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Sophia Johnson, Whitworth University, undergraduate student, “From Counterinsurgency to Chemical Warfare: Technology Dependence and Agent Orange”

Abstract: In 1961, President John F. Kennedy approved the use of chemical defoliants in Vietnam. Taking British use of chemical defoliants during the Malayan Emergency as precedent, American counterinsurgency efforts used the potent “rainbow” herbicides to destroy enemy crops and jungle foliage. Although the use of Agent Orange was intended to be a limited counterinsurgency tactic, the rapid escalation of Agent Orange’s use, negligence in ensuring its safety, and its auxiliary intentional use on humans all indicate an irresponsible exercise in chemical warfare on behalf of the U.S. government. Sources examined include monographs such as David Zierler’s *Invention of Ecocide: Agent Orange, Vietnam, and the Scientists Who Changed the Way We Think About the Environment*, and Peter Sill’s *Toxic War: The Story of Agent Orange*. Additionally, peer reviewed articles from historical and scientific journals provide information on the origins and use of Agent Orange in the Vietnam War. Agent Orange and the rainbow herbicides’ consequences on human health were largely overlooked at the time of their deployment and research on their long-term effects has been spotty, partially due to the nature of dioxin, the chemical byproduct that made these defoliants so dangerous.

From Counterinsurgency to Chemical Warfare:
Technology Dependence and Agent Orange

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The first chemical herbicides were synthesized in 1900 by researchers in the chemical industry attempting to find scientific means to ease labor-intensive agricultural practices.¹ This goal soon branched out to the potential use of herbicides during wartime: during World War II, new herbicidal compounds discovered by Allied researchers were considered for use in Japan, but the debate surrounding their use stalled until the war was already over.² Although the “rainbow herbicides,” named after the colored bands on the barrels they were packaged in, were the main chemical defoliants used early in the Vietnam war, the compound that made up the majority of herbicide dropped on Vietnam and garnered the most infamy was Agent Orange.³ Initially used to destroy Viet Cong crops, spraying missions grew in scale as the war escalated and by 1971, nearly twenty million gallons of herbicide would be sprayed over Vietnam, defoliating millions of acres.⁴ Although the use of Agent Orange was intended to be a limited counterinsurgency tactic, the rapid escalation of Agent Orange’s use, negligence in ensuring its safety, and its auxiliary intentional use on humans indicate an irresponsible exercise in chemical warfare on behalf of the U.S. government.

During the early years of the Vietnam War, the U.S. military was looking for fast-acting defoliants to use against the Viet Cong. Inspiration and precedent were partially drawn from Britain’s use of herbicides during the Malayan Emergency (1948 – 1960), where compounds nearly identical to Agent Orange were used to suppress a pro-independence communist guerrilla uprising.⁵ In early 1961, advisor Walt Rostow recommended that President Kennedy begin preparing for operations to stabilize South Vietnam.⁶ Kennedy was averse to committing American troops but was also convinced that the unpopular Diem administration’s armed forces would not be capable of handling the Viet Cong, so supporting the ARVN with American technology, including herbicides, was a potential path to take instead of increasing American

involvement.⁷ The U.S. government had anticipated increased involvement in support of Diem's unpopular administration even before the Rostow Taylor report detailing the deteriorating situation in South Vietnam was released on November 3, 1961.⁸ In late September of 1961, over a month before the report's release, the Defense Department and State Department released a joint plan detailing potential means of supporting Diem. This plan contained a myriad of counterinsurgency tactics, including the use of herbicide, in hopes of preventing American troop deployment while preserving the anticommunist government in Saigon. The basic objectives for herbicide use in Southeast Asia were as follows: use defoliants in the Mekong Delta's "Zone D," the site of Viet Cong bases, remove the manioc groves that fed Viet Cong guerrillas, remove foliage on the Cambodian-Laotian-Vietnamese borders, and destroy mangrove swamps that gave the Viet Cong cover.⁹

Concerns about herbicide use were common but generally political. Kennedy and Robert McNamara were both reluctant to authorize chemical defoliant spraying in Vietnam, fearing international criticism and a slew of propaganda from North Vietnam that would work directly against the U.S. directive to win "hearts and minds."¹⁰ However, any strategy to aid the struggling Diem administration that did not involve direct escalation or the involvement of American troops was valuable in Washington. Upon Deputy Secretary of Defense Roswell Gilpatric's urging, Kennedy approved a new program to spray chemical defoliants in Vietnam.¹¹ Kennedy was insistent on limiting the program's reach; the original memorandum sent by McGeorge Bundy emphasized that defoliant operations in South Vietnam were to be "carefully controlled," and that they would focus on "the clearance of key routes and proceeding thereafter to food denial only if the most careful basis of resettlement and alternative food supply have been created."¹² Still, on November 30, 1961, approval was granted for the new program now

called Operation Trail Dust. Throughout the course of the war, this program would spray millions of gallons of chemical defoliant on Vietnam and is perhaps better known by the nickname that air force squadrons gave it: Ranch Hand.¹³

Early Ranch Hand operations did not see much success. Chemical defoliants removed leaves from Vietnamese vegetation, but trees and roots remained, leaving plenty of hiding spots for the Viet Cong and hardly improving American visibility.¹⁴ A more bothersome consequence was the fact that Ranch Hand pilots accidentally sprayed commercial crops, angering civilians and inviting the wave of propaganda from the North that Kennedy and McNamara feared.¹⁵ Regardless, Ranch Hand failures were explained away as a tactical error of simply spraying during the dry season, and in late September of 1962, Kennedy approved another crop destruction program. New spraying missions used Agent Blue to destroy Viet Cong rice and Agents Pink and Purple to destroy root crops and broad-leafed vegetation.¹⁶ Once again, Kennedy insisted that Air Force squadrons were to only spray crops that intelligence was absolutely certain were used by the Viet Cong, and once again, there was overspill due to corruption in Saigon and the fact that it was difficult to identify enemy versus friendly crops.¹⁷ After new spray runs of Agent Purple demonstrated that it was 60%-80% effective against most tropical vegetation, in late November 1962, Kennedy gave MACV commanders the authority to approve defoliant spray runs with limitations on large targets and restrictions from spraying during combat. The original goals of herbicide spraying continued to change as the abilities of highly concentrated defoliants were demonstrated.¹⁸ Despite Kennedy's reservations, the use of Agent Orange skyrocketed hand in hand with American involvement and the total volume of herbicide dropped on Vietnam increased from one million gallons in 1964 to twenty million gallons in 1966.¹⁹

In Washington, Operation Trail Dust continued to garner serious doubts about health consequences and the political devastation they could potentially bring. Many of these concerns were related to the two main active compounds found in highly concentrated military-grade defoliants: 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid, or 2,4-D and 2,4,5-T.²⁰ Agent Orange itself was a potent half-and-half mixture of 2,4-D and 2,4,5-T. In spring 1963, the State Department asked that Kennedy request a report on the potential health hazards that the high concentrations of 2,4-D and 2,4,5-T posed.²¹ There was significant precedent pointing to the dangers of these acids. In 1949, German researchers had discovered 2,3,7,8-tetrachloro-dibenzo-para-dioxin (TCDD), a potent dioxin and byproduct of producing 2,4,5-T, to be the cause of health problems experienced by workers at German plants producing trichlorophenol (TCP), the synthetic precursor to 2,4,5-T.²² Diamond Alkali TCP plant workers in New Jersey saw similar health problems, as well as Monsanto plant workers producing TCP in West Virginia.²³ TCDD is a dioxin, which is a class of chemicals that includes hundreds of compounds. Dioxins are often byproducts of chemical manufacturing, have a very high longevity in the environment and human body, and are highly toxic human carcinogens.²⁴ Following an industrial accident, workers at the Monsanto plant developed chloracne, a painful and often disfiguring rash caused by exposure to dioxin. In some cases, chloracne was accompanied by neurological problems and sometimes liver damage.²⁵ However, chloracne and the other health problems that often accompanied it had for years been considered a standard problem for herbicide production workers and were not seen as worthy of concern. American companies ignored the German researchers' discovery and dismissed it as inapplicable due to differences in manufacturing processes.²⁶ Monsanto was not obligated to release the results of its internal investigation regarding the illnesses at the TCP plant, so it is possible that the USDA

was not aware of the risks accompanying 2,4-D and 2,4,5-T.²⁷ Regardless, the rainbow agents continued to be sprayed in Vietnam.

For the U.S. military, the demand for technologies that would help support South Vietnam often outweighed safety concerns. Less than a month after Kennedy approved Operation Trail Dust, head of the Crops Division Charles Minarik requested that chemical company Diamond Alkali develop a crop killer stronger than the herbicides currently in use. The rainbow agents used in Ranch Hand operations were already tremendously potent, particularly Agent Purple.²⁸ These defoliants all contained highly concentrated 2,4-D and 2,4,5-T and were already tens of times more powerful than their domestic counterparts, but the military still wanted even faster-acting herbicides.²⁹ Minarik suggested that potential health consequences were not a priority for the U.S. military at the time, saying that “wartime herbicides are somewhat different than those needed for peacetime purposes. The problems of selectivity and toxicology are not as critical as the requirements for an herbicide used in agriculture.”³⁰ After finding no evidence that they were safe, the Army Environmental Hygiene Agency (AEHA) refused to list 2,4-D and 2,4,5-T as nontoxic. The military ordered the AEHA to cease work on their comprehensive herbicide manual and argued that widely publishing the AEHA’s findings would give the communists propaganda material and endanger the war effort in Vietnam. Eventually, the AEHA and the military compromised: the AEHA would only publish the risks 2,4-D and 2,4,5-T associated with drinking water. MACV claimed that they had received no complaints of ailments caused by the herbicides and that they were safe.³¹

In early 1964, Trail Dust switched from mostly using Agent Purple, a chemical whose patent caused corporate conflicts and supply issues, to using the unpatented Agent Orange.³² As undiluted Agent Orange became the main compound used in Ranch Hand operations, chemical

suppliers like Monsanto and Diamond Alkali pushed their facilities to the limit to meet the military's growing demands and altered their manufacturing processes to make 2,4,5-T more efficiently. One of the consequences of these changes was an increase in dioxin levels: increasing autoclave temperature during manufacturing resulted in higher levels of the dioxin TCDD, the compound sickening plant workers.³³ As the Dow chemical company and Monsanto worked nonstop to produce enough chemical agents for military quotas, they grew less able to guarantee that their compounds were chemically pure.³⁴ As early as 1965, higher concentrations of dioxin began appearing in Agent Orange.³⁵ Although it is still not clear exactly how much of the dioxin TCDD was present in the Agent Orange dropped on Vietnam, Columbia University chemistry researchers estimated that at the very least, there were around three parts per million TCDD in Agent Orange.³⁶ They included that the true number may be more than four times higher than that figure.³⁷ Other studies indicate a level of dioxin as high as twenty parts per million.³⁸

American deployment of Agent Orange ranged beyond crop and jungle destruction. There is evidence that the U.S. military directly sprayed Viet Cong troops with the defoliant after learning of the guerrillas' intense fear of it.³⁹ In June 1965, the Air Force's research trust, the RAND corporation (research and development) interviewed Viet Cong prisoners of war and defectors during an analysis of Trail Dust's impact on the war.⁴⁰ While the study produced did not indicate a significant U.S. tactical advantage gained by the use of Agent Orange, the interviews suggested that the Viet Cong were terrified of the compound. The interviewees believed it to be highly toxic, avoided areas where it had been sprayed for significant amounts of time, and did not eat crops or drink water that had been allegedly sprayed. With these findings, RAND argued that tactical spraying of Agent Orange had great potential for psychological

warfare and could significantly demoralize the Viet Cong, as well as potentially force them to adopt costly and time consuming protective measures like gas masks and plastic protective clothing.⁴¹

After the RAND report was released, a memo that focused on Agent Orange's potential for intentional use on humans reached Henry Lodge in the summer of 1965, who then approved and forwarded it to the State Department.⁴² Soon afterwards, Ranch Hand sorties were authorized to extend spraying to populated regions.⁴³ In a 1992 interview, Air Force herbicide specialist Dr. Alvin Young said, "Did we spray where the enemy was? You're damn right we did. We were trying to expose enemy guns, enemy bunkers, enemy cache sites... [the enemy] been told by their own people that this was so poisonous... I knew of stories when we ran out of material and put water in and we sprayed sites with just the water. And the enemy thought it was Agent Orange and would run."⁴⁴ In the early years of Operation Trail Dust, supporters in Washington argued that the use of defoliants could not be truly classified as chemical weapons because their intended use was not on humans.⁴⁵ While it is unclear exactly how many military officials were aware of Agent Orange's direct use on humans, as the war effort stagnated in the mid to late 1960s, Agent Orange's convenient effect of terrifying enemy guerrillas was exploited.

As objectives that were already unclear muddled further throughout the course of the Vietnam War, so did the goals of Agent Orange. What was initially meant to expose guerrilla transportation routes and bases eventually expanded to a massive operation that devastated five million acres of jungle and swamps in Vietnam. Agent Orange was banned for use in 1971, soon after environmental activists successfully petitioned to ban it on farms in America.⁴⁶ Today, the impacts of Agent Orange on veterans and the people of South Vietnam is still hotly debated and

the scars of chemical destruction are not yet healed. Initial research on the health effects of chemical herbicide was seriously flawed, an issue that is compounded by the fact that the effects of dioxin can take years to manifest and show in many different ways.⁴⁷ The U.S. government has also had a mixed response to allegations of the health consequences of Agent Orange; many health claims of veterans have been blocked.⁴⁸ Vietnamese class-action lawsuits against the chemical manufacturing behemoths that produced Agent Orange for the military have been dismissed on the grounds that the herbicide was not considered a poison at the time of use.⁴⁹ Herbicide spraying in Laos and Cambodia has also received little attention on the part of the U.S. government.⁵⁰ However, the long and difficult process of cleaning up the toxic residue of Agent Orange has begun as both nations continue to recover from the war. In 2019, a massive endeavor to clean the city of Bien Hoa, which faces heavy soil contamination, began as a joint project between the governments of Vietnam and the U.S.⁵¹ However, as restoration efforts proceed and nations try to reconcile, the scars of Agent Orange remain on both American veterans and the people of Vietnam.

¹ David Zierler, *Invention of Ecocide: Agent Orange, Vietnam, and the Scientists Who Changed the Way We Think About the Environment* (Athens, Ga.: University of Georgia Press, 2011), 35.

² Peter Sills, *Toxic War: The Story of Agent Orange* (Nashville, Tenn.: Vanderbilt University Press, 2014), 15-17.

³ Zierler, *Invention of Ecocide*, 105.

⁴ Zierler, *Invention of Ecocide*, 2.

⁵ Peter Hough, *The Global Politics of Pesticides: Forging Consensus from Conflicting Interests* (Oxfordshire, U.K.: Routledge, 2014), 61.

⁶ Sills, *Toxic War*, 19.

⁷ Sills, *Toxic War*, 19.

⁸ Zierler, *Invention of Ecocide*, 58-61.

⁹ Zierler, *Invention of Ecocide*, 61.

¹⁰ Zierler, *Invention of Ecocide*, 62-64.

¹¹ Sills, *Toxic War*, 24.

¹² McGeorge Bundy, "National Security Action Memorandum 115: Defoliant Operations in Vietnam," (official memorandum, Washington, D.C.: Office of the Special Assistant to the President for National Security Affairs, November 30, 1961) <https://catalog.archives.gov/id/193508>.

¹³ Sills, *Toxic War*, 24.

¹⁴ William Buckingham, *Operation Ranch Hand: The Air Force and Herbicides in Southeast Asia, 1961-71*, (Washington, D.C.: Office of Air Force History, United States Air Force, 1982), 47.

¹⁵ Buckingham, *Operation Ranch Hand*, 46-47.

¹⁶ Sills, *Toxic War*, 38-39.

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- ¹⁷ Sills, *Toxic War*, 38-39.
- ¹⁸ Sills, *Toxic War*, 39.
- ¹⁹ Zierler, *Invention of Ecocide*, 66.
- ²⁰ Sills, *Toxic War*, 29-31.
- ²¹ Buckingham, *Operation Ranch Hand*, 82-83.
- ²² Committee to Review the Health Effects in Vietnam Veterans of Exposure to Herbicides, *Veterans and Agent Orange: Health Effects of Herbicides Used in Vietnam*, (Washington, D.C.: National Academy Press, 1994), 305-312.
- ²³ Sills, *Toxic War*, 29-31.
- ²⁴ American Cancer Society, "Agent Orange and Cancer Risk: What is Agent Orange," last modified June 9, 2020.
- ²⁵ Committee to Review the Health Effects in Vietnam Veterans of Exposure to Herbicides, *Veterans and Agent Orange*, 305-312.
- ²⁶ Sills, *Toxic War*, 29-30.
- ²⁷ Sills, *Toxic War*, 40-45.
- ²⁸ Sills, *Toxic War*, 32.
- ²⁹ Jeanne Mager Stellman et al., "The Extent and Patterns of Usage of Agent Orange and Other Herbicides in Vietnam," *Nature* 422 (2003): 681.
- ³⁰ Sills, *Toxic War*, 32.
- ³¹ Sills, *Toxic War*, 40-45.
- ³² Sills, *Toxic War*, 56-57.
- ³³ Sills, *Toxic War*, 56-57.
- ³⁴ "Bright '68 for Ag Chemicals," *Chemical Week* (November 25, 1967), 32.
- ³⁵ Zierler, *Invention of Ecocide*, 105.
- ³⁶ Richard Stone, "Agent Orange's Bitter Harvest," *Science* 315, no. 5809 (2007): 177.
- ³⁷ Stone, "Agent Orange's Bitter Harvest," 177.
- ³⁸ Leo Uzych, "Agent Orange, the Vietnam War, and Lasting Health Effects," *Environmental Health Perspectives* 95, (1991): 211.
- ³⁹ Sills, *Toxic War*, 71.
- ⁴⁰ Sills, *Toxic War*, 70.
- ⁴¹ Sills, *Toxic War*, 70.
- ⁴² Sills, *Toxic War*, 70.
- ⁴³ Buckingham, *Ranch Hand*, 113.
- ⁴⁴ Sills, *Toxic War*, 70-71.
- ⁴⁵ Sills, *Toxic War*, 40-45.
- ⁴⁶ *The Vietnam War*, episode 9, "A Disrespectful Loyalty," directed by Ken Burns, aired September 27, 2017, on PBS.
- ⁴⁷ Stone, "Agent Orange's Bitter Harvest," 178.
- ⁴⁸ R. Scott Frey, "Agent Orange and America at War in Vietnam and Southeast Asia," *Human Ecology Review* 20, no. 1 (2013): 7.
- ⁴⁹ "Agent Orange Case for Millions of Vietnamese is Dismissed," *The New York Times*, March 10, 2005. <https://www.nytimes.com/2005/03/10/nyregion/agent-orange-case-for-millions-of-vietnamese-is-dismissed.html>.
- ⁵⁰ Stellman, et al., "The Extent and Patterns of Usage of Agent Orange and Other Herbicides in Vietnam," 686.
- ⁵¹ George Black, "Fifty Years After, A Daunting Cleanup of Vietnam's Toxic Legacy," *Yale Environment* 360, May 13, 2019.

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