface water and ground waters of rice paddies. Southeast Asia is a region where natural occurring As in soils and sediments tends to be higher because of the occurrence of As-containing geologic formations in the region [15]. Spraying significantly added to the As load in Mekong Delta environment. In addition, the U.S. used an estimated 7.8 million liters of Agent Blue herbicide (1,132,400 kg of As), as part of Operation Ranch Hand, as a chemical (herbicide) weapon for “crop destruction and defoliation”. For the last 50 or more years, this As has been ingested by the Vietnamese living in the Mekong Delta via the food and drinking water.



Figure 18. Mekong Delta drainage ways and canals. Reprinted with the permission of the editor of the Open Journal of Soil Science.

Water-soluble As leached into the soil root zone and into the groundwater from

the frequent application of Agent Blue by the U.S. Army and Navy (in addition to the Air Forces Operation Ranch Hand) and/or was transported by the surface runoff water directly into the waterways and rivers (Figure 18). After the Vietnam War was over, vast amounts of natural and residual manufactured arsenic laced groundwater was pumped from private wells (Figure 17) to the surface to irrigate the rice paddies, fill shrimp ponds (Figure 21) and to meet the drinking water needs of the 20 million people living in the Mekong Delta. The water-soluble As continues to cause health effects in both animals and humans. In addition, during the 1961 to 1971 period, animals and humans absorbed As primarily through skin contact with Agent Blue in their environment.

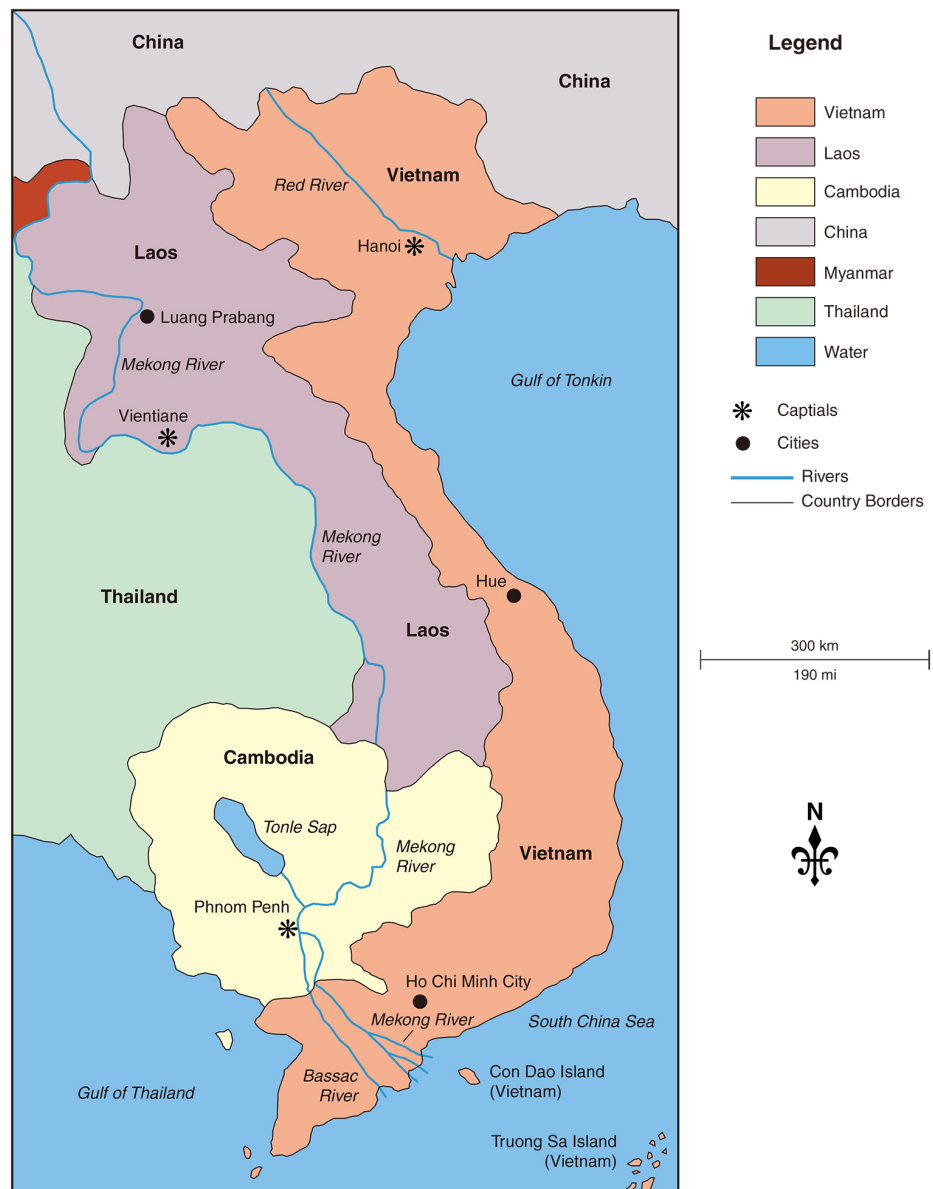


Figure 19. South East Asia countries including Vietnam. The Mekong and Bassac Rivers flow south into the Mekong Delta. Reprinted with the permission of the editor of the Open Journal of Soil Science. Map by Mic Greenberg.



Figure 20. Bamboo growing in Mekong Delta. Reprinted with the permission of the editor of the Open Journal of Soil Science.



Figure 21. Shrimp farm in Mekong Delta of Vietnam that was developed after 1975. Reprinted with the permission of the editor of the Open Journal of Soil Science.

3.5. Vietnam War Archive No. 2—Ho Chi Minh City

Olson [1] found the “Official RV government records are all stored at the Vietnam War archive number 2 in Ho Chi Minh City (Figure 10). The Archive No. 2 staff have indexed (Table of Contents) and stored these documents in loose binders. Unfortunately, the documents have not yet been scanned into electronic files. That needs to be done since the paper copies are 50 to 60 years old and the information needs to be preserved.”

“These records include personal and government correspondence between the RV President Diem and US President Kennedy administrations. After reading publications by historians, and other Vietnam Era veterans and connecting dots over the years, it is now apparent that US President Kennedy’s administration and US military were hesitant to introduce chemical weapons into the Vietnam War. There was a lot of concern on the part of the Kennedy administration (1960 and 1961) that they could be prosecuted in World Court, after the war’s end, for war crimes related to use of chemical weapons. Since the British first used herbicides in the Malaysia conflict in the 1950s, the US government and military justified their use of tactical herbicides, including Agent Blue. They were not the first country to use herbicides in a war or conflict.”

“In addition, President Diem administration’s requested Agent Blue herbicide shipments and US military assistance in spraying the South Vietnam rice crop to help implement the RV hamlet strategy. The US government was initially reluctant to destroy the food supply of our RV partners’ people. The RV military using their own helicopters and spray equipment sprayed Agent Blue on the crops as part of their food denial program. In war, the goal is often to eliminate the food supply for the enemy and their people not the food supply of your people/allies. The reason the RV military sprayed the South Vietnamese food crops was to get the rural Vietnamese to move into the slums of Saigon or into hamlets so the government could better protect them from the NVA and VC. Most of RV President Diem’s supporters were in the urban areas. Many rural Vietnamese favored ‘Unification of Vietnam’ and supported the NVA and VC and not the Republic of Vietnam’s government lead by President Diem. This suggests the RV hamlet strategy (food denial) was really an attempt to control the rural southern Vietnamese by eliminating their food supply and forcing them to move into either the slums of Saigon or into hamlets which could be more easily protected by the RV military.”

“Once in the hamlets or slums, the rural southern Vietnamese could be ‘protected’ from the ‘enemy (NVA and VC)’. But many locals were NVA and VC guerrilla supporters and favored re-unification efforts. They provided food in support of the NVA and VC unification effort. The RV government needed to ‘control’ the rural South Vietnamese people. This background knowledge helps to explain why the RV government wanted to obtain Agent Blue and other tactical and commercial herbicides from the US and requested US military assistance in spraying Agent Blue on South Vietnam rice crops when NVA and VC ground fire was intense. Historical documents suggest that the President Kennedy administration struggled with RV requests for tactical herbicides and assistance, but after extensive deliberations got President Kennedy to signed off on the use of military and environmental chemical weapons for defoliation missions. The US government and military decision to supply Agent Blue and commercial formulations to South Vietnam military was

justified, since it was done at the request of the request of the RV government and military and in support of their hamlet strategy (Khai Quang program).”

“These Vietnam War Archive no. 2 documents could prove whether the US government sent Agent Blue and a similar commercial version to South Vietnam (Tan Son Nhut AFB between 1961 and 1965) for RV spraying of rice crops (food denial program) in that Mekong. Apparently, the Agent Blue powder was mixed with water and then sprayed by the RV military, with and without US military assistance, on the rice crops in the Mekong Delta to eliminate the food supply. In addition, RV and US militaries sometimes sprayed a crop area and then burnt the rice crop residue. The smoke adversely affected nearby villages and there should be reports in the Vietnam War Archive no. 2 files documenting these incidents. It appears that the US DoD has never had access to these Vietnam War Archive no. 2 files. These documents need to be protected since the US Army, CIA, and US Navy spray records, in support of the RV military, do not exist. The RV spray records can be used to show that Agent Blue was sprayed by the RV military as part of the food denial program in the Mekong Delta, with the assistance of the US military. This could support the Olson and Cihacek previous calculation that more than 1 million kg of pure arsenic was applied to South Vietnam between 1962 and 1971. Much of the initial RV Agent Blue spraying was done using their own helicopters and handheld and backpack sprayers. The Agent Blue powder (1962-1965) was mixed with water before application then sprayed in a liquid form.” [1] [14] [20]

The Vietnamese archives staff were provided the Merry Band of Retirees, which includes nine US Army and Vietnam Era veterans, and four Agricultural College Professors, published documents, a total of 23, which are now being archived. Vietnam War Archive No. 2 in Ho Chi Minh City and Vietnam War Archive No. 1 in Hanoi have agreed to accept the 23 team-refereed journal articles (**Figure 10**), four Vietnam Veteran News radio podcasts of Mack Payne on Agent Blue, and four Ken Olson ppt lectures on both Agent Orange and Agent Blue. The Olson exhibit contains more than 700 Open Journal of Soil Science journal pages on Agent Orange and Agent Blue, 64 minutes of radio podcasts on Agent Blue and four ppt talks on both Agent Blue and Agent Orange which will be available for future Vietnam War researchers and scholars. While the Olson slide talks and Payne radio podcasts are very important, our Merry Band of Retirees refereed journal articles are the primary source of the most important information of value to future Vietnamese War scholars and historians. The radio podcasts and power point talks are designed to inform and educate the current Vietnamese government, media, scholars including students and the public.

4. Summary

4.1. History of 2nd Indochina War

One of the lesser told stories of the Second Indochina War in Southeast Asia was the United States secret use of the tactical herbicides, rather than ground troops, in the neutral nation of Laos. The United States has not taken full responsibility for spraying the tactical herbicides used on Ho Chi Minh Trail in Laos during the

Second Indochina War. In 2002, Laos signed the Stockholm Convention on Persistent Organic Pollutants, a class of 12 “forever chemicals” including the dioxin family. All signatories were obligated to report on the extent of contamination in their countries. According to William Buckingham’s history of Operation Ranch Hand [9], the U.S. Air Force sprayed 1,589,850 liters—of which, 75 percent were Agent Orange, 15 percent Agent Blue, and 10 percent Agent White—over 582 km² of Laos, up until September 1969.

4.2. Use of Tactical Herbicides in Southeast Cambodia

Researchers at Columbia University and the Institute for Cancer Prevention [9] [15] say that the U.S. military sprayed around 154,823 liters of Agent Orange in Cambodia. However, the US government has not offered any financial assistance to affected Cambodians who struggle to afford astronomical health care bills. Multiple investigations in the Cambodia in [21] provide evidence that the United States military sprayed commonly known as Agent Orange, on southern Cambodian villages in the 1970s. People directly exposed to Agent Orange suffered from respiratory and hearing problems and their offspring were born with cognitive impairments and crippling deformities. President John F. Kennedy approved the first defoliant-spraying missions in the early 1960s, a time when tens of thousands of Communist PAVN and Viet Cong (VC) guerrillas had infiltrated and begun recruiting within U.S.-aligned South Vietnam. By 1971, the U.S. sprayed in South Vietnam nearly 72 million liters of tactical herbicides, at least 41 million liters of which was Agent Orange, to decimate the vegetation that provided the Viet Cong with cover and sustenance. The guerrillas’ infamous Ho Chi Minh Trail extended into Cambodia and Laos (Figure 1). Where it did, American bombs and Agent Orange and other tactical herbicides, including Agent Blue the arsenic-based herbicide used to destroy the rice crop, often followed [21]. In the 50 years since the Vietnam War, the Laotian hill tribes who were exposed to dioxin TCDD and arsenic and their offspring have had to live with the environmental damage. United States government, while admitting to causing the environment damage and is addressing these long-lasting effects of tactical herbicides used in Vietnam; however, the U.S. has largely ignored the issue of dioxin (and arsenic) in these two officially neutral neighboring nations. The U.S. is continuing to account for the U.S.’s explosive ordnance as part of the Cambodian and Laotian legacy. Still, the U.S. continues to maintain that chemicals were not widespread there, despite records indicating otherwise [9] [21]. As a result, the U.S. has offered no assistance to affected Cambodians and Laotians, and constrained benefits to Americans who secretly served in these countries [22] without entering Vietnam (no boots on the ground) [23] but still may have been exposed to dioxin and/or arsenic [21]. The US, in pursuing military intervention, assumes at least some responsibility for the post-conflict well-being of those affected. America’s shirking of such responsibility has become routine. In the case of the Vietnam War, the U.S. used a borderless weapon. Now when addressing those who were exposed to dioxin and arsenic,

they use national borders. Leaving those exposed to dioxin and arsenic, on the wrong side, to suffer without support.

4.3. Veteran Affairs Benefits for Dioxin Affected American Veterans

No American governmental body has appropriated any funds for similarly suffering Cambodians and Laotians. However, U.S. historical records, along with academic analyses, detail what the VA called “heavy” tactical herbicide spraying in parts of Cambodia and Laos. For example, scientists from institutions including the Institute for Cancer Prevention and Columbia University analyzed U.S. records. In a 2003 *Nature* article [16], scientists found during the Second Indochina War that the U.S. dispersed approximately 1.8 million liters in Laos and 154,800 liters of Agent Orange in Cambodia. The article noted that undocumented spray drift may also have occurred in Cambodia and the of spraying in Laos was determined to be incomplete. While Randal Noller, a VA spokesperson, opted not to discuss dioxin’s Cambodian and Laotian legacy, the VA publicly concedes that these chemicals were sprayed in both countries. This contradictory American position, perhaps unsurprising, given that it affects the rural residents of two geopolitically marginal countries. However, it also affects some of the Americans who served in Cambodia and Laos [23]. The VA, seemingly based on this limited recognition of Agent Orange’s presence in Laos and Cambodia, does not extend the “automatic presumption of dioxin exposure” to the Americans who served in Cambodia and Laos but did not enter Vietnam [23]. A VA spokesperson confirmed that the “automatic presumption of exposure” extends only to veterans who served in Vietnam. Those who served elsewhere must prove with military records that they served in Agent Orange affected areas in Cambodia and Laos. Providing this proof is difficult, though, as these CIA and military records are often still classified. Noller said the department “in most cases” concedes dioxin exposure to veterans who served in exposed parts of Cambodia and Laos. Because of the covert nature of U.S. (CIA) operations in Cambodia and Laos, it is even unclear how many U.S. veterans served in those countries without entering Vietnam. However, there are certainly some: Gary Beatty, a retired lawyer and the president of the Thailand-Laos-Cambodia Brotherhood, a veterans’ service group, said he served in Laos and Thailand without stepping foot in Vietnam [9] [21]. The Vietnam War Historian H. Bruce Franklin said in an email that many veterans fought in Laos exclusively, but that estimating how many remains difficult “because some who were on active duty were dishonestly masked as civilian contractors”.

Agent Blue was also used by the CIA and Air America during the 2nd Indochina War in Laos and Cambodia. The CIA, at the direction of Laos Ambassador, used Agent Blue starting in 1961 to kill the rice and other food crops being grown along the Ho Chi Minh trail in Laos and Cambodia. That was part of United States effort to eliminate the food supply of the NVA and VC traveling the Ho Chi Minh trail

to South Vietnam.

4.4. Recommendation for CIA to Declassify Documents

After 60 years, it is time for the CIA to provide all tactical herbicide records of their secret Air America and the RLAFF spray missions in Laos and Cambodia including the purchases and/or donation of defoliant and food destruction materials, and use of any spray equipment. That would allow the identification of potential dioxin TCDD and arsenic hotspots. Once the locations are determined, it would permit an assessment of the environmental impact. The tactical herbicides were used by the U.S. military to destroy the enemies' food supply and to clear vegetation during the Vietnam War. Agent Blue, known as the arsenic-based herbicide, was used to destroy the rice crops and other food crops. Agent Purple and Agent Orange are notorious for being contaminated with a chemical called 2,3,7,8-Tetrachlorodibenzo-p-dioxin, or TCDD, regarded as one of the most toxic substances ever created.

4.5. History of Vietnam War

In 1961, the Tan Son Nhut Air Force base on the northern edge of Saigon received the first shipments of Agent Blue, the arsenic-based herbicide used to destroy rice crops. The Tan Son Nhut Air Force base has been covered by urbanization and the only building still standing is the Tan Son Nhut Air Force base museum with a horticultural garden and lawn with many aircraft on display on apparently arsenic rich soil. These soils need to be tested for arsenic.

4.6. Vietnam War Archive

The Vietnam War Archive no. 2 in Ho Chi Minh City houses both the correspondence between the RV and US government related to the Khai Quang program as well as the RV Agent Blue spraying flight records in the Mekong Delta (**Figure 10**). Paper copies of the RV correspondence, between President Diem's administration and the President Kennedy administration, are shelved in loose binders at the Vietnam War Archive no. 2. Since the binders only have a table of Contents, it will take considerable time and effort to find the key documents. Our team, the Merry Band of Retirees, attempted unsuccessfully for more than two years to obtain the US military Agent Blue spray mission records for the Mekong Delta. Therefore, it is important that the RV Agent Blue spray records for the Mekong Delta be preserved since they are apparently the only surviving records. The limited US Air Force Operation Ranch Hand flight records suggest that the Agent Blue spraying in the Mekong Delta was minimal. However, the William A. Buckingham book "Operation Ranch Hand: The Air Force and Herbicides in Southeast Asia 1961 to 1971" [9] documents many cases where the RV military, with or without assistance from US Army, CIA and US Navy, sprayed Agent Blue and/or similar commercial herbicides containing cacodylic acid and arsenic on Mekong Delta food crops as part of the food denial program. Buckingham also documents

many Operation Ranch Hand (US Air Force) defoliation missions in the Mekong Delta. There is strong evidence that the RV and US military goals were to eliminate the NVA and VC food supply, implement the RV hamlet strategy, and defoliate the transportation corridors, including the waterway and canals. Most of the South Vietnam rice was produced in the Mekong Delta, not the Central Highlands. The US Army, CIA and US Navy Agent Blue spray records were either not kept or not maintained. However, Vietnam Archive No. 2 may have the Agent Blue spray records (written in Vietnamese) of the RV military's food denial program that was used to implement the RV hamlet strategy.

The United States Department of Defense and United States Department of Agriculture Operation Ranch Hand records for the tactical herbicide spraying in South Vietnam during the American Vietnam War, except for the Mekong Delta, are very detailed, rather complete, and available. The same is not true for the spraying by RV military during the Khai Quang program, which was supported by the US Army, US Navy, and CIA in the Mekong Delta. Agent Blue was sprayed by the RV military for four years during the Vietnam Civil War (1961 to 1965) and before the official start of the American-Vietnam War. The Vietnam War Archive no. 2 in Ho Chi Minh City (**Figure 10**) may have the RV Mekong Delta spray records. Few US Army, US Navy and CIA spray records exist, from the period, 1961 to 1965, during the Vietnam Civil War. Vietnam War veterans, historians and scholars have reported the spraying of 3.2 million liters (468,008 kg As) Agent Blue on the rice paddies and mangrove forests of South Vietnam by the RV military, with and without the support of the US Army, US Navy and CIA on the rice paddies and mangrove forests in the Mekong Delta and Central Highlands. The RV military may have maintained spray records, including location and amount records, like the U.S. Air Force (Operation Ranch Hand) did and these records should be in Vietnam War archive No. 2 in Ho Chi Minh City. The Institute of Medicine estimated that 3.2 million liters (468,000 kg of pure As) were sprayed during RV Khai Quang program (primarily between 1962 to 1965). This was in addition to the U.S. Air Force's Operation Ranch Hand spraying of the tactical herbicide Agent Blue primarily by C-123 aircraft for defoliation of the jungle and transportation corridors (1962 to 1971). The Operation Ranch Hand missions were recorded and maintained (sprayed over 4,712,000 liters or 664,392 kg As). The RV military, US Army, US Navy, and CIA spray records were classified.

Agent Blue and cacodylic acid had short half-lives and are degraded to water soluble arsenic, which was released into the surface water and/or leached into groundwater. Once the water-soluble arsenic leached into the Mekong Delta groundwater, arsenic rich water was pumped back to the surface by tens of thousands of tube wells for urban and agricultural use. The environmental impacts of Agent Blue, on the Menominee River, at manufacturing sites in the United States, were studied to identify possible arsenic remediation and mitigation strategies. The lessons learned at the Agent Blue manufacturing Ansul Chemical plant sites

in Wisconsin and Michigan (**Figure 14**), United States should be applied in the Mekong Delta to help mitigate and remediate arsenic-rich surface water, soil, sediment, and groundwater found in the Mekong Delta. The fact that U.S. military was assisting the RV military in eliminating the food supply of the South Vietnamese was left to the RV government to explain. The official reason for the RV military hamlet strategy is to make it easier for their soldiers to defend the civilians from enemy attacks.

Agent Blue, the arsenic-based herbicide, was a secret US military and environmental chemical weapon that was used by the RV and US militaries in South Vietnam for food denial during the Vietnam Civil War (1961-1965) and continued to be used until President Nixon order cessation of defoliations in 1971. The addition of 1,132,400 kg As during the Vietnam Civil war and the subsequent American Vietnam War would have increased the arsenic levels and spikes in Mekong Delta groundwater. Similarly, arsenic levels in the soil (root zone) and drinking water were increased. In many places in the Mekong Delta there are arsenic spikes, both anthropic and natural, which exceed the WHO standard of 10 µg/l, for the food supply, including raised arsenic levels in rice, shrimp, and fish. During the Vietnam Civil War, the bioaccumulation of arsenic in the environment adversely affected human health of the Vietnamese, those directly exposed to Agent Blue (cacodylic acid and arsenic), and their off spring.

4.7. Vietnam War Archive Record Recommendations

1) The Vietnam War Archive No. 2 in Ho Chi Minh City needs to electronically scan and store the 1960 to 1963 correspondence between US President Kennedy's administration and RV President Diem's administration (removed from office in 1963 after a political uprising) related to the shipment and use of tactical herbicides in southern Vietnam [1]. This will make the documents available to current and future Vietnam War historians and scholars.

2) The Vietnam War Archive No. 2 in Ho Chi Minh City needs to electronically scan and store the RV Agent Blue spray records for the Mekong Delta including the date of application, the amount of Agent Blue used, and the geographic application locations. This will make them available to current and future Vietnam War historians and scholars.

3) The soil at the former Tan Son Nhut Air Force base, which is now a museum, plantation and lawn, needs to be sampled and tested for arsenic.

4) The Vietnam War Archive No. 1 in Hanoi and Vietnam War Archive No. 2 in Ho Chi Minh City should consider preserving the 23 Merry Band of Retirees refereed journal articles on tactical herbicides, four radio podcasts of Mack Payne on Agent Blue, and four Ken Olson Agent Blue and Agent Orange lectures. These documents focus on both Agent Orange dioxin TCDD contaminated soil and sediments and Agent Blue, the arsenic-based herbicide used to destroy the rice crops and make the information available for future Vietnam War researchers and scholars [1].

5. Conclusion

5.1. Second Indochina War

The primary objective was to determine why no major news organization in the US, including the New York Times and Washington Post, never investigated Agent Blue use during or after the Vietnam War? How can this use of Agent Blue to destroy South Vietnamese civilian food (rice) sources and agricultural production sites never be covered by US print media news organizations, with one exception in 64 years? The 2nd Indochina War remained a secret war for approximately 20 years (1982). These CIA spray records were classified to prevent the US media from reporting on the use of Agent Blue the arsenic-based herbicide used to kill the rice and other food crops. Since the war on the Ho Chi Minh trail was an air war with no US soldiers officially having boots on the ground, there was no opportunity for embedded US media reporters to cover the secret war which included the spraying of Agent Blue along the Ho Chi Minh trail in Laos and Cambodia. These CIA records are still classified. After more than 60 years, it is time to declassify these records.

5.2. Vietnam War

Agent Blue was shipped in power and liquid form to South Vietnam starting in 1961, four years before the official start of the American-Vietnam War. The primary use of Agent Blue was for food denial by the Republic of Vietnam government and military. Agent Orange the herbicide of choice for defoliation was not introduced into the Vietnam War until 1965 with the official use being to defoliate the jungle to expose the enemy and their base camps. The initial Agent Blue spraying in 1961 was done by the Republic of Vietnam with the assistance of the United States as a “test” that was approved by President Kennedy. President Diem picked the targets in the Central Highland and Agent Blue was used to kill the rice and starve the rural Vietnamese and force them to move into the slums of Saigon or into Hamlets. The food denial mission was a Republic of Vietnam initiative and program. Therefore, the embedded US media paid little attention to it. The focus was always on Operation Ranch Hands defoliation program. However, the United States government, CIA and DoD provided all the Agent Blue herbicide used in the food denial program, provided the spray equipment, helped to train the RV government and military on how to spray herbicides, and assisted when and where needed. Starving your own people (RV) or even your partners (US) people was not considered a noble program. Consequently, the Agent Blue food denial story was only occasionally covered by the US media during and after the Vietnam War.

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cultural College Professors. Our team mission is to conduct soil, water, agricultural, and natural resource management scientific research; the synthesis and analysis of current and historical documents and scientific evidence relevant to the legacies of war, especially the U.S. Vietnam War; and the preparation and publication of peer-reviewed papers of interest and value to those who lead and served in the U.S. military, especially Vietnam Era veterans, their families, and the public. The legacies of the U.S. Vietnam War had impacts far beyond front-line veterans; encompassing civilian and military personnel who manufactured, transported and handled the tactical herbicides--arsenic-based Agent Blue and Agent Orange (and other 2, 4, 5-T herbicides) contaminated with the dioxin TCDD; those who came in contact with contaminated aircraft and other equipment; and the residual effects of these chemicals on southern Vietnam soil and water and the health of people who continue to work these lands for their living.

Conflicts of Interest

The author declares that there is no conflict of interest.

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