

Review and Analysis: Evaluation of the Impacts and Consequences of Using Agricultural Herbicides as Military Chemical Weapons in Second Indochina War

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Abstract

The legacy of the human misery caused by the application of the herbicides including Agent Purple and Agent Orange contaminated with unknown amounts of dioxin TCDD and Agent Blue, the arsenic-based herbicide, sprayed over the jungles, rice fields, and hamlets of Vietnam is still haunting us today. Why did this happen? Could it have been prevented? Was it necessary United States military strategy? Was it an intentional decision to inflict this blight on the enemy soldiers and the Vietnamese, Cambodian, and Lao-tian civilians, to poison their land and cause generations of harm? Alternatively, was it an unpreventable accident in the march of military history? What patterns in the U.S. government's thought process could be identified as the cause, which led to the decision to use these herbicides as tactical chemical weapons? If the introduction of herbicide (chemical) weapons had not been made, would the outcome of the Vietnam War and the Secret Wars in Laos and Cambodia have been any different? The objective of this treatise is to outline the role of world events and backgrounds and the role of the leaders, U.S. military, CIA, USDA, U.S. State Department, the U.S. President appointed Ambassadors to Vietnam and Laos, chemical companies, and President Diệm's Republic of Vietnam (RVN) government and military. Their collective advice led to the decision to use herbicides as military and environmental chemical weapons in the Second Indochina War. Were the National interests achieved by U.S. military strategy in the RVN using herbicide weapons worth the long-term environmental and human health consequences in Vietnam, Cambodia, and Laos? Did it impact the outcome of the Second Indochina War?

Keywords

Second Indochina War, Cambodia, Laos, South Vietnam, Vietnam War, Tactical Herbicides, Agent Blue, Agent Orange, Agent Purple, Dioxin TCDD, Arsenic

1. Introduction

The interconnections among world events during post-World War II (WWII), European reconstruction, the Cold War with the Soviet Union and fear of the spread of communism, the backdrop for the belligerents in Laos and Cambodia, and Vietnam conflict which became the Vietnam War tested the skills of leaders and their advisors to deal with these complex events. Starting with the United States (U.S.) President Truman, the Marshall Plan was the guide to rebuild after WWII. Its focus was on Europe. Southeast (SE) Asia, from the Allies' perspective, was to be returned to its former colonial state¹. Returning to the old order did not fit well with many of the region's inhabitants including communist Vietnamese leader, Hồ Chi Minh. U.S. President Eisenhower's administration challenges were supporting old allies and countering the communistic influence in postcolonial emerging nations. His advice to President-elect Kennedy about SE Asia was to stay wary of Laos¹ (not Vietnam). President Kennedy prided his intellect and filled his inner circle with highly intelligent advisors with the intent to make quick agile decisions. This was contrary to the methodical staff organization management style of the prior administration under General Eisenhower. President Kennedy, in his short tenure, based on his intuitive grasp of the Asian quagmire gained from a previous Senatorial visit¹ had one overriding principle for Southeast (SE) Asia, no boots-on-the-ground, only advisors.

President Johnson and his generals approached the SE Asia problem with their knowledge of what worked for WWII, massive military power. Finally, President Nixon (**Figure 1**) and Secretary of State Henry Kissinger (**Figure 2**) relied on a mix of past administrations' strategies including subterfuge. The opening of China to the West was President Nixon's primary contribution to the region. This complexity across five U.S. Administrations makes sorting through the historical details and understanding the Vietnam War and how it came to pass challenging. Poisons in the form of dioxins from the use of defoliation

¹America's position to counter colonialism by encouraging capitalism and individual freedoms during this period was overshadowed by its conflict with interventions to counter communism's message. Franklin Roosevelt's shift in his position on America's need for colonial intervention was solidified after his Casablanca trip, after being routed through Bathurst, the capital of Britain's dismal Gambia African colony. The notes by his confidant Harry Hopkins and his son, Elliot, show a chief executive with an interest in the welfare of the common man, an ability to make his observations of a commoner's life and arrive at meaningful goals that he wanted to press other world leaders to follow. While Roosevelt did not live to influence post-WWII Indochina directly, his views helped father the concept of politically independent nations versus colonies. Kennedy's actions appear to emulate Roosevelt's in this one regard. Kennedy's intuitive decision style based on a handful of pre-WWII trips to Europe for his father and the one SE Asia trip demonstrates a similar skill to observe the social lay of the land and arrive at decisions.

herbicides such as Agent Purple and Agent Orange and arsenic in the form of Agent Blue were left on SE Asia battlefields, contaminating land, water bodies, military airbases, transportation aircraft, vessels, and storage depots. The toxic trail of dioxin-contaminated herbicides leads back to American manufacturing sites with dioxin affecting civilians, military personnel, allies and enemies, contractors, and Southeast combatants and noncombatants. Information about the Vietnam War with America and its allies' troops supporting South Vietnam and the American bombing of North Vietnam was allegedly open to the public. However, the official records of secret wars in Laos and Cambodia have only recently been released for public scrutiny. Furthermore, leadership, both executive offices and embassies, had a disdain for the press and shaped how journalists accessed the battlefield. Journalists unable to observe the secret wars, were effectively used to withhold that information to the public. These military actions have become known as the Second Indochina War (**Figure 3**). Obscured within overshadowing world events during this period was the tactical decision to use chemical herbicide weapons in SE Asia during the Cold War.



Figure 1. President Nixon at a White House briefing. Photo Credit: Jack E. Kightlinger.



Figure 2. Dr. Henry Kissinger portrait. Photo Credit: White House photograph. In public domain.

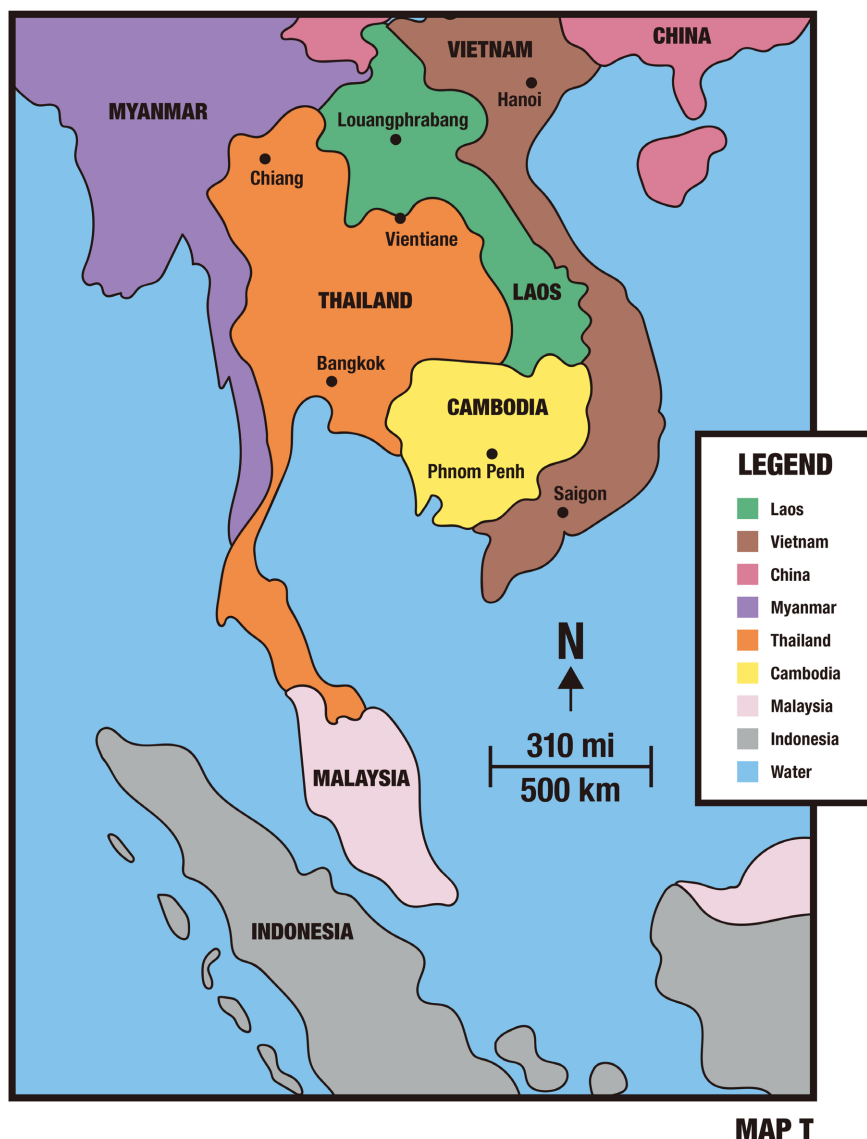


Figure 3. Asia countries including Thailand location of countries in SE Asia. Reprinted with the permission of the Editor of the Open Journal of Soil Science. Map by Cruz Dragosavac.

The objective of this treatise is to outline the role of world events, the use of defoliant herbicides in Vietnam and adjacent countries, the backgrounds and diverse visions of leaders of the U.S. military, CIA, USDA, U.S. State Department, the President appointed Ambassadors to Vietnam and Laos, chemical companies and President Diệm's RVN government and military. Their collective advice and requests led to the decision to use herbicides as a military and environmental chemical weapon in the Second Indochina War. Were the National interests achieved by the U.S. military strategy in the RVN by use of chemical herbicide weapons worth the long-term environmental and human health consequences in Vietnam, Cambodia, and Laos? How did this decision impact the outcome of the Second Indochina War?

2. Findings

2.1. Timeline Review of Consequential World Events

The Consequential World Events **Table 1** below reviews the timeline of events leading up to the Vietnam War and the decision to use chemical herbicide warfare in the Vietnam War. The decision to use these defoliates was made early in the Kennedy Administration.

Table 1. Timeline review of consequential world events.

YEAR	<i>CONSEQUENTIAL WORLD EVENTS Leading to the use of Agent Orange in Indochina</i>
	Truman Doctrine – Containment Strategy states the need to invest in foreign governments’ military and economic aid to prevent communism. Then Under Secretary of State Dean Acheson first articulates the containment strategy.
1947	March 12 President Truman stresses the severity of the crisis to Congress, the need to prevent the spread of communism, and a \$400 million aid request for Greece and Turkey [1]. April 7 President Eisenhower delivers the Cold War “Domino Theory” speech [2] April 26 Geneva Peace negotiations start [3]
1954	May 7 French military defeat at Dien Bien Phu by Viet Minh Communists [4] July 21 Geneva Peace Accords conclude, 14 countries sign non-binding agreements, North and South Vietnam divided at the 17 th parallel by global elite countries.
1955	Southeast Asia Treaty Organization (SEATO) was formed to protect against communist expansionism. [5]
1956	South Vietnam President Diệm with United States backing delays planned elections in Vietnam. [6]
1957	October 4 USSR’s Soviet space program launches <i>Sputnik, the first Earth satellite</i> [6]
1959	Secret War on Laos and Cambodia initiated by US government (CIA). (Figure 3). [7]
1960	September Nikita Khrushchev, 1 st Secretary of the Communist Party of the Soviet Union meets communist leader Fidel Castro, Prime Minister of Cuba in Harlem, New York at United Nations meeting. [8]
1961	March Operation Millpond, sponsored by the CIA, approved by President Kennedy in March April 13-17 Bay of Pigs, US, and Cuban exiles invasion to overthrow Castro fails. May Operation Millpond is canceled by Kennedy [9]. Operation Millpond would have introduced airpower early into the Laotian Civil War. Final aircraft withdrawal, August, Thailand to Okinawa. May U.S. V.P. Johnson visits five SE Asia counties including South Vietnam. Three days are spent with President Ngô Đình Diệm. Communique states the United States recognizes its responsibility and duty...defense of its liberties against...Communism. VP Johnson consults with President Diệm on the establishment of the United States-Vietnamese Combat Development and Test Center (CDTC) in Saigon [10]. CDTC’s first herbicidal tests were designed to determine, if manioc, a food staple of the Vietnamese Communists could be destroyed; and whether the chemical compounds could be successfully used as defoliants to increase forest area visibility. August 13 Berlin Wall. The German Democratic Republic begins building the wall dividing Germany and the Soviet Union [11]. October Chemical herbicide test shows Vietnam jungle defoliation possible. Opens new war strategy. President Diệm hand selects, for the second test, a rice field in the Central Highlands, to test if herbicides can destroy rice to prevent food to Vietnam Communist soldiers. American Advisors voice their concern this will cross the Protocol chemical-biological line [12]. November U.S. President Kennedy authorizes, with advice and the request of the U.S. military, the U.S. Ambassador to the Republic of Vietnam, and South Vietnamese President Ngô Đình Diệm, the use of defoliant missions in Vietnam [6]. December U.S. President Kennedy makes the U.S. Ambassador to Laos the de facto commander of U.S. military and paramilitary operations within the <u>Kingdom of Laos</u> [13].
1962	May 16-July 23 Geneva Peace Conference, (Second Geneva Accords) Laos becomes neutral/coalition government. October 16-29 Cuban Missile Crisis, the confrontation between U.S. and Soviet Union [14].

2.2. World Events Impact

The background and beliefs of the leaders and their advisors during the Cold War period played an important role in what they believed was effective policy. Belief in the “domino effect”, criticized as sloppy thinking today, was clearly at the forefront of Western leaders’ thinking during the Second Indochina War. Some authors say the Kennedy Administration was trapped by fear of troop escalations, confrontation with the Soviets, and political fallout from public failure. Other authors were impressed with Kennedy’s charisma and personal style. Kennedy often acted as his own Secretary of State writing memos for policy and directly contacting staff and leaders to gather information or to negotiate [6] [7] [10].

Kennedy’s administration in 1961-62 had to make an extraordinarily high number of crisis decisions. Early in 1961 was the Bay of Pigs, followed by the Berlin Wall that summer, and the Cuban Missile Crisis in 1962. Interspersed within these events were the United States’ decision to send the first 500 military advisors to Vietnam, U.S. Vice President Johnson’s May 1961 visit to Saigon, and the announcement of the National Moon mission that spring. Evaluation of the Indochina programs was made Fall of 1961 and essentially the “die was cast” when South Vietnam President Diệm participated in the discussion of using tactical herbicides and selection of the site location for the second herbicide trial. This became his first food crop destruction and defoliation test.

The year after this first food crop destruction and defoliation test, U.S. military advisors routinely participated in Army of the Republic of Vietnam (ARVN) operations that destroyed food crops. One advisor of notoriety was Collin Powell [15]. Powell’s military efficiency report it was noted, that Powell had displayed “determination, physical stamina, and professional competence” that contributed to his unit’s killing of “many Viet Cong” and the destruction of enemy “supply bases, crops and livestock.” evident in his willingness to participate in the torching of South Vietnamese villages, the slaughtering of livestock and the destruction of farm fields. Collin Powell eventually became the U.S. Secretary of State, National Security Advisor, and Chairman of the Joint Chiefs of Staff.

Kennedy’s judgment to never employ ground troops in Indochina was based on a single encounter (a visit as a Senator) ten years prior [16]. Kennedy developed his skills of observation and insightful judgment through his extensive travel to Europe while his father was ambassador to England. These insights are reflected in his Harvard Thesis *Why England Slept* [17]. Kennedy’s inner circle of advisors was a small group of elite thinkers. The odds of his rethinking the use of chemical weapons in Vietnam might have been favorable based on Kennedy’s intuitive preferences if someone in his administration military or CIA had had both the knowledge of the potential environmental hazards of these chemicals and the courage to speak up. This elite group did not know of the hazard or were not concerned.

During this critical stage in deciding whether to use the new chemical weapon system, herbicides to defoliate cover and destroy food production combined with bombing (**Figure 4**) and/or ground attacks (**Figure 5**), a process to ensure the best outcome in policy selection was needed. Instead, this administration, driven by a strong personality, short political timelines, belief in America's technological and scientific capability, and trapped in the mindset of the communism domino theory, the herbicide solution seemed quick, cheap, and simple. The inner circle advisor approach used to develop policy can also be viewed as destabilizing the normal internal government organization structures. These institutional structures would have allowed specialized staff to point out in more strongly worded memos the potential hazards of chemical herbicide warfare and give scientists the time needed to analyze and model potential outcomes likely to occur. Enabling leadership choices with a higher probability of success than just what leadership wished for.



Figure 4. B-52s bomber dropping bombs. Photo Credit: United States Air Force.



Figure 5. ARVN troops entering Cambodia. Photo Credit: Defense Department Employee or soldier. In public domain.

2.3. The Laotian Ambassadors

Five Ambassadors were assigned to Laos 1960-75 (**Figure 6**). Three, all officers, had WWII combat experience. One received 7 distinguished Flying Crosses and 21 Air Medals. Another was at D-Day and participated in Okinawa invasion. Two Ambassadors went on to higher positions of influence for SE Asia in the Department of State [7] [18]. The sixth, an Ambassador at Large, W. Averell Harriman, a notable SE Asia policy maker until 1969 had experience back to FDR as Franklin's Lend-Lease organizer and Ambassador to Moscow [13].

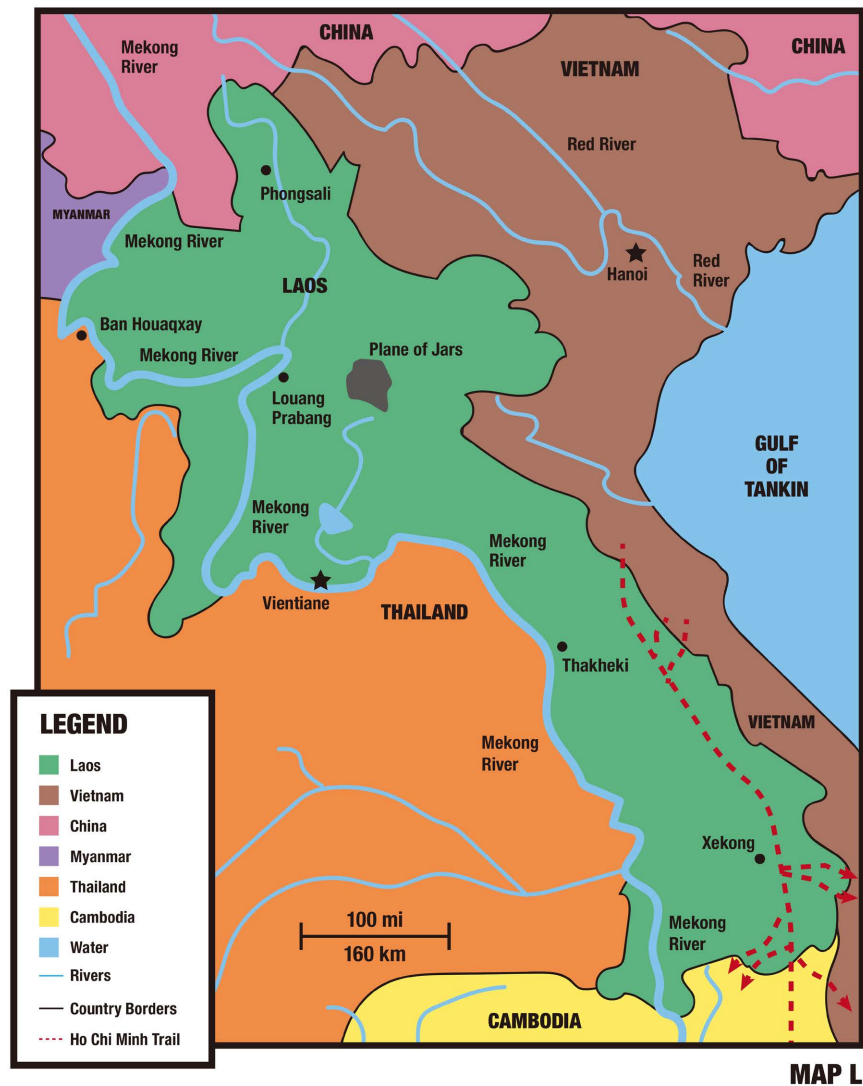


Figure 6. Laos map of Hô Chi Minh Trail location. Hô Chi Minh Trail spanned 15,000 km with 16,000 km of parallel and side trails. Reprinted with the permission of the Editor of the Open Journal of Soil Science. Map by Cruz Dragosavac.

These men would have not have bothered to try to understand the complicated herbicide formulation of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) with unknown amounts of dioxin TCDD. However, their beliefs and opinions did influence senior policy makers. Only a

few of America's statesmen, would only briefly mention dissents viewpoints as opposed to their contemporaries, military first and only option. Averell Harriman's comments in 1961 stood out.

Harriman, an elder statesman, with extensive experience in Roosevelt Administration during WWII, stated during the Kennedy administration that the Indochina region was not important to America's long-term interests. Despite this dissention, he strongly worked for a coalition government in Laos and advocated for a neutral Laos. However, holding with his opinion of Indochina and America's interests, he felt all the Indochina governments were better off if they remained neutral. Once the second Geneva Accords, 1962, were completed, he felt that the Viet Mieh would continue to use the Hồ Chin Minh Trail. Few other statesmen were as outspoken.

The telegraph cables coming out of Saigon had far more influence. Mr. Frederick Nolting, Ambassador to Vietnam 1961-63 was instructed to get on Diệm's wavelength rather than influence RVN policies with pressure, as his predecessor did [19]. The Ambassador oversaw funding to increase military strength by 20,000 and would have been responsible for continued support of the Rural Community Development Program [20]. Two dozen Agrovillage villages, founded under his predecessor's tenure, were absorbed into new CIA supported RVN-sponsored Hamlets and the food denial program. The food destruction program used the same herbicides as the Hamlets food denial but was not connected with moving villages into secure hamlets. The new goal for villages was to increase their numbers to 8600. The hamlets were intended for Diệm's relocated peasants, who were assumed to be under Vietnamese Communist influence. These villagers did not support his policies. However, only 1000 or so villages were completed. The funding for peasants' compensation never reached them, but rather was siphoned off by corrupt RVN officials and Diệm's family [20]. After the first year, Ambassador Nolting's outlook was shared in a speech made in Saigon. He said, "*What a marvelous transformation would take place in this country if all those who criticize their government would decide to work with it and for it.*" The Asia expert Stanley Karnow, in his 1983 book "Vietnam: A History," contended that the statement was "*an astonishing display of naiveté*" and that "*Mr. Nolting had carried out a policy of appeasing Mr. Diem*" [21]. This included vegetation defoliation and the hamlet food denial test trials.

Neither Ambassador Harriman nor the current Laos U.S. Ambassador was mentioned in any of the CDTC planning and herbicide test selections or results assessments [6] [10] [13] [19]. The South Vietnam President's insistence on the food denial herbicide test was telling [19]. This insight into Diệm's lack of empathy for his constituents (*denying food to your own people or your partner's people is not a noble mission*) should have been glaring to American diplomats and military leaders. Other indicators which should have been observed were the civilian hardships resulting from the ARVN implementing the May 1959 notorious Law 10/59 [20]. 1959, Diệm passed a series of acts, collectively known as Law 10/59, that made it legal to hold suspected Communists in jail without

bringing formal charges. The Central Intelligence Agency helped identify those who sought to bring the government down. Thousands were arrested. While this information was reported by the media, these accounts were not documented in formal reports. The accumulation of these government policy failures and Vietnamese displeasure eventually gave Harriman a hearing among policymakers. By 1963, Harriman was involved with the White House with avocation for an internal coup [6] [13]. Many military leaders, other Department of State staff, and Ambassadors such as Nolting, however, remained Diệm supporters. In hindsight, a better institutional structure to assemble, analyze, and forward updates on the herbicide program recommendation to the leadership could have made a difference. However, by 1963 the opportunity to change the course of the herbicide program destiny had nearly passed.

The Laos American Ambassador's authority to direct military operations was exceptional [7] [13]. This authority even came into play in selection of missions over the Hồ Chí Minh Trail in Laos. When defoliant missions started to be coordinated with bombing missions the U.S. Laos Ambassador in charge advocated the use of lower-cost prop plane versus jet. This seems an unusual use of a senior diplomat's time. However, possibly was more beneficial in other situations.

The Ambassadors, assigned to these Indochina posts' lack of experience or training in the local culture may not have been recognized as a disadvantage, since they had successful military and/or business experience, but limited recommendations to only military options. Considering the tumultuous times, this can be understood. The militaries' first contact with Hồ Chí Minh was through the Office of Strategic Services (OSS), the United States' covert intelligence arm in WWII [22]. The use of this "minor" contact was never considered. Not until academics started to study SE Asia did the nuances of the various groups emerge. John Sikora, one such academic [23], determined that SE Asians' desire for freedom was not just to overthrow the 150 years of French colonial rule, but a long 1000-year history of loafing overlords. This detest of outsider control was the underlying drive by Hồ Chí Minh, General Võ Nguyên Giáp and later General Lê Duẩn for an independent Vietnam².

²American experience which developed a similar strong desire for independence can be found in our revolution. The Scotch-Irish frontier settlers had left their overlords, after hundreds of servitude years, for a new life in the southwest Virginia and northwest Georgia mountains. As subsistence farmers and hunters their only trust was in kin and their immediate neighbors. They had remained aloof of the 1780 events along the east coast until threaten. British commander General Lord Cornwallis assigned Major Patrick Ferguson to recruit from the Carolinas. Ferguson, meeting resistance sent the settlers an ultimatum to quit opposing or "he would march his army over the mountains, hang their leaders, and lay their country waste with fire and sword" The American frontiersmen reacted. Soon 400 mounted Virginia militiamen headed south into Carolina. Joined shortly by another 600. In three weeks, Ferguson lay dead on the Kings Mountain battlefield. 90 percent of his force dead, wounded, captured or missing. The British General Sir Henry Clinton Overall commander stated "The first link in a chain of evils that ended in the total loss of America". Overmountain Victory National Park Service U.S. Department of the Interior, 2024 brochure.

Diplomats' failure to recognize the similarity in shared value 'love of independence' by the common man wither in SE Asia or America resulted in a missed opportunity to go a different route with effective development programs.

2.4. The United States Military

The U.S. Military advisors at the Saigon and Vientiane United States embassies were surely adequately competent to have earned their positions, but their opinion of the enemy's capability as a low-level foe was telling. This was noted in the literature review more than once. The American military held the Vietnamese Communists as warriors in low esteem and expected they would be easily defeated. It should have been clear to their State Department planning members that their military counterparts had not learned the lessons of the French military experience.

The French defeat at Dien Bien Phu disrupted President Eisenhower's hopes for Indochina. America had supported the French at Dien Bien Phu with 60 cargo aircraft. Several had been damaged and two Americans had lost their lives [4]. The French had miscalculated.

The French battle plan was simple. To destroy the enemy force, the French plan was to send in paratroops to entice the enemy to commit a large force in a quick attack. This had been accomplished the year before. The November 1953 battle, gave the French a victory at Nà Sản. Dien Bien Phu was selected because it would block the roads into Laos. Na Sản's terrain was different from the lay of the land around Dien Bien Phu. The French military staff objected to the Dien Bien Phu plan when first presented, because of the different terrain, but to no avail. Na Sản's position had been on a steep hilltop, resupplied via an airfield; however, Dien Bien Phu's road junctions were in a valley. The Viet Minh's frontal attack up the Nà Sản hillside had been soundly defeated. The French General hoped to do the same on a larger scale in the open valley at Dien Bien Phu [4].

In March 1954, 9000 French paratroopers arrived at Dien Bien Phu. This valley with a rice bowl shape was surrounded by a ridge with steep hills and a triple canopy jungle 440 km from Hanoi or 1050 km Nanning, China, or 700 km from Vientiane, Laos. Despite his staff's warnings of the enemy possessing the high ground, the French General saw the remoteness as his advantage. He could fly in all his needed supplies and replacements while the enemy's resupply was limited due to distance and difficult terrain [4]. The Viet Minh nearly took the bait.

The Viet Minh General Giáp hoped to catch the French before they were fully prepared. His original plan was simple, to stage a three-night and two-day attack as soon as forces were assembled. However, before he attacked the Viet Minh General observed the French positions had created a large kill zone between three French emplacements. The Viet Minh General Giáp reconsidered his plan. The new plan was audacious in its demand to lug howitzers, cannons, and anti-aircraft guns through the surrounding jungles and up the hill slopes. These weapons were emplaced on the hillside, inside dugouts with camouflaged casemates and some were within tunnels dug through the hillside. The Viet Minh were meticulous in their attention to gun alignment on selected targets. The preparation took three months, but the French obliged by waiting for the attacks.

The Viet Minh learned how to resupply through the difficult terrain during the Dien Bien Phu battle. The French were eliminated after the fall of Dien Bien Phu. When Laos became a neutral nation, this neutrality reduced any other ground threat, to the Viet Minh. As the campaign for Vietnam continued, the U.S. Navy closed the sea resupply routes (**Figure 7**) to Vietnam. The Hồ Chí Minh Trail then became a viable alternative. North Vietnam, using the resupply skills learned in 1954, continued infiltration now along the Trail of advisors, troops, and supplies to the Viet Cong insurgency in South Vietnam. Rather than three months to prepare for the Dien Bien Phu battle, the difference was a three-year program would have to be the battle plan to attack Saigon.

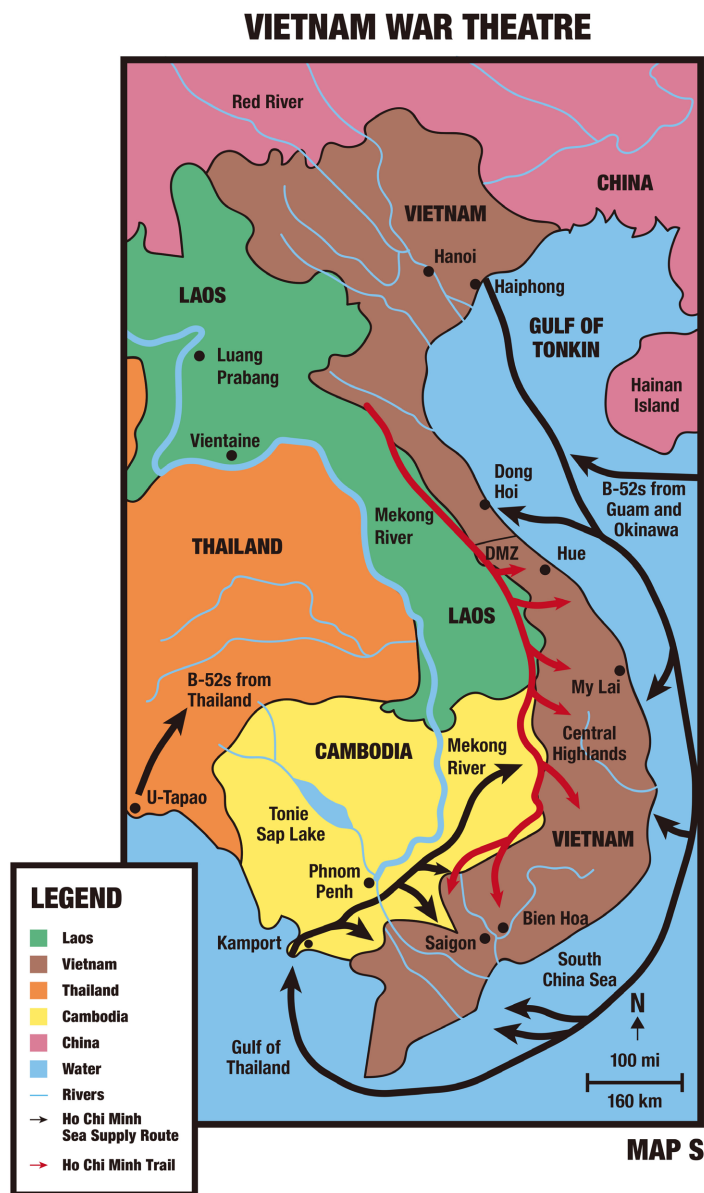


Figure 7. Ho Chi Minh Sea supply routes and the Hồ Chí Minh Trail in Laos and Cambodia. Reprinted with the permission of the Editor of the Open Journal of Soil Science. Map by Cruz Dragosavac.

An overlooked, but important U.S. military leader was General Curtis LaMay. Serving as the Air Force Chief of Staff 1961-65, he advised aggressive bombing to resolve the Cuban missile crisis and early intensive bombing of North Vietnam. Both military solutions were turned down, by Kennedy and Johnson as too provocative with the potential to widen the conflict; the near sole use of air power (**Figure 4**) to attack the Hồ Chi Minh Trail had all the earmarks of General LaMay. The designer of the firebombing of Tokyo, during WWII, a more destructive attack than Hiroshima, LaMay was a believer in air power and advocated its use as the dominant solution to Vietnam. He is credited with the quote “*Bomb them back into the Stone Age*”. The use of chemical defoliants fits with this destructive mindset.

When the Viet Minh encountered deterrence in the form of CIA-backed Laos irregular fighters and Vietnamese ARVN forces, and the U.S. military use of defoliants and bombing of the Trail, the North Vietnam Army (NVA) simply added more time, plus regular NVA troops with support labor battalions to their battle plan. In the end, when the United States under the Johnson administration started Operation Rolling Thunder, the damage from the bombing of North Vietnam became extensive. Up to 65% of the North Vietnamese fuel storage was destroyed. Still, while this was significant, it would not have been enough to prevent a tenuous foe from reprioritizing resources to continue the fight. The Tet offense in 1968 demonstrates that point. Only on-the-ground forces could prevent repair and rerouting around each barrier created by the bombing and defoliation by chemical weapons would have been effective in stopping the resupply on the Trail. This military doctrine method to keep barriers created by the bombing closed, at the time was called overwatch. Simply soldiers with machineguns keep the barriers from being repaired. Simple, but logistically challenging to support on the Hồ Chi Minh Trail. Since Laos was neutral and the U.S. did not want to tell the American public of its secret war, ground forces were not considered part of the military alternative plans made in 1961 [6] [7] [13]. Because of the domino theory mindset, other non-military alternatives were not considered.

Part of the possible oversight to close the resupply route earlier was initially the Trail was not used for Viet Cong resupply into Vietnam until the Navy cut the sea resupply routes (**Figure 5**). The indiscriminate employment of the food destruction program fit into Diệm’s desire to eliminate his competitors whose bases were rural. He believed destruction of local food would minimize rural support. Thus, the request for expansion of United States-funded initiatives such as the vegetation defoliant, food crop destruction, and Hamlet food denial programs. The desire to use America’s technology and economic advantage to avoid committing troops led to a positive evaluation of this crucial phase in the chemical herbicide weapons program. However, just because the first test to destroy the rice fields in the Central Highlands was successful, that did not necessarily affect the Viet Cong or later the NVA soldiers. The planning staff’s reliance on

the British effectiveness in Malaysia with their first use of defoliants was faulty. Destroying the crops in that remote jungle region affected everyone since the area in Malaysia was already food poor. Harriman [13] pointed out to Saigon that Indochina was food rich. The CIA estimated the enemy needed only two percent of Vietnam's crop for food. August 1961 military planners for the CDTC program proposed an \$80 million defoliant program centered on the Mekong Delta. It would cover 50 percent of the country. It was not considered, but a revised program estimated at \$6 million to cover ten percent of the countryside was proposed. The final Operation Ranch Hand defoliant and crop destruction program in eight years covered 20 percent of the country [6] [7] [13]. Why was the program not debated more? South Vietnam was food-rich.

Destruction of the one rice field in the Central Highlands would affect the farmer and his family. However, the Vietnamese Communist insurgents and NVA soldiers could be fed by simply having the trucks, now empty after off-loading weapons and ammunition, stopover at Cambodia's rice fields and load up with bags of rice (Figure 8). For the more remote section of the Trail in Laos and Cambodia (Figure 9), the bicyclic battalions (Figure 10) would have been able to accept two more ten-kilo bags on top of their existing loads. Unless 98 to 99 percent of the rice crop was targeted and the resupply routes blocked, to ensure the enemy was starved, an effective outcome was not likely. This level of analysis was not effectively communicated to decision-makers by planners. The plan to use herbicides to destroy food crops should never have been offered for consideration by the military and CIA staff. The leadership should not have been given this option. The military and Ambassadors' like-minded-thinking to appease the Diem regime was faulty.



Figure 8. Cambodian civilians bag up captured North Vietnamese rice. Photo Credit: William H. Hammond. The U.S. Army. In public domain.

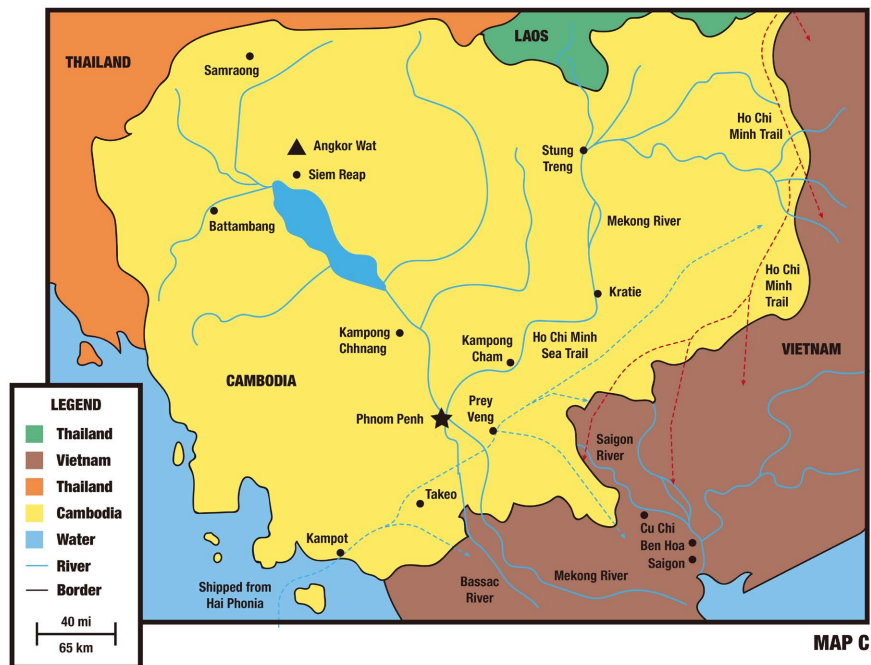


Figure 9. Hô Chi Minh trail pathways through Cambodia to Vietnam. Map by Cruz Dragosavac.



Figure 10. PAVN troops in the Mekong Delta and along the Hô Chi Minh Trail. Photo Credit: In the public domain.

2.5. Leaders, Journalism, and Ethics Missed the Environmental Hazard of Dioxin TCDD

For 40 years, our U.S. leaders followed the Truman Doctrine of using American military and economic aid to direct a communist containment policy. This ended with the fall of the Berlin Wall and the collapse of the Soviet Union. Each leader was not necessarily confined to following his predecessor. President Richard Nixon with Secretary of State Henry Kissinger initiated a more open policy with China, participated in peace talks with North Vietnam to stop the bombing, and after persuasion by scientists rescinded the use of Agent Orange

and other tactical herbicides. This reflected a different approach and was the real turning point in the Second Indochina War [24]. President LB Johnson tried to create conditions for peace talks by ratcheting up the military effort combined with the defoliate and food destruction program. However, in neutral Laos, there were no effective blocks across the Hồ Chi Minh Trail (Figure 11). The North Vietnam leadership had extended its long plan, a strategy, from three years to six years. Using the Hồ Chi Minh Trail, enough supplies and labor were moved along the Trail to ensure a world media event would be staged by the Tet Offensive. This was nine months before the American elections. This coordinated strategy included their negotiation methods, delay by postponements, misdirected time spent on nonproductive topics as the shape of the table, and confrontational by refusing to work with Harriman, and waiting for Kissinger to take over at the Paris Peace Conference [13].



Figure 11. The Hồ Chi Minh Trail through the mountains and jungles of Vietnam, Laos and Cambodia. Reprinted with the permission of the editor of the Open Journal of Soil Science.

Harriman, during the Johnson administration in 1968, was Head of the U.S. Delegation Peace talks with North Vietnam in Paris. Unknown to the United States, the North Vietnam delegates, to strengthen their position with a battlefield victory, delayed the talks with preliminary discussions. This supported the Nixon campaign. In turn, the Nixon campaign, as documented in H.R Halde- man's campaign aide notes, also aided the delay efforts through indirect pressure on the RVN President Thieu. The result was obstructionism first led by North Vietnamese communist delegate delaying the administration's efforts from May to October. Finally, when an agreement was made to stop the bombing as a con-

dition to officially start the talks, originally set for May, the date was slid to November 2, the U.S. Presidential Election Day. Then the Nixon campaign intrigues into the peace process may have caused the additional delays, when Saigon protested that a round table meant that everyone was equal implying that the National Liberation Front (better known as the Viet Cong delegation) was equal to the South Vietnamese government. By not agreeing on the shape of the negotiation table, the outcome of starting the talks was delayed until January 17 when all U.S. Democratic staff had to vacate. After January 20th, the day Nixon was to be sworn in, the talks resumed [13] [25] [26]. North Vietnam had a complex strategy whereas (Figure 4) America's strategy, while heavy with money, had only one card, its bombing. Defoliation using Agent Orange and crop destruction and hamlet food denial programs using the arsenic-based Agent Blue were part of the chemical weapon system supporting the bombing.

Key to the U.S. leader's plans was shaping positions with journalists to selectively guide release of information. The results of the Tet offense were well covered. However, the coverage of military actions in neutral Laos was hampered by distance and the "official" absence of soldiers on the ground. Thus, no journalist could easily report what was happening in neutral Laos. In retrospect, it was during the original planning to use herbicides (Air America) under CIA management in neutral Laos to impede incursions of Viet Minh, supported by North Vietnam, into Laos without the involvement of American Troops, the secrecy fit the Kennedy criteria, no soldiers on the ground [13] [19]. The secret was safe from embedded reporters.

While not an embedded journalist, this author [27] had a similar experience as a consultant for a State Department Reconstruction Team in Iraq. I found when soldiers were on the ground, civilians could generally find a way to visit outposts. Getting a ride in an armored vehicle became common once I discovered how to work rides. Air movement was favored, but lifts were sporadic. Needing to have eyes on one of our rehabilitation contracts, but not able to get a helicopter lift, I obtained a night ride on the provisions supply truck to an outpost near the Iraq/Iran border. I observed the Civil Affairs Team and interviewed city leaders about the contract with a District Agricultural Ministry official and farmers. Having eyes on the ground is important [27].

In 1961, the decision to use herbicides as part of a weapons system was made, and the planners could not have foreseen the future extent of the military spray campaign (Figure 12). One-fifth of the countryside would be sprayed (Figure 13). Nor were the planners in Saigon and Vientiane likely informed of the dioxin TCDD contamination problem by the U.S. government which suppressed the public release of biological information from the scientists (such as Dr. Arthur Galston) [28] who were aware of the hazard at that time and trying to stop the spraying. Years later, after many dioxin contamination accidents journalist investigators began to publish that the herbicide manufacturers were aware of the dioxin contamination as far back as 1949 [29] [30] (Figure 14).

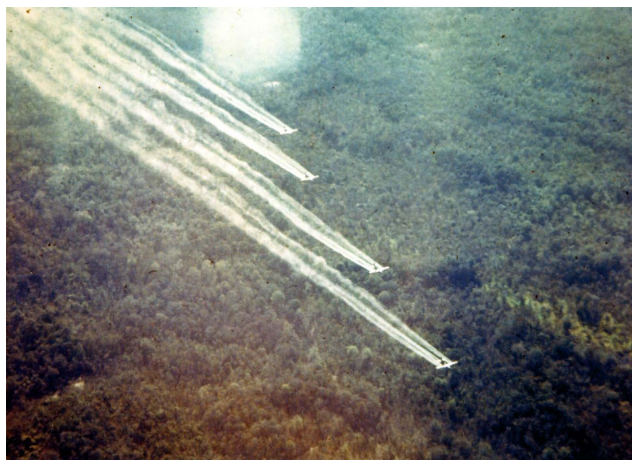


Figure 12. C-123s spraying tactical herbicides in formation over southern Vietnam in the 1960s. Reprinted with the permission of the editor of the Open Journal of Soil Science.

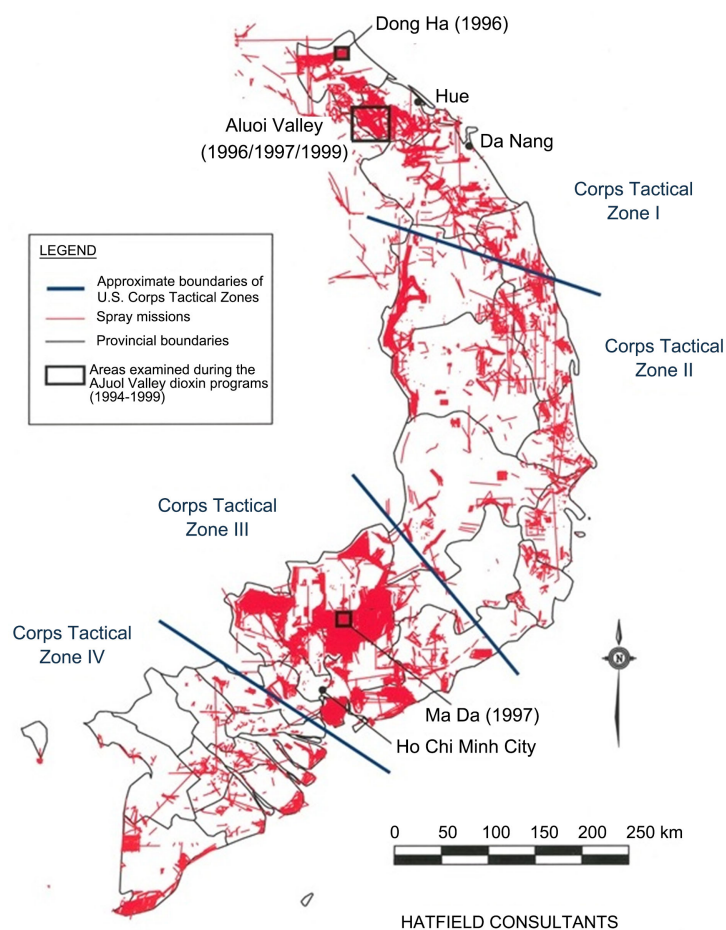


Figure 13. Tactical herbicides spraying mission zones in South Vietnam by the U.S. Air Force Operation Ranch Hand. Numerous spray missions require on the most remote regions. Dioxin impact in hot spots as A Sau Valley and Ma Da are still visible more than 55 years later. Overlay of 1994-1999 dioxin examination areas. Reprinted with the permission of the Editor of the Open Journal of Soil Science.

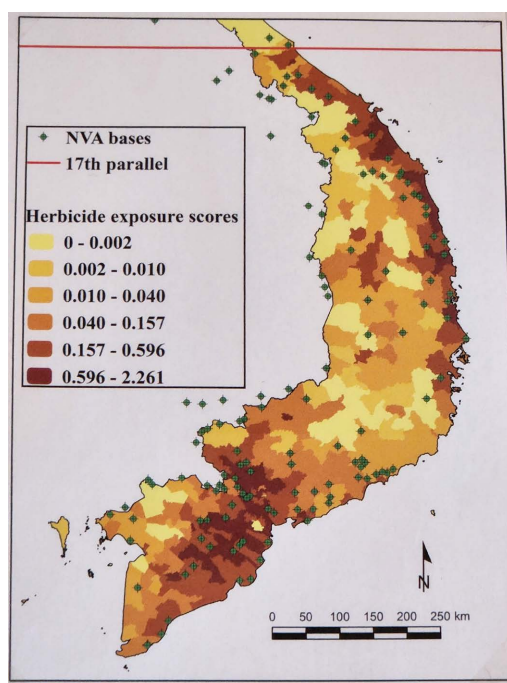


Figure 14. Distribution of herbicide exposure scores and location of North Vietnamese Army bases. The modified figure shows the distribution of herbicide exposure scores reflected chloracne injuries and human ailments with dioxin TCDD and locations of NVA bases. Reprinted with the permission of the Editor of the Open Journal of Soil Science.

In 1949 a boiler [30] [31] which was used for the production of 2,4,5-T with unknown amounts of dioxin TCDD exploded at a Monsanto chemical plant in Nitro, West Virginia affecting 120 employees with skin injuries (**Figure 15**) and (**Figure 16**). At another 2,4,5-T chemical plant explosion in 1953, listed as a BASF German plant in Europe, workers reported skin chloracne injuries. Formal memos by research scientists in 1955 and 1957 reported concerns for these injuries and pointed out linkage to a by-product agent labeled “dreaded substance X”, today known as dioxin TCDD [12]. The Monsanto chemical companies’ management never pushed for internal investigations [30]. Nor did Monsanto share this information and concerns with the government before herbicide tests in Indochina. This communication failure points to more than an ethical dilemma. Considering our government had its biological and chemical research ongoing, at Fort Detrick [31], these incidents and concerns should have been known by their scientists and reported to the government for public notification. However, the public only learned about dioxin TCDD toxicity approximately twenty years later. Our military and CIA research facility at Fort Detrick, MD, funded for biological warfare agent studies in the mid-1950s was ideally located for an effective line of communication between industry and the executive office in Washington DC. Institutional structure, between Fort Detrick and the Executive Office to effectively communicate, was lacking. Why? The environmental law, Clean Water and Clean Air Act, directing studies before any federal under-

taking was not enacted until 1977's. Earlier EPA Acts as NEPA in 1970 did not address pesticides, nor did the Toxic Substances Control Act of 1976 which excluded monitoring and reporting of pesticides, even Presidential Decree No 1586 which required broad environmental impact statements was limited to only U.S. territories. Laws to protect the public from industrial hazards took nearly a decade to write and another to implement.



Figure 15. The North American locations of the eight Agent Orange chemical manufacturing plants, the primary Agent Blue chemical manufacturing site and the two Ports on the Gulf of Mexico where tactical herbicides were loaded on ocean-going ships. These nine herbicide plants could not meet peak military demands so U.S. agricultural shipments were re-purposed for military use. The domestic and foreign agricultural needs were met by foreign suppliers. Reprinted with the permission of the Editor of the Open Journal of Soil Science. Map by Cruz Dragosavac.



Figure 16. A black and white photograph taken in the 1950s at Monsanto Chemical Plant in Nitro, West Virginia. Photo Credit: Terry Humphreys. Pinterest. Reprinted with the permission of the Editor of the Open Journal of Soil Science.

Control of the flow of information by DoD and CIA from their Fort Detrick scientists to government decision-makers is key to understanding how the defoliant and food destruction program happened [29] [31]. Saigon overshadowed the outlying spheres of influence from Vientiane. The strong, outspoken individual was favored over the methodical deliberate one. Ambassador Nolting and General Maxwell Taylor, military advisor to Kennedy, were like-minded that a military solution was needed in Vietnam, not a political one [32] [33] [34]. This fits with President Diệm's wish. Both remained Diệm supporters even when Washington had given up on President Diệm in 1963. Pressuring Diệm to make a series of political, economic, military, and social reforms, designed to improve the counterinsurgency effort failed. He would not use U.S. aid and military support to make desired reforms. By August, Kennedy's inner circle was considering ways to change that regime. President Diệm was assassinated in 1963. Who sanctioned the killing of the South Vietnam President and his brother? If the U.S. government is responsible, the documentation is still officially buried in CIA files. It was discussed in the Kennedy administration, with U.S. strategic planners stating, "*There was not anyone else they believed could run the country*", but Diệm was failing to implement reforms that could have appeased his constituents. [19]. What happened?

America had few specialists in SE Asia [6]. A few were posted or stationed there for two years or less. Intelligence gathering started in WWII with the U.S. Office of Strategic Services (OSS) [22]. The voluminous reports starting in 1943 through the end of the Vietnam War while detailed were based on observations by men in the country for possibly a year and only knew French. It was only during the OSS posting in Hanoi that the Americans had the opportunity to learn about Hồ Chí Minh. Knowledge and information about Vietnam President Ngô Đình Diệm were deficient. He grew up in a rich Hanoi family, formally educated. He spoke in a dialect different from the average Saigon person and peasants could not understand him. Diệm, a catholic, did not relate well to rural Buddhist people in South Vietnam and did not have their support. Since the rural area did not support President Diệm, they became the focus of the Strategic Hamlet Program strategy to prevent villagers ostensibly from feeding the enemy coming down the Hồ Chí Minh Trail and presumably to make it easier to protect them. The strategy's result forced villagers to move away from their ancestral homes, fields, and markets they knew well, to live near cities in poverty. After the Mekong Delta and Central Highlands rice crop was destroyed using Agent Blue, the arsenic-based herbicide, the peasants were moved to either a Hamlet, designed by the U.S. Dept of State and administrated by RVN, or the slums of Saigon. At this critical juncture, what happened; McGeorge Bundy, special assistant for national security affairs, appears to have had a large voice in policy decisions affecting SE Asia. Bundy was efficient shaping and execution these executive programs [6]. Our government and military supported President Diệm's hamlet strategy and provided the Agent Blue required to destroy the rice crop. Officially it was the RVN government, and not the U.S. military, that led the

food denial program. The U.S. military focused on Agent Orange use and jungle defoliation [30].

In these circumstances, accurate information was critical. Being able to retrieve it years after being reported and incorporate it into functional policy was challenging. How could a scientist or industrial businessperson with knowledge of the environmental hazards of dioxin TCDD and arsenic communicate that information and put it into the policy process? Still, that is the job of policy planners, and they failed in part because they did not understand the Vietnamese culture.

While information about the herbicide contamination and potential hazards of dioxin was not well understood in 1961, it should have been shared with leaders. If it had been shared, the information may have affected the decision to embrace herbicides as a new chemical weapon. However, the Kennedy administration rather than following a deliberate, methodical planning process wanted agility and flexibility for quick decisions [6]. The staffing for the decision to use defoliants was decentralized with the CDTC in Saigon and the decision to use was made within 30 days. Knowledge of dioxin TCDD contamination and human effects gained by the chemical industry, medical doctors, and scientists after the 1949 and 1953 explosions at 2,4,5-T chemical plants in West Virginia and Europe might not have been known, eight to twelve years later by the CDTC testers, Ambassadors and Generals as a part of the briefings given to President Kennedy in 1961 and 1962 before President Kennedy approving the testing and use of agricultural herbicides during the Vietnam War. The U.S. Air Force and CIA demand for defoliants greatly increased to secure bases and interdict border incursions. The increased demand resulted in changes in Agent Orange production methods. The resulting higher temperatures [29] [30] created even more dioxin per unit, greatly increasing its toxicity. This appears to make the decision to use Agent Orange for 20 percent of the countryside and require greater production, an apparent accident. The decision was based on limited (less than all the available) facts. Thus, a costly miscalculation [31]. One that had great consequences and has left an ongoing legacy of human misery and environmental harm [34] [35] [36]. Nevertheless, the decision was made to only spray the herbicides on the enemy under tight application control.

The food destruction program [32] [35] [36], pushed by President Diệm in the early 1960s, led to the use of cacodylic acid an organic arsenic [37]. Organic arsenic is on a special health hazard substance list and should not be confused with naturally occurring organo-arsenic compounds which while less harmful can convert to more hazardous compounds. Kennedy's advisors discouraged this food destruction phase (use of Agent Blue to kill the rice before it matured) of the program [37]. Both Kennedy and Johnson should have had human health information. Dioxin TCDD was known by the medical community as a carcinogen when the decision was made in October 1961 [32] [35] [36] to use herbicides in South Vietnam. That herbicide use decision, regardless of how spun, was to be implemented with special care but did not reduce the hazard to U.S. soldiers and

the South Vietnamese, Laotian, and Cambodian people. President Kennedy's decision to use herbicides as a military and environmental chemical weapon was hard to accept by many biological scientists. U.S. advisors often suggested, to the media, that the use of agricultural herbicides, used by our farmers, did not cross the 1926 Geneva Protocol prohibition of chemical weapons use. The U.S. government and military policy for a secret operation (in Laos and Cambodia) prevented journalists from observing and questioning the program's effectiveness, its value to America, and the hazards to innocent villagers and soldiers. Herbicides, originally a boon to agriculture, were made a part of a chemical weapon system program [38], and became a political tool, with harmful environmental and human health effects.

3. Discussion

How dioxin (TCDD) and arsenic ions interact with soil, and groundwater and migrate through the environment when applied as herbicides is important to understand to develop plans to mitigate the harm. This is a complicated science. It is equally important to understand the complex human element of why such a decision can be made to use such hazardous chemicals as a weapon. Understanding this is important to learning better decision processes to avoid future misapplication of new technology.

If the premise is accepted, that the decision to use agricultural herbicides as a chemical weapon was a miscalculation, then what could have been done to prevent it? Accepting South Vietnam President Diệm's selection of a rice field for a food destruction and denial test was a major step down the wrong path. The lack of thorough planning and the poor analysis resulted in the introduction of arsenic into the Vietnam water and food supply during the Second Indochina War. The result was a lack of rural Vietnamese public support for the Hamlet and food denial program and the ineffective food destruction program. Vietnam and Cambodia were too food-rich for an effective food destruction program. Good planning would have pointed out the ineffectiveness of the program as a result of the need to impact a large segment of the general population to reach the insurgency through food denial. The plan should have forecast how big the defoliation and food destruction program would become. The Washington scientists and policy planners should have considered the huge requirement for defoliant. In the end, the bombing, which included North Vietnam, delivered power 100 times the equivalent of the two atomic bombs used in Japan [39].

One military option presented, but not used in the Second Indochina war was atomic weapons. If dioxin TCDD had been studied earlier with results available to the media and the public, it may have been considered equivalent to radiation poison. Had the new secret chemical weapon system presented to President Kennedy disclosed the hazard of dioxin consequences (a cancer-causing chemical), the decision in 1961 to start a defoliant program may not have been made. It would have followed then not to fund the RVN food denial program officially in 1962, keeping arsenic (toxic to human health) out of the environment. Alter-

natives such as commodity monetization should have been considered in 1961. Alternatives, such as using part of the money budgeted for defoliation and food denial, could have been used to buy rice. Additional funds could have been used for roads, schools, and medicine, effectively shutting out the communist's influence. To effectively keep the resources away from the Vietnamese communists. The outcome of the Second Indochina War may have been different.

Throughout this review and analysis, the resulting conclusion was Diplomats' ability to have empathy with all peoples, regardless of station in life, was critical. Furthermore, to make sound policy recommendations they must have deep understanding of a people's culture, and the economic and/or military options or at least access to competent advisors. In reflection have things changed today? Commerce is strong between Western countries and countries with different forms of government as China, Vietnam, and others. Does that mean the democratic values of individual freedoms are not relevant today? To illustrate this point, understanding different cultural values is important to accurate decision making, one last digression is merited. What social systems are the best fit? The OSS in the 1940's, and then the diplomats, appointed ambassadors and military planners, in the 1950's and 1960's, all missed what drove the common man in Indochina. Sikora captured this in the 1970's [23]. The reader will want to decide for himself what social systems are best with these different cultures.

The illustration presented here is observations based on the author's experiences during an August 2000 sponsored trip to the Yangtze River Valley to observe silt control measures to lengthen the life of the Three Gorges Dam, the author had the opportunity to observe the People's Republic of China (PRC) in operation. While we did have "keepers" to "protect us" during the three-night stay in Chongqing I was able to get out for an unaccompanied run each morning. In the market district produce and livestock were brought in early for sale to butchers and street vendors for meals. It was clear everyone had a job. Cleanup was organized. First, the stall floors, covered walkways, and finally the gutters were swept and everything, even the carcasses was hauled away before the main day started. These sweepers, after only working two hours each morning, were the same men seen standing around later in the day. Everyone in China the government made sure had a job.

For a one-day excursion across a bridge over the Yangtze River this author noticed two cab drivers stopped by a water puddle using the water to wash their cabs. Asking about this, I was informed all cars must be washed within 24 hours of rainfall to keep the mud from the outlying dirt roads, off the city streets. On our return trip, just where a long, smooth rock slab lay downstream in the middle of the river that served as one of the old Flying Tigers' landing fields when this city was called Chungking, we saw a car stopped. The car, a black, large car, was surrounded by a dozen or more policemen. From what we could tell the car owner, was very important, thus the large number of police. His car had been stopped due to not taking time to wash his car. Maintaining order was paramount in the PRC. Along nearly every side of the road, the silhouette of a guard

could be seen, even deep into the country the shadow of guards could be seen standing watch on distant passes. Finally, we had one more stop at a model village of resettled farmers from the river valley floor. Over a million people living in the Yangtze River valley were to be impacted by the 100 meters of lake flood water once the dam was completed. There were new homes in clean apartments, jobs, and farm fields. After meeting the local village host in his apartment, we visited his fields. First seeing one mu (a mu in China is one-fifth of a hectare) of citrus we then walked the ridgeline overlooking the sloping hills 200 meters down to the valley floor. The vista was expansive. Below the planned elevated waterline, the terraced, tilled fields stopped. The farmsteads were abandoned, animal pens vacant of any livestock. No one was seen walking or working (Figure 17).



Our Western perspectives of Eastern Culture are shaped by stories by authors as Pearl Buck

Figure 17. Unknown Author Tumblr social network source. Three peasants working. Foggy morning, an apparent weak ox straining against a wooden plow tended by the farmer. His family, assume wife and mother-in-law, are hoeing. An ancient willow tree guards the field. Photo Credit: In the public domain.

But then there was one farmstead. A hut with a small green garden on one side and a small pen with one sow in a little shed on the other side. I asked our guide what the one farm's story was. Before our group left for this People-to-People exchange trip between technical societies, we were informed that our guides would always answer questions, but the questions must be well-formed. The guide told us that the hut belonged to an old woman who had been offered to move to the new apartments. She had refused to make the move. We looked at the two small buildings, garden, and sow's pen, which were below the planned waterline. I asked what was going to happen when the dam was finished. Our guide only gave us a shrug.

4. Conclusions

This essay is not meant as an endorsement for an alternative to our democratic

values. Rather, both history and personal observations endorse the individual freedom offered by a democratic society. Insight into socialist and communist forms of government is documented in journalists' interviews during that era. James Michener's novel *The Bridge at Andau* developed from his December 1956 interviews with Hungarian refugees fleeing on foot across 160 kilometers of frozen fields to Austria, to escape, after their freedom protest, the Soviet crack-down. The first 500 copies published in February 1957, a remarkable reporting speed at the time, made an impact on American policy by strengthening the domino theory. A critical-thinking public must be open to different viewpoints, to benefit from new historical insights and past lessons learned.

Study of the lessons of Vietnam War herbicide misuse as a weapon can help guide evaluation of new technology weaponization's environmental impact to avoid future harm to mankind.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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