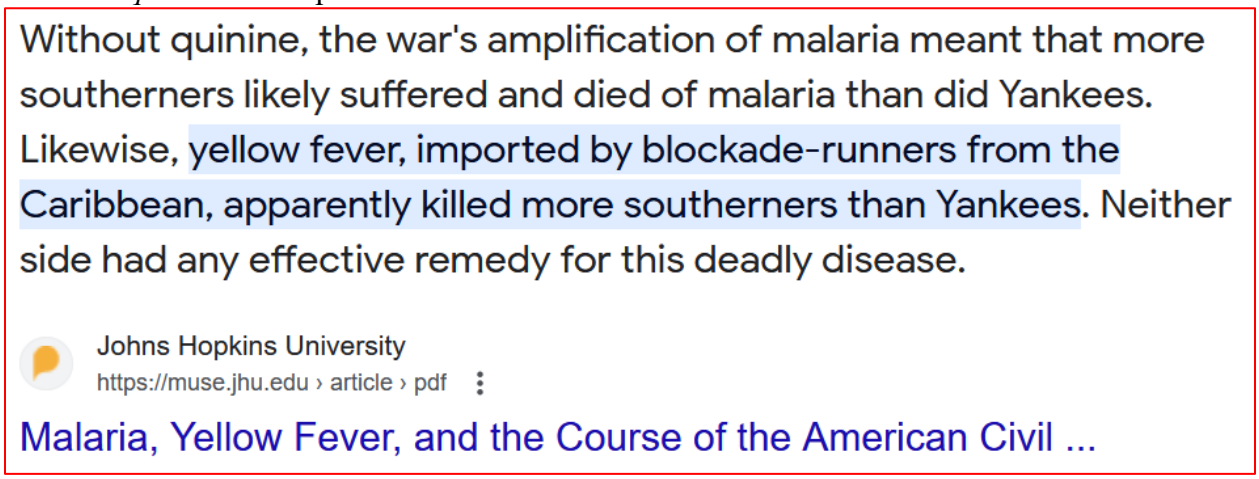
> Understanding the causation, solutions, and ongoing battle against diseases like malaria and yellow fever, which stopped the French Panama Canal attempt, requires swallowing a healthy dose of historical context. Without it, we put ourselves at risk of missing important questions and answers.

We best know mosquitoes for their role in the transmission of diseases, among the more important are malaria, yellow fever, dengue fever and the encephalitides and filarial worms. Of these, malaria is by far the most important. According to recent data released by the World Health Organization and the Centers for Disease Control, mosquitoes infect A MINIMUM OF 500 MILLION people with the disease each year, and more than two million -- mostly children in sub-Saharan Africa -- die of it. The following research article covers the history and implementation of methodologies employed by the US Department of Defense to prevent mosquito-borne illness within their military and civilian personnel. This research article deals specifically with Panama, where effective control of mosquitoes began in the early 1900s and continued until the US relinquished control of the Panama Canal Zone to Panama in 1999.

Importance of Mosquitoes

A knowledge of mosquito biology is necessary to understand the epidemiology of mosquito-borne disease and for a successful mosquito control program. Mosquitoes are insects belonging to the order Diptera, the True Flies. Like all True Flies they have two-wings, but unlike other flies, their wings have scales and their mouthparts (in female mosquitoes) form a long piercing-sucking proboscis. Males differ from females by having feathery antennae and mouthparts not suitable for piercing skin. Nectar is their principal food source.

The transmission of disease by mosquitoes was not known when malaria and Yellow Fever epidemics broke out in the Civil War and again during in the Mississippi Valley in 1878. The book *Mosquito Soldiers* provides an excellent treatise on the role of disease in the Civil War.



Over the course of spring and summer of 1878, this region recorded 120,000 cases of yellow fever and between 13,000 and 20,000 deaths from the disease. The outbreak originated in New Orleans and spread up the Mississippi River and inland.

Digital Public Library of America
https://dp.la › primary-source-sets › the-yellow-fever-epi...

The Yellow Fever Epidemic of 1878 | DPLA

As a result, the US military began researching the epidemiology of these diseases. Progress was made in the late-1800s when Sir Major Dr. Ross in England linked the spread of these diseases with mosquitoes. In 1901, Major Walter Reed, a U.S. Army physician, led the team that confirmed the theory of Cuban doctor Carlos Finlay that yellow fever is transmitted by the *Aedes Aegypti* mosquito. That team included Dr. William Gorgas, who was in charge of the "Mosquito Brigades" as outlined in Dr. Ross' book *Mosquito Brigades and how to organize them*. Lt. Walter Reed, MD, isolated the mosquitoes that carried malaria as being the female *Anopheles* genus of mosquitos. "Malaria is caused by a parasite called *Plasmodium* that mosquitoes transmit to humans. Only few types of mosquitoes can transmit the parasites. Among them, some species have a high degree of probability of transmitting the parasite and are considered particularly dangerous."[1]

Tactics and Strategies used in the War on Mosquitoes

The 1901 book, ***Mosquito Brigades and how to organize them***, by Sir Ronald Ross (a contemporary of Dr. Gorgas), lays out the basic stratagem to be followed when waging war on mosquitoes:

- "Obliterate" breeding pools [pg33],
  - Cover storage water containers [pg6]
  - Increased sanitation [pg6]
  - Cement drainage canals [pg17]
- Kill larvae
  - **Oiling or chemical insecticides** [pg 17, 34]
    - Oil is best sprayed or brushed, not poured

[1] https://www.mpg.de/13274217/malaria-mosquitos

- **Reduce food sources** (They feed on **fruit and leaves**, on cattle and birds, as well as on men [pg2])
  - **Reduce vegetation from around homes/living quarters; well-kept lawns**
  - Mosquito netting to sleep under
  - Mosquito netting on windows
- **Segregation** [**increase living space** between British and "infected natives"]

1. The War on Mosquitoes begins in Panama

The "War on Mosquitoes" began in earnest with the US purchase of the Panama Canal. Prior to the US purchasing the Panama Canal, the French had spent eight years working on their plan but Yellow Fever and Malaria stopped the work by the French in 1901. The Panama Canal was then purchased by the United States. The CDC's history of the Panama Canal provides an excellent history of the WAR ON MALARIA, yellow fever, and mosquitoes.[2]

US Army Maj. Gen. William C. Gorgas during his tenure as US Army Surgeon General.
Photo: US Army

The 'commanding general' for this "War" was then Captain Dr. William Crawford Gorgas, who successfully waged war on Yellow Fever in Cuba. "In 1904, Gorgas was sent to Panama as the Isthmanian Canal Commission's chief sanitary officer, charged with the elimination of two major obstacles to the completion of the American project there: malaria and yellow fever. However, despite the work of Drs. Reed & Ross and Dr. Gorgas' efforts in Cuba, most of the political leadership in Washington and key members of the commission, including Admiral John G. Walker and Governor George W. Davis, did not believe in the mosquito transmission theory. Gorgas's arguments fell on deaf ears until a deadly epidemic hit the Canal Zone in the spring and early summer of 1905 and John Frank Stevens was subsequently appointed the commission's chief engineer.

"Stevens, an engineer with considerable railroad experience, … **clearly perceived that before construction could begin effectively, diseases such as yellow fever and malaria had to be eliminated; he knew that Gorgas needed to receive unequivocal support in addressing this task. Thus, in 1905, Stevens's engineering department stood behind Gorgas, who now had first priority in terms of men and materials**."[3]

Under the leadership of Colonel William Crawford Gorgas, head of hospitals and sanitation, many new departments of sanitation were founded, covering **different aspects of the sanitation problem**. Commissions were also formed to look after the basic welfare of laborers.

[2] https://www.cdc.gov/malaria/about/history/panama_canal.html
[3] https://wikisummaries.org/gorgas-develops-effective-methods-of-mosquito-control/

The sanitation work included clearing land and establishing quarantine facilities. The most ambitious part of the sanitation program, though, was undoubtedly the effort to eradicate the mosquitoes *Aedes aegypti* and *Anopheles*, the carriers of yellow fever and malaria, respectively, from the canal zone. There was initially considerable resistance to this program, as the "mosquito theory" was still considered controversial and unproven. However, with the support of chief engineer John Frank Stevens, who took over the post on July 26, 1905, Gorgas was finally able to put his ideas into action.

Gorgas divided Panama into 11 districts, and Colón, Panama, into four. In each district, inspectors searched houses and buildings for mosquito larvae. If larvae were found, carpenters were dispatched to the building, and work was done to eliminate objects or places where stagnant water could collect.

Mosquitoes lay their eggs on the surface of standing water, and when the larvae hatch, they live just below the surface, breathing through a siphon in their tails. Therefore, by eliminating standing water where possible and by spreading oil on the surface of any remaining pools, the larvae could be destroyed.

Gorgas also had domestic water systems installed in urban areas around the Canal Zone. These systems eliminated the need for rainwater collection, which had been collected in barrels and was a place for mosquitoes to breed. The United States government also provided $20 million to give workers free medical care and burial services. Gorgas's sanitation department also provided about one ton of prophylactic quinine each year to people in the Canal Zone to combat malaria.[3]

Gorgas organized a major program to drain and fill swamps and wetlands around the Canal Zone. Many miles of ditches were dug, and grass and brush were cut back over wide areas. Oiling was used in a variety of means: workers with spray tanks were sent to spray oil on standing pools, and smaller streams were tackled by placing a dripping oil can over the water-way, which created a film of oil over each still patch of water in the stream. About 700,000 gallons of oil and **124,000 gallons of larvicide** were used on the project. Gorgas also took another step in his efforts to eradicate mosquitoes in Panama: **fumigation**. He fumigated the residences of Panamanians who had been confirmed to have contracted yellow fever. "Pans of **sulfur or pyrethrum** were then placed in the rooms, the right quantity of powder was weighed out (two pounds per thousand cubic feet), and the pans were sprinkled with wood-alcohol and set alight" (Cameron 132). When the effectiveness of this procedure was realized, fumigation was extended to all of Panama. Within a year of Stevens's appointment, every building in Panama had been fumigated, using up the entire US supply of sulfur and pyrethrum. In 1906, only one case of yellow fever was reported, and until the end of the Panama Canal's construction, there were zero.

Gorgas's final means of attack on disease was to quarantine individuals infected with yellow fever or malaria from the rest of the workforce. Those who were diagnosed with either disease were put into "Portable Fever Cages", easily transportable screened structures used to prevent mosquitoes from biting an infected person and carrying the disease to others. Gorgas also had the

thousands of canal **workers sleep in screened verandas**, as the mosquitoes that spread malaria are nocturnal and would infect the most people at night.

"Employing recent discoveries on the role of mosquitoes in the transmission of malaria and yellow fever, William Crawford Gorgas applied strict sanitary controls within the Panama region, enabling construction of the Panama Canal."[4] "By the fall of 1905, Gorgas had more than four thousand men engaged in sanitation work, and his budget was increased dramatically. Supplies necessary for the eradication of mosquitoes were ordered and received in unprecedented quantities, including 120 tons of **pyrethrum**[5] powder, 300 tons of sulfur, and 50,000 gallons of **kerosene** per month. **Fumigation** pots, screens, buckets, garbage cans, and brushes were soon in abundance; this equipment was used in the subsequent house-by-house campaign. As a result of these efforts, cases of yellow fever in the Canal Zone fell from sixty-two in June, 1905, to twenty-seven in August and one in December, with no further outbreaks in 1906. By using similar techniques to combat the Anopheles mosquito, Gorgas's team was able to reduce malaria, but **that disease was not totally eradicated because the *Anopheles* mosquito had a much broader range of flight and bred in a more widespread area than did the mosquito that transmitted yellow fever**."[6] [Emphasis added]

Photo: The Field Museum Library via Wikipedia

Dr. Gorgas insisted that any American living in Panama be housed in areas free of mosquitoes. Dr. Gorgas employed thousands of Panamanians for land clearance. Eventually, as they were developed, the clearing of vegetation and keeping the jungle at bay employed the use of herbicides for cost-saving benefits. The 1977 Panama Canal Treaty document[7] includes testimony from Mr. James C. Luitweiler, Secretary of the Joint United States-Republic of Panama Land Commission. Pages 8-9 provide an introduction: 14-15 provide relevant information regarding the war on mosquitoes. "Mr. Luitweiler, now 88 years of age, is what the historians would refer to as a "primary source". "Mr. Luitweiler can singlehandedly refute the ... claim that we somehow "stole" the Canal Zone." ... "He can speak about such people as Colonel

[4] https://wikisummaries.org/gorgas-develops-effective-methods-of-mosquito-control/
[5] Pyrethrum is a plant (Chrysanthemum cinerariifolium). Pyrethrum is also the name of the crude extract obtained from flowers of this plant. Whole, crushed flowers are known as pyrethrum powder. Pyrethrins are commonly used to control mosquitoes, fleas, flies, moths, ants, and many other pests. Pyrethrins are generally separated from the flowers. However, they typically contain impurities from the flower. http://npic.orst.edu/factsheets/pyrethrins.html
[6] https://wikisummaries.org/gorgas-develops-effective-methods-of-mosquito-control/
[7] https://www.scribd.com/document/519624049/Panama-Canal-Treaty-1977

Goethals and William Crawford Gorgas from personal reminiscence. He was on the scene when the Canal Zone was transformed from a pestilential swamp to the greatest manmade waterway in the world." ...Mr. Luitweiler was asked about the 'Reason for "Luxury" Living'. Mr. Luitweiler testified:

> "That is what the Panamanians claim. Right across the border they lived in squalor while Americans lived in luxury. That was all because Mr. Gorgas **decreed** that every American down there should live in a **screened-in barracks** ... with a **well-kept lawn**. Of course, you know mosquitoes breed in mudholes and he was against that. You have to live in the tropics for many years to realize what it is to be there and to be subject to the things that the tropics have. You don't experience that up here. ... Of course, in Panama it is worse than ever. **A jungle will creep back and take over within a month or two.** ... The Panamanians are not so fearful as we are of malaria because to Panamanians malaria is what a common cold is to us. They get a chill and fever and that is it. To us it can kill us." [emphasis added] He "would not abide mudpuddles."[8] Page 7 of Dr. Ross' *Mosquito Brigades* states: "These insects breed mostly, not in vessels, but in puddles on the ground." … "In such cases it is probable that the breeding pools have been overlooked owing to the copious vegetation, or that the insects are old ones which have lived in the bush since the last rainy season." This is the background for the ongoing requirements for "well-kept lawns" and vegetation reduction in the war to reduce malaria and Yellow Fever. Hence the reason for killing mosquitoes, clearing the jungle and having "well-kept lawns".
>
> "Workers cut all grass to less than 12 inches high, drained open water where possible or sprayed a film of oil on it where it wasn't. **Custom poisons were spread across areas where larvae grew**. Workers cleaned homes regularly and placed screens over windows and doors."[9] [Emphasis added] Larvae grow in standing water.

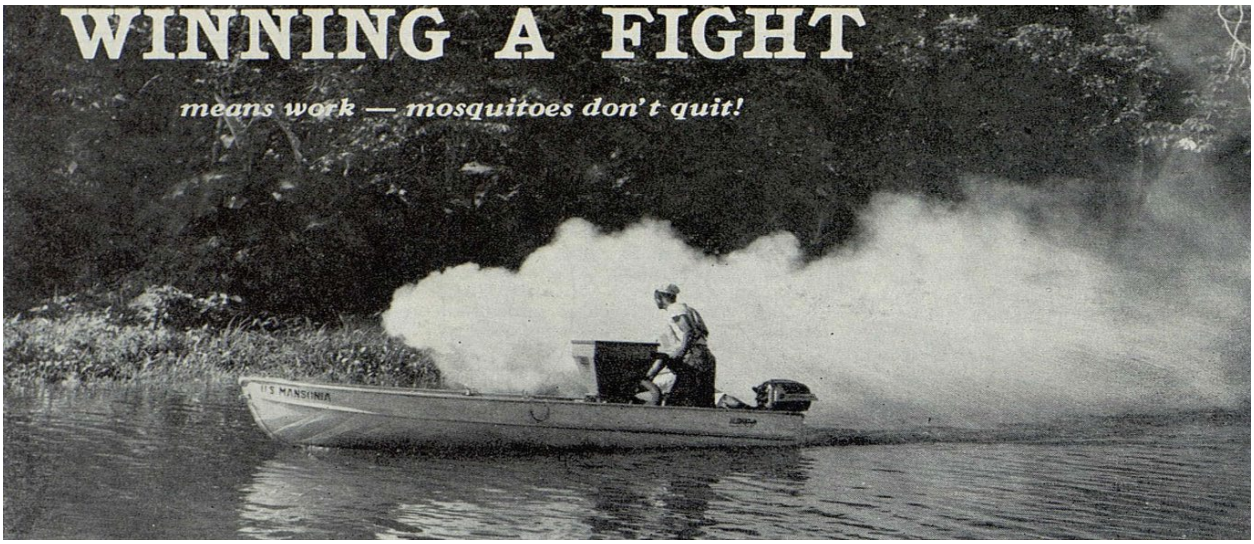
"Progress was slow, but success did come. The campaign launched in the summer of 1905. In August 1906, new yellow fever cases were at less than half of their historical norm. After November 1906, no more canal workers would die of yellow fever. Malaria never went away completely, but in January 1910 the death rate fell to 1 percent of the historical norm. Dr. Gorgas went on to fight disease in South African gold mines before becoming the Army's 22nd Surgeon General."[10]

The War against Mosquitoes continues in Panama

"Since the construction of the Panama Canal, in the 1910s, pesticides, herbicides and chemicals, including arsenic, have been essential for controlling wetland vegetation, including hyacinth, which blocked rivers, lakes, and the canal as well as managing mosquitoes. Pesticides and

[8] 1977 Senate Hearings, testimony of James Luitweiler, Secretary to the Panama Canal Committee, knew Colonel William Gorgas personally
[9] https://www.wearethemighty.com/articles/this-army-doctor-made-the-panama-canal-possible-by-killing-mosquitoes/
[10] https://www.wearethemighty.com/articles/this-army-doctor-made-the-panama-canal-possible-by-killing-mosquitoes/

chemicals flowed into Lake Gatun (reservoir) either attached to sediment or in solution during the monsoon season. Lake Gatun was the drinking water source for most of the people living in the Panama Canal Zone. The United States military base commanders had the ability to order and use cacodylic acid (arsenic based) from the Naval Depot Supply Federal and Stock Catalog and the later Federal Supply Catalog on the military base grounds in the Panama Canal Zone. Cacodylic acid was shipped to Panama Canal Zone ports, including Balboa and Cristobal, and distributed to the military bases by rail or truck." (Olson 2023)



The November 7, 1958, issue of Panama Canal Review documents that a one-year "intensive fight" against malaria. "The one-year period of intensified malaria eradication and mosquito control ended in September [1958]. It was instituted after an upsurge of malaria in June 1957 which occurred, coincidentally, with a scourge of mosquitoes in residential areas, particularly on the Atlantic side." … Some highlights of the program are: "Development of a *Master plan report for eradication of malaria and control of mosquitoes in the Canal Zone*; employment of additional personnel …; restoration of 10 mosquito survey stations; restoration or cleaning of 234 miles of mosquito control drains, most of which were in the swampy areas on the Atlantic side; respraying of all rural dwellings and other selected buildings with a **residential insecticide**, **dieldrin**; … improvement of drainage in the practically closed East Diversion on the Atlantic side by the Dredging Division's specially constructed suction dredge *Mandinga*; topographic surveys by the Engineering Division for drainage improvement; **bimonthly aerial spraying through assistance of the U.S. Army**; and acquisition of much additional equipment and supplies of **newest approved insecticides**." The question remains, what was aerially sprayed bimonthly? The **1990 US Navy Memorandum confirms the spraying of Malathion twice a week as a regular base procedure and the spraying of Diuron (Karmex) every six months**.

Despite success on the mainland by 1959, **malaria never went away completely**[11] in Panama. Thus, these strategies for fighting mosquitoes continued to be used until the Panama Canal Zone was turned over to Panama in 1999. The movie "The Big Picture" confirms the continued use of insecticides in the 1970s as part of the DoD's strategy for keeping American soldiers safe from

[11] https://www.wearethemighty.com/articles/this-army-doctor-made-the-panama-canal-possible-by-killing-mosquitoes/

malaria. The recommendations from the EPA reads very similar to Dr. Ross' list of recommendations for mosquito control. "Remove Mosquito Habitats" … "Use Appropriate Pesticides" … "Use Structural Barriers" (including mosquito netting and screens on windows). Sound familiar? https://www.epa.gov/insect-repellents/tips-prevent-mosquito-bites

The "War on Mosquitoes" was an ongoing war—not a once-and-done war. Thus, **records for pesticides, insecticides, and herbicide use would have been on the installation level**, not on the unit level. Thus, requiring the Veteran's unit records to indicate pesticide, insecticide, or herbicide exposure is misdirected and will inevitably result in a negative finding—which is probably the desired outcome. Purchases of pesticides, insecticides, and herbicides would have been performed at the base level—not the unit level. The installations were just following orders put in place by Dr. Gorgas.

2. Use of Insecticides in the War on Mosquitoes in Panama

The first insecticide used was **pyrethrum powder** (crushed chrysanthemum).

The CDC article describes and confirms that oiling was carried out in the Panama Canal. Per Robert Paterson, "in the early years plain oil was spread about areas that standing water would accumulate because the oil film would expand on water surfaces and create an air proof barrier that would suffocate the mosquito larvae in the water."

Panama Canal Museum Collection, "This is a 1905 Mosquito Fumigation Cart … with horses or perhaps mules as the "horsepower".

Sir Ross in his book *Mosquito Brigades* recommends the use of chemical poisons.

> "Waters which can be poisoned are those which are not required, and which had, therefore, better be drained away at once. Moreover, few poisons are effective against larvae unless concentrated; and then most of them become dangerous, inasmuch as children and cattle may suffer from our well-meant zeal. I have long wished to find an ideal poison for mosquito larvae. It should be some solid substance or powder which is cheap, which dissolves very slowly, and which, when in weak solution, destroys larvae without being capable of injuring higher animals. What a boon it would be if we could keep the surface of a whole town free from larvae simply by scattering a cheap powder over it, once in six months or so. It is very possible that such a substance exists, but unfortunately we have not yet discovered it. Many chemicals kill larvae …; but these have hitherto proved disappointing in practical work." [Emphasis added]

DDT

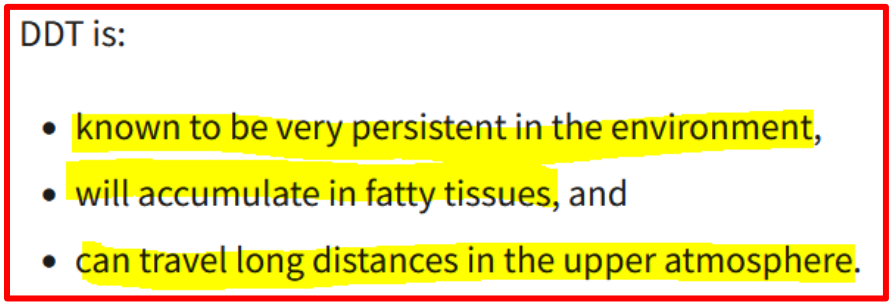
"The effectiveness of DDT (Dichloro-diphenyl-trichloroethane) as an insecticide was discovered in 1939. Shortly thereafter, particularly during World War II, the U.S. began producing large quantities of DDT for control of vector-borne diseases such as typhus and malaria abroad. After 1959, DDT usage in the U.S. declined greatly as a result of (1) increased insect resistance; (2) the development of more effective alternative pesticides; (3) growing public concern over adverse environmental side effects; and (4) increasing government restrictions on DDT use. However, exposures of DDT increased from 12% to 67%." [Department of Commerce export reports confirm this figure.] …

"Both the pros and cons of DDT use were considered by four Government committees who issued the following reports: (1) may 1963, "Use of Pesticides," A Report of the President's Science Advisory Committee (PSAC); (2) November 1965, "Restoring the Quality of Our Environment," A Report of the Environmental Protection Panel, PSAC; (3) May 1969, Report of the Committee on Persistent Pesticides, Division of Biology and Agriculture, National Research Council, to the Agriculture Department; (4) December 1969, Mrak Commission Report. All four reports recommended an orderly phasing out of the pesticide over a limited period of time."[12]

The search for the ideal insecticide was pursued. "DDT (dichloro-diphenyl-trichloroethane) was developed as the first of the modern synthetic insecticides in the 1940s. It was initially used with great effect to combat malaria, typhus, and the other insect-borne human diseases among both **military** and civilian populations. It also was effective for insect control in crop and livestock production, institutions, homes, and gardens. DDT's quick success as a pesticide and broad use in the United States and other countries led to the development of resistance by many insect pest species."[13] [Emphasis added] Per the Environmental Protection Agency (EPA), "DDT is a persistent and toxic nonionic organic chemical commonly present as a contaminant in aquatic sediments."

"New information is also emerging about the **heavy use of other kinds of pesticides in military bases in Panama besides Agent Orange, such as DDT and Chlordane, which were sprayed in residential areas of the Canal Zone, often daily, against termites."** (Lindsay-Poland, 2013) According to a preliminary study commissioned by Panama, **"DDT, DDD, and DDE were all found in high quantities" on the two bases** [Corozal and Clayton]."

1 https://www.epa.gov/ingredients-used-pesticide-products/ddt-brief-history-and-status



Malathion

Also per the EPA: "Malathion is an organophosphate (OP)

[12] https://www.epa.gov/archive/epa/aboutepa/ddt-regulatory-history-brief-survey-1975.html
[13] https://www.epa.gov/ingredients-used-pesticide-products/ddt-brief-history-and-status

insecticide that has been registered for use in the United States since 1956. It is used … **in public health pest control programs for controlling mosquito-borne illnesses**. Malathion is part of an **integrated overall strategy to control mosquitoes**. In particular, malathion is an adulticide, used to kill adult mosquitoes. **Most malathion mosquito adulticide applications (about 90%) are made by ground application (fogging equipment mounted on trucks)**. However, **in situations of heavy mosquito presence across large geographic areas, aerial application is an important method of application**. Less than 1% of spraying for mosquitoes is malathion aerial spray." [Emphasis added]

In comments under the PCMC "Object of the day" 1905 oiling cart, Janet Widell commented, "By 1959 trucks were used that would create a fog using DDT to combat mosquitoes. Many houses only had screens rather than glass windows. The fog could pass into houses or other buildings." Several comments describe chasing the spray trucks in the 1950s. Many of the veterans filing claims for chemical exposure in Panama have stated they remember daily fogging, though most didn't know what was in the fog.

When reviewing the Army Supply Bulletin, you will notice DDT, Malathion, and several other insecticides used for getting rid of mosquitoes and/or mosquito larvae. The DoD began using DDT in the 1940s, at the same time the 2,4-D became commercially available and was used to control water hyacinth in Lake Gatun.

A Department of the Navy memo dated 23 July 1990 was inserted into personnel files of all personnel who served at Rodman. The memo acknowledges the twice daily use of Malathion as an insecticide.

2. In view of the above, I have instructed this memorandum placed in all health records as a permanent entry of command personnel exposed to pesticides for future reference, if necessary. The following pesticides are regularly used in close proximity to Naval Special Warfare personnel stationed at Naval Special Warfare Unit EIGHT, Rodman Naval Station, Panama Canal.

a. Insecticides; Malathion (Cythion) used twice daily in an ultralow volume sprayer by Public Works personnel.

The letter dated September 1, 2016 from Beth Murphy, Director of VA Compensation Services, VA, verifies spraying of Malathion from Agent Orange contaminated airplanes from 1970-1974.

Evidence shows that Malathion was tested by the Panamanian government, published in 1975, followed by additional testing. It also shows that mosquitoes in Panama had become resistant to DDT, dieldrin, and HCH, which means these three insecticides were being used in sufficient strength and frequency to create that resistance.

The *An. albimanus* strain used is susceptible to DDT and malathion, while the *A. aegypti* strain is resistant to DDT, dieldrin, and HCH, but susceptible to malathion, ABATE, and fenthion.

There is thus every indication that ground-level ULV spraying with malathion, applied at thrice-weekly intervals, can serve as an additional highly effective mosquito control measure. A research project is now underway, supported by the Pan American Health Organization, for purposes of confirming this finding

3. Implementation of Drainage Canals

Drainage canals were instituted by Dr. W. Gorgas in the early 1900s as part of his policies to reduce mosquito population. He also instituted (per the CDC) the spraying of insecticides and lawn maintenance policies and the spraying of oil to reduce the mosquito population.

"An integrated program of mosquito control was initiated that involved seven basic programs that were strictly enforced. These were, in order of importance:

1. **Drainage:** All pools within 200 yards of all villages and 100 yards of all individual houses were drained. Subsoil drainage was preferred followed by concrete ditches. Lastly, open ditches were constructed. Paid inspectors made sure ditches remained free of obstructions.
2. **Brush and grass cutting:** All brush and grass was cut and maintained at less than one foot high within 200 yards of villages and 100 yards of individual houses. The rationale was that mosquitoes would not cross open areas over 100 yards.
3. **Oiling:** When drainage was not possible along the grassy edges of ponds and swamps, oil was added to kill mosquito larvae.
4. **Larvaciding:** When oiling was not sufficient, larvaciding was done. At the time, there were no commercial insecticides. Joseph Augustin LePrince, Chief Sanitary Inspector for the Canal Zone developed a larvacide mixture of carbolic acid, resin and caustic soda that was spread in great quantity.
5. **Prophylactic quinine:** Quinine was provided freely to all workers along the construction line at 21 dispensaries. In addition, quinine dispensers were on all hotel and mess tables. On average, half of the work force took a prophylactic dose of quinine each day.
6. **Screening:** Following the great success in Havana, all governmental buildings and quarters were screened against mosquitoes.
7. **Killing adult mosquitoes:** Because the mosquitoes usually stayed in the tent or the house after feeding, collectors were hired to gather the adult mosquitoes that remained in the houses during the daytime. This proved to be very effective. Mosquitoes that were collected in tents were examined by Dr. Samuel T. Darling, Chief of the Board of Health Laboratory. Cost of adult mosquito killing was $3.50/per capita/per year for whole population of the strip. https://www.cdc.gov/malaria/about/history/panama_canal.html

The practice of building concrete canals began with and continued long after Dr. Gorgas implemented his plan. In fact, it continued into the 1990s, when the US turned the PCZ over to the Panamanian government. Note the drainage canals in this picture of the Corozal, Canal Zone, taken in 1919. It is from the "Lt. Charles B. Austin Special Collection Photo"[14]. Lt. Austin was a pioneer pilot with the US Army. (This collection has many more pictures of Panama in and around 1919. They are very interesting.)

[14] Repository: San Diego Air and Space Museum Archive

4. Continued Use of Drainage Canals

In her sworn statement about the living quarters at Howard AFB, Mrs. Nickisch, wife of MSgt P.R. Nickisch, USAF (ret), who served at Howard Air Force Base in the Panama Canal Zone from 1991-93, describes the ditches behind the housing. "Behind that flower bed (every house had a flower bed) and across the back of the house, there were cement run-off ditches that ran around every house. The ditches were 12" deep and 12-15" wide. It rained almost every day, and when it rained the rainwater would run down these ditches, and the kids and parents would play in them. They played, ran up and down in the water! The chemicals from the fog would settle on the grass and on the drive-ways, and whenever we played in the rainwater, we unwittingly played in the chemicals." Thus, drainage canals built in the early 1940s (when the base was built) were still in use in 1995 at Howard AFB, which was the staging area for Operation Just Cause. Note: The picture was taken 08/29/1995.

Navy Lt Garcia:

> "In August 1981, I reported to my next assignment, this time an overseas assignment to Commander U.S. Naval Forces Southern Command, Fort Amador, Panama under Captain Thurber as the Plans and Readiness Officer. Simultaneously, he and I were also assigned to command U.S. Naval Station Rodman, Panama. Both locations were in the Panama Canal Zone. U.S. government records from various sources prove that

insecticides and herbicides were used in Panama before, during and after my active service there 1981 - 1984.

"I worked at Fort Amador but berthed at Rodman Naval Station. Not long after I arrived, I remember leaving my Fort Amador office to go to Rodman quarters to receive my household effects. I noticed that no one was outside, specifically no mothers or parents playing with their children on this beautiful day or any other sunny day. When I asked my Fort Amador office colleagues, military residential neighbors and my cousin Brenda, all gave the same answer. "No parent with young children or an expectant mother would allow their children to play on the grassy areas that received twice daily and weekly herbicide and pesticide spraying. The children would get rashes."

The picture on the left is of Fort Kobbe (Army) in the 1960s. The next picture was taken of Fort Kobbe in 1970. In both of these pictures, you can see the drainage ditches.

E5 P.J. Clark was an infantryman like SP4 Couzens. He was stationed in the Canal Zone at Ft. Kobbe, Panama, from the end of 1969 to December 31, 1970; assigned to Company C, 3rd Battalion, 5th Infantry. He was a driver, "driving brass all over Panama". He too has been diagnosed with type II diabetes mellitus and Parkinson's Disease. His sworn declaration is full of pictures of Fort Kobbe and Howard Air Force Base (since they were connected and he frequented both bases) taken by himself and Gene Whitmer, who was Senior Medic for C Company. (The two pictures of Fort Kobbe on the previous page are from Mr. Clark's sworn Declaration.) Mr. Clark notes "I did not know Gene, but we were there at the same time." He also notes the windows were screened and remembers fogging trucks.

"From this picture of the C Company Barracks[15] taken by Gene Whitmer, you can see there wasn't much vegetation on base. I had my own corner room on the top of the barracks, left-hand side, because I was a sergeant. They were screen

[15] https://www.flickr.com/photos/47509268@N07/5850708905/in/photostream/

windows, so if they were spraying outside, the spray would come inside. I remember spraying from the fogger truck coming by."

This picture is titled "Rain in the tropics". Boy, did it rain! Look at the base of the mountain, and you can see what the vegetation would look like on base outside the maintained areas. There were tall grasses and bushes and trees. I do not recall seeing anyone mowing the lawns or hacking at grasses with a machete.

Mr. Loring's Sworn Declaration discusses drainage issues at Albrook Army Air Base (later turned over to the Air Force). **Mr. LORING**, a U.S. Army veteran who was stationed in the Panama Canal Zone and was at Albrook Army Airfield from May 1976 to October 1977, stated in a **Sworn Declaration**:

> "This airfield (**Albrook Army Airfield) was built in 1928**, twelve years after the canal was completed. Built atop soil from the canal construction utilized to fill in the Curundu swamp, the area remained prone to flooding during the annual monsoon season with large drainage ways in place to remove the water.

SP4 Couzens was stationed at Fort Davis (built in 1920s), on the Atlantic side near Fort Sherman, where he and many other Veterans went through Jungle Warfare Training. This is an enlarged picture of Maria Denson's living quarters at Fort Davis[16]. Note the drainage ditch on the left-hand side.

[16] https://i.pinimg.com/originals/fb/aa/0b/fbaa0ba4afcd096e9e44409c6f14d87c.jpg

In her sworn statement about the living quarters at Howard AFB, Mrs. Nickisch describes the spraying of insecticides. "Our house was sprayed with chemicals to prevent termites and other insects, because one day I got stung by a "Christmas Tree caterpillar" which paralyzed my leg, so Phil took me to the Emergency Room. After that they sprayed insecticides again, so I know what insecticide smelled like. Leaf-cutter ants were around our house. One day there was an actual battle between army ants and leaf-cutter ants that I observed. Once again, they came in to directly spray with insecticides. There were big reasons why the Air Force sprayed on a regular basis to prevent insects."

The sworn declarations above confirm tactical application of standard building style and the persistent use of drainage canals on ALL bases.

5. Tactical Use of Herbicides in War on Mosquitoes

Dr. Ross established that mosquito habitat involved leaves. In addition to insecticides, herbicides were used to control mosquito habitat. Mr. Luitweiler testified before the US Senate, "**A jungle will creep back and take over within a month or two.**" Even though Philip and Mrs. Nickisch were at Howard AFB from 1991 to 1993, she recalls observing the procedure for the use of chemicals around her home. "Our living quarters on base housing were located approximately 50-75 feet from the jungle line and this area was consistently being treated with various chemicals to prevent over-growth. We had Panamanian gardeners who mowed and hacked the

jungle. Then they would come around and warn us whenever they were going to spray chemicals. Some of those chemicals killed the jungle. Some of the chemicals killed the bugs."

- 2,4-Dichlorophenoxyacetic acid, known as "2,4-D" to millions of farmers, was reported by R. Pokorny in **1941**, and it was developed as a major herbicide during World War II. It has been used as a pesticide ***since the 1940s.***
- Testing performed at Fort Davis and the Fort Sherman Tower by the US Army Environmental Hygiene Agency from 1973 to 1977 confirms the presence of aldrin, DDT/DDD/DDE, Chlordane, Dieldrin, endrin, heptachlor, methoxychlor, toxaphene, diazinon, malathion, as well as "organophosphorus compounds and a chlorophenoxy herbicide" in soil samples. 2,4-D, 2,4,5-T, and silvex were specifically listed. 2,4,5-T and silvex both contain dioxins.[17]

Methods of Spraying

Spraying was the most common method of exposure for insecticides and herbicides. Insecticides were sprayed on a regular basis on every base and installation as part of the "War on Mosquitoes" by truck and airplane under the direction of the PCZ government as part of their Public Health programs. The letter dated September 1, 2016 from Beth Murphy, Director of VA Compensation Services, VA, verifies spraying of Malathion from Agent Orange contaminated airplanes from 1970-1973.

[17] ADA034765.pdf (dtic.mil) https://apps.dtic.mil/sti/pdfs/ADA034765.pdf

The 1990 US Navy Memorandum confirms the spraying of Malathion twice a week as a regular base procedure and the spraying of Diuron (Karmex) every six months at Rodman Naval Base:

a. Insecticides; Malathion (Cythion) used twice daily in an ultralow volume sprayer by Public Works personnel.

b. Herbicides; Divoron (Karmex) used every six months as a direct pressure spray by base contractors.

[The person typing the 1990 US Navy Memorandum mistyped the generic name for Karmex. Instead of Divoron, it is "Diuron".] Diuron is composed of dichlorobenzene and dichlorophenyl. Dichlorobenzene has benzene, which is a known toxic substance known to cause diabetes mellitus and hypertension. Dichlorophenyl is an irritant for tissues including eyes and mucous membranes, and inhalation of dust from the chemical is poisonous.

It is a dichlorobenzene and a 3-(3,4-substituted-phenyl)-1,1-dimethylurea. Diuron, also known as DCMU (3-(3,4-dichlorophenyl)-1,1-dimethylurea), is an herbicide in the urea chemical family that inhibits photosynthesis. It was introduced by Bayer in 1954 under the trade name of Diuron.

National Institutes of Health (.gov)
https://pubchem.ncbi.nlm.nih.gov › compound › Diuron

Diuron | C9H10Cl2N2O | CID 3120 - PubChem

Please recall that most all the bases (Army, Navy, Air Force) were interconnected (with connecting boundaries) or close to each other and that these pesticides could travel long distances once airborne. In fact, the Panama Canal is 50 miles long, while the Isthmus is only 37 miles wide. So, drift with air contamination exposure is a strong contender for exposure.

According to the archival video, *Panama Soldier*, they show spraying of insecticide by hand/truck and by airplane. Per Beth Murphy, the only time airplanes were used for spraying insecticides was between 1970 and 1974. The insecticides used until 1975 were DDT and Malathion—depending on your source, and it was sprayed by plane or fogged by truck into the air. The picture in the movie shows pesticides being sprayed on the ground, presumably insecticides. Government documents also include aerial spraying by helicopter.

The DOD does not deny the use of DDT or malathion in Panama. The Army lauded its use in the film "The Big Picture" where they describe the duties of soldiers in Panama. Enclosed is a PDF of the documenting information from the National Archives along with some still images from the movie. The actual clip of interest is at minute 21 of the 30-minute video, which can be watched at NARA, where it is archived at https://archive.org/details/gov.archives.arc.2569553.

While showing the soldiers spraying the creek the narrator says: "*A tiny insect had been the deadly enemy of the builders. It was the Anopheles Mosquito, a product of the swamps, carrier of*

malaria and Yellow Fever, that had caused the French attempt of the 19th Century to be abandoned. Rigid health regulations and sanitation methods instituted by Colonel William C. Gorgas solved the problems which had stymied the French. The fight against disease has never been relaxed. A vigilant insect control program for the Canal Zone brings the attacks right into the swamps to places where disease is born."

While showing the picture of the plane the narrator says: "*Every resource of medical knowledge has been brought into the fight against tropical sickness—sickness, which if left unchecked, could endanger the security of the Americas.*" The movie then shows two different sequences where planes are used to spray over Panama. Beth Murphy confirms that C-123s sprayed malathion between 1970 and 1973 from these Agent Orange contaminated planes. But reports about malathion indicate it was primarily fogged from trucks. So, what were they spraying from the planes?

1. Corroborating Testimony from multiple veterans confirm the spraying of insecticides and herbicides in the Panama Canal Zone on a regular basis.

B.J. TERRY, US Army, was stationed at **Fort Clayton in 1968**, drove truck, and delivered and sprayed pesticides/herbicides. He also served on guard duty at Albrook Army Airfield. In a **Sworn Declaration** dated December 23, 2020, he stated:

- "I joined the U.S. Army on 7/23/1968. I took basic training at Fort Ord, CA. I was stationed at Ft. Clayton, Panama Canal Zone, from around the 5th or 6th of October 1968. My barracks were at the Garrison Company, which is next to Building 126. There was a little field to separate the men from the women. **We sprayed these buildings using hand-pump sprayers on a weekly basis with herbicides when we would come out and spray the jungle."** [emphasis added]

- **"My Military Occupational Specialty (MOS) was 645B20, a heavy vehicle driver. I drove the biggest trucks they had at the time. These were 5-ton trucks."** "I was assigned as a heavy-duty truck driver at the Corozal Motor Pool, down the road from Fort Clayton, Panama. **We were dispatched to haul herbicide chemicals in black barrels with an orange stripe around the barrels**. This herbicide was used to spray vegetation along the roadside and around the various military posts in the Fort Clayton area. [emphasis added]
- "We would load 10 – 12 barrels on the 5-ton trucks provided and would take them to Fort Sherman, Panama Jungle Training School. After delivering the barrels, we would take the barrels to various spots to load the spray truck or the hand-pump sprayers. The spray trucks were 2-1/2-ton trucks with a 300-gallon tank on the back. The hand-carried hand-pump sprayers would only carry 2-3 gallons.
- "**We would deliver to Fort Clayton, Fort Sherman, and Rio Hato Beach, Panama. We went all over the surrounding areas. Sometimes we would need to bring a second load to complete the spraying. They were spraying herbicides in Central America long before they started spraying herbicides in Vietnam.** [emphasis added]
- "**The drums were basic, metal 55-gallon oil drums. Some were new, some were old, some were dented.** Whatever they brought from the warehouse at Corozal is what we put on the truck. There were about 100 barrels in the warehouse." "**There was no fork lift, so we would roll the barrels off the truck onto the ground. Sometimes the barrels would break open and splash on our feet. The first time I got exposed to herbicides, one of the barrels broke open, and I jumped down to right it, and I got liquid all over my feet.** I complained to the Supervisor, Specialist 5th Class Hogg who was in charge of our detail that I was concerned about chemical exposure. He replied, '**Don't worry you could take a bath in it.**' [emphasis added] Alvin Young, Ph.D., in his paper *The Agent Orange Controversy in the Republic of South Korea* states, "**handling of the drums could result in damaged and leaking drums, although the projected loss of damage was less than 1%**." This would put concentrated Agent Orange onto the soil.
- "The barrels were used for the hand sprayers or on the spray truck. There were two guys sitting on a platform on the back of the spray truck. When they were running low, they would motion for us to come closer to fill them up. Sometimes they would goof around, and they would spray all over the truck. **We got herbicide all over us. It would be all over our face and arms. When this happened, it would sting and burn. We would get water from our cool tank to wash it off, but it wouldn't come off completely because it was sticky. Those operating the spray hoses would sometimes play around with the spray hoses and spray everyone and everywhere.** [emphasis added]
- "**We followed the spray truck around the perimeter/fence lines,** around the NCO club, around the 123 Club, and in the back of all company areas. They also sprayed the jungle because the buildings were close to the jungle, and they wanted safety. There was a little road between the buildings and the jungle to allow for deliveries.
- "The **roadways were sprayed on both sides of the highway going from Fort Clayton [to] Fort Sherman.** We would go up about 5 miles on one side of the road and then come back on the other side. I did this for about five days.
- I also did guard duty at Albrook AFB a couple of times during the 8 months I was there. **We were guarding the areas around the helicopters.** … **All of the area was dusty,**

> **and every time a helicopter came in or left, it would kick up the dust into a cloud. That dust contained herbicides.**" [emphasis added]

Mr. Terry stated that he delivered and sprayed pesticides/herbicides by truck and hand sprayers. Mr. Bartlett's testimony indicated: "**When the material was applied by ground means**, that is [by] trucks or **compression pump sprayers** or some such thing that the **soldier could use on the ground**, **the actual application rate was far, far higher than ten gallons per acre.** And so **… we found areas where the application rate was high enough that you could see a greasy sheen on the foliage or vegetation and so, the exposure rate was much higher than would be even typical of Vietnam applications."** [Emphasis added]

Mr. W. LORING, a U.S. Army veteran, served from 1974 to 1980 as a helicopter mechanic, crew chief and academic instructor at the Army Aviation School at Fort Rucker, AL. He was at Albrook Army Air Field from May 1976- October 1977. He is now a military historian and has written several books. He testified on behalf of a disabled veteran, Gloria Becker. Mr. Loring stated in his **Sworn Declaration in Ms. Becker's case**:

- "**Chlorophenoxy 2,4,5-T based herbicides were utilized to control weed and grass growth at Albrook Field between airfield taxiways, ramps, and runway. 2,4,5-T is recognized by the Centers for Disease Control (CDC) as being in the same class of herbicide as Agent Orange and its use in the Canal Zone was confirmed in an Environmental Sampling Report dated from December 1976.** At the 14th Annual Meeting of the US Army Corps of Engineers Aquatic Plant Management held in Vicksburg Mississippi in 1980, a report was issued noting that **2,4-D (a component of Agent Orange) was also used in areas of fresh water about the Canal Zone.** [emphasis added]
- "At the Pacific end of the canal was the large *Empire Range Complex*, a weapons range for use by Army and Marine elements stationed in the zone, somewhat opposite the canal from Fort Clayton. Nearby was an Air Force bombing range known as Balboa West. *Empire* was in constant and continual use from 1949 until the mid-1990s. Previous firing ranges were scattered and not quite as well defined but concentrated mostly at the Pacific end. … defoliant[s] were in constant and heavy rotation throughout the zone. There does appear to be evidence that Orange was *tested* at the Empire Range Complex via airborne spraying for defoliation purposes intended for use in Vietnam under *Operation Ranch-Hand*. [emphasis added]
- "**All in all, specific areas of the Canal Zone should be considered as having been quite heavily contaminated, … and if located in the conti-nental United States it would have been placed on EPA Superfund lists.**"

The Sworn Declaration of former Marine Corps Chief Warrant Officer, **M.E. Doyle,** dated 18 November 2019 describes an event between November-December 1976 where he was assigned by Lt. Col. Leonard Wunderlich to "obtain the herbicide the Army was using at Ft. Gulick for use at the Marine Barracks to help control the jungle and to kill vegetation". CWO Doyle's duties were to supervise the use of herbicides at the Marine Barracks, Canal Zone, from June 1976 to October 1978. As such, he is qualified to know what herbicides were being used. Mr. Doyle describes working with the "**excess property manager**" turned out to be an Army warrant officer. "Together, we traveled to **the warehouse in Corozal**. **There were about six barrels of**

the herbicide, one of which was opened and about ¾ full. I was told I could have the open barrel. There was no paper work. I was told that the herbicide was not on inventory; the implication being it was not an item that could [be] officially requisitioned (or as excess property reclaimed). I was also told this was a one-time favor, and I would not be able to get anymore." While Mr. Doyle does not specify the actual name of the herbicide, he does state, "I do not remember who the source was, but after making inquiries, I determined that **we would use a 20 percent concentration**. The herbicide would be sprayed using the back-pack sprayers the Marine Corps Exchange already owned. **I began inspecting the effectiveness of the herbicide the next week. It was obvious that it was effective in killing the unwanted vegetation, and I directed its continued use. The herbicide was still being used by the grounds crew when I left the Marine Barracks in late October 1978.**" … "It is incontrovertible that herbicides, pesticides, and other chemical agents were routinely used within the Canal Zone. I have documented my own role in the use of herbicides at the Marine Barracks, and my knowledge of their use at other naval facilities within the Canal Zone. Others have also come forward to discuss their roles in the acquisition, storage, and use of these products within the Canal Zone. There is also photographic evidence; including photographs taken by the government of the spraying of chemicals and the results these chemicals had on vegetation and insects. Also indisputable is the fact that the Panama Canal only exists because of the use of these chemicals."

A notarized letter from **Mr. E. Dziekan** (U.S. Army Veteran previously stationed at both Fort Kobbe and Fort Clayton for 16 months of service, with assignment to Jungle Warfare Training at Fort Sherman) to Commander John Wells includes pictures taken by Mr. Dziekan of barrels discovered at Fort Sherman while on vacation in February 2020. "Just past that front gate where a few of the old Military Houses started, I saw a fence made of **old rusted 55-gallon barrels with orange stripes and green data areas still available. These looked like "Agent Orange" barrels**…"

Johnson Atoll 1971-1978 https://vspa.com/ao-johnston-island-1972.htm

Abandoned barrel at Fort Sherman Panama

The picture on the left is from Johnston Atoll, where residual herbicides used in the Vietnam War were stored until they were destroyed. Note the variety of different colorations on these designated Agent Orange barrels. Next to it is a cropped version of the barrels identified by Mr. Dzieken.

In his testimony before the BVA, Mr. Bartlett testified that barrels of Agent Orange used for testing in the late 60s were left in Panama for use by the Army. There is testimony and evidence the herbicides tested in Panama stayed in Panama and were used by the Army, Navy, Marines, and Air Force.

So far, expert testimony establishes that Agent Orange WAS delivered to and tested in Panama, and then it was left in Panama for continued use. Testimony from Veterans corroborate the continued use in Panama. The testimony above by Veterans and the list of herbicides available on the Department of the Army Supply Bulletin dated September 18 1968 contradict the "Memorandum for the Record" from the Department of the Army, JSRRC, dated May 6, **2013**, states, "…the JSRRC has not identified evidence of record that the **tactical herbicide**, Agent Orange (AO) was used, stored, tested, or transported within the country of Panama or the Canal Zone." [emphasis added] It stated further that "At this time the **JSRRC research** has produced no evidence to support the **potential for exposure to Agent Orange** in the country of Panama or the Canal Zone." **The following evidence from government documents and scientific articles will further contradict this obsolete memorandum of record, which the VA continues to use.** NOTE: According to the dictionary definition of the word "tactical", pretty much ANY substance could be "made or carried out with only a limited or immediate end in view."

2. Soil and water contamination.

Soil is an excellent filter and purifier. The 1990 Navy memorandum establishes that "Pesticides are transported great distances by air and water, and some do not break down readily." The discussion of half-life provides the "persistence" of a chemical versus its ability to break down and no longer be toxic. Arsenic is organic and has no half-life. Dioxin, the toxic component in Agent Orange, remains in the soil for 40 to 100 years, depending on your source. The reason we know this is because of testing from soil scientists as well as military sources.

"Though organophosphorus insecticides [including Malathion] are more biodegradable as compared to organochloride insecticides (Lal, 1982), their presence in the **contaminated environments have been detected even after a rather long period from the time of introduction**." (Wong/Chang, 1988, pg 7)

The *Herbicide Manual for Noncropland Weeds*, page 36, states: "For some situations, mixtures of two or more chemicals are more effective than single-chemical herbicides. Proprietary mixtures are combinations of chemicals that (1) provide a quick knock-down of vegetation **plus a residual toxicity in the soil** … Caution—Observe the precautions as given for each chemical in the mixture." [emphasis added] On page 3: "There is no way to determine accurately whether a lethal dose for a man is larger or smaller than LD50 (lethal dose for 50% of animals tested) for a laboratory animal, but animal studies are the best available." [emphasis added]

I am submitting the article, **Long-Term Environmental Impacts of Pesticide and Herbicide Use in Panama Canal Zone*, by Kenneth Olson, Professor Emeritus of Soil Science in the Department of Natural Resources and Environmental Sciences, College of Agricultural, Consumer, and Environmental Sciences, University of Illinois, Urbana, USA, published in Scientific Research, 2021. This article states that dioxin stays in the soil. **This article cites the following government documents.**

- *14th Annual Meeting of the **U.S. Army Corps of Engineering** Aquatic Plant Control Research Program* section concerning "Aquatic Plant Control Activities in the Panama Canal Zone". This section notes the initiation of large-scale testing of 2,4-D on water hyacinth began in June of 1978. 2,4-D is another component of Agent Orange that was present in Panama.

This same article states Agent Orange was not the only toxic pesticide and/or herbicide used in Panama. Also, they note the commercial versions of 2,4-D and 2,4,5-T are toxic.

> "The canal channel went through the newly created Lake Gatun, which was periodically covered with hyacinths and other floating plants. An early attempt to eliminate the floating plants was to purchase commercially available **white arsenic and mix it with soda bicarbonate (soda) and water**. This mixture was then sprayed on floating plants including hyacinths. The arsenic desiccated and killed the water plants and the residues laced with arsenic sank to the bottom of Lake Gatun and the Panama Canal. Thus the **water soluble arsenite and arsenate were disbursed throughout the lake and canal waters and sediments**. **After 1932 the white arsenic (As has no half-life) and soda usage was discontinued and replaced by other herbicides including 2,4-D. The U.S. military bases constructed throughout the Panama Canal Zone also had challenges in controlling the tropical fauna and flora. The solution used was commercially available herbicides and insecticides which were obtained through the Federal Catalog to control weeds and insects.**
>
> "The **U.S. Army technical manual and the U.S. Army Medical Department Center and School subcourse for groundskeepers** were used to provide guidance on how to eradicate specific weeds, such as kudzu, and insects on the military base grounds. **The military properties, housing units, and connecting roads were sprayed daily using truck-mounted sprayers apparently filled with DDT.** .... In 1963 the Curundu Jungle Test site at Fort Clayton on the Pacific side [**near Fort Kobbe**] was used to determine **which pesticide and chemically treated stakes would not be eaten by the termites**. **The commercially available herbicide, 2,4-D was used in Lake Gatun since 1948, which was the feeder lake water source for the Panama Canal.**
>
> "2,4-Dichlorophenoxyacetic acid (2,4-D) is an organic compound [17] with the chemical formula $C^8H^6C^{l2}O^3$ (2,4-D). This systemic herbicide has growth regulator effects that selectively kill plants by causing uncontrolled growth in most broadleaf weeds. The herbicide has been commercially available since 1945. The herbicide 2,4-D is one of the most widely used and oldest defoliants in the world. After the patent expired it was produced by many chemical companies. **There are over 1500 herbicide products which contain 2,4-D as the active ingredient. It is widely used as a commercial lawn herbicide and as a weed killer on cereal crops and orchards.**

"The initial publication of 2,4-D's ability to control broadleaf weeds as a selective herbicide came in 1944. **The herbicide 2,4-D was one of the ingredients in Agent Purple and was used in the Malayan Emergency. 2,4-D was also contained in other tactical herbicides: Agent Orange, Agent White, Agent Green, and Agent Pink which were used during the Vietnam War [13]. Agents Purple, Pink, Green and Orange also contained 2,4,5-T contaminated with TCDD (2,3,7,8-tetrachlorodibenzo-dioxin) which caused adverse human health effects. 2,4-D kills both terrestrial and aquatic broadleaf weeds [17]. It was and is still used to control aquatic weeds in the Panama Canal and Lake Gatun which interfered with boating and shipping. In other waterways it was used to unclog irrigation canals and hydroelectric equipment. Some ester forms of 2,4-D are highly toxic to fish, moderate toxicity to birds and mammals, and slightly toxic to aquatic invertebrates.**

"A chlorophenoxyacetic acid herbicide 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T) is a synthetic auxin created to defoliate broad-leafed plants. It was developed in the late1940s and was **slowly phased out in United States in the late 1970s due to toxicity concerns and not manufactured after 1985**. **The herbicide 2,4,5-T itself is toxic.** An intake rated of 10 mg/kg/day 2,4,5-T can cause adverse alterations in organisms. In addition, **the manufac-turing process for 2,4,5-T can contaminate this herbicide with unknown amounts of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)**. The half-life of 2,4,5-T is similar to 2,4-D. The degradation of 2,4-D and 2,4,5-T are rapid (half-life of 6.2 days) in an aerobic mineral soil but have a 15-day half-life in anaerobic mineral soils [18]. The herbicides are moderately persistent to persistent (half-life of 41 to 333 days) in anaerobic aquatic environments.

"The by-product 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is an **unanticipated contaminant created during the manufacture of the herbicide 2,4,5-T**. TCDD has a very long half-life and does not degrade easily. **Each batch of commercially available 2,4,5-T herbicide has an average concentration of about 2 to 3 ppm of TCDD but can vary between 0.05 ppm to 50 ppm**. **TCDD** is an endocrine disrupter and **can cause** a variety of chloracne, cancers and developmental and reproductive effects." Endocrine disrupters cause Diabetes Mellitus. TCDD is linked to neurologic disorders such as Parkinson's Disease, parkinsonism, and peripheral neuropathy by presumption.

Dr. L.W. (Wayne) Dwernychuk is an Environmental Scientist and Agent Orange Specialist. Expert testimony by Dr. Dwernychuck establishes soil contamination. Claimant is submitting excerpts from 3 pages of written testimony dated August 2, 2016, which was given to the VA by **Dr. L.W. (Wayne) Dwernychuk** in the claim of Gene Tornoe, who also served in the Panama Canal Zone in the 1970s. (Also enclosed is his C.V.)

- "I have been asked to provide a professional opinion regarding the potential for exposure of Mr. Tornoe to toxic chemical(s) while he was stationed in the Panama Canal Zone (PCZ) during the period 1974-1977. The toxic chemicals referred to here may have been a 50/50 mixture of the herbicides 2,4-D and 2,4,5-T, otherwise commonly known as Agent Orange (AO), and/or 2,4,5-T in isolation from other herbicides. The term 'Orange

Herbicide', as labelled by the US military, was a 50/50 formulation of 2,4-D and 2,4,5-T to definite specifications of the US military.

- "During the manufacture of 2,4,5-T, the toxic chemical 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) was generated and was initially an unknown toxin in this herbicide. By the mid 1970's the presence of TCDD in 2,4,5-T was commonly known. However, there is evidence that TCDD was known as a by-product of the 2,4,5-T manufacturing process back in the mid 1960's." (Dwernychuk, pg1) "…Herbicides were also used for perimeter spraying and reducing vegetation along right of ways and roadsides in the PCZ.
- "Table 2 titled *Schedule B Commodity by Country-Domestic Merchandise* [from Bureau of the Census] (http://catalog.hathitrust.org/Record/000497548), clearly shows the transport and exportation of the herbicides 2,4-D and 2,4,5-T to Panama. It is unclear whether these two herbicides were, in fact, in an Agent Orange composition (as defined by US military specifications) as a shipping commodity, or they were shipped separately. They may have been mixed on site in the PCZ, or were, conceivably, applied separately. …
- "However, **with respect to toxicological properties, it makes no matter whether these two herbicides were mixed or not. The very fact that 2,4,5-T was used is sufficient grounds to conclude that TCDD was applied wherever 2,4,5-T was used as a vegetation control agent.** The TCDD content of the 2,4,5-T varied over time, but regardless, it **was** present in this herbicide and introduced to the PCZ environment. Unfortunately for service personnel, there were no attempts, to my knowledge, to ascertain the TCDD content of 2,4,5-T used in the PCZ or, for that matter, in PCZ soils or any other environmental media. A cynic could interpret these analytical omissions as 'intentional'.
- "**TCDD in soil can remain a toxic component of the environment for over 100 years (Paustenbach, et al. 1992, Journal of Toxicological and Environmental Health, 36:103-149).** Consequently, applications of 2,4,5-T on the PCZ … without question resulted in the deposition of the characteristic dioxin found in this herbicide, TCDD. Its presence through the adsorption onto soil/dust particles could, as likely as not, have been inhaled into [the Veteran's] lungs resulting in accumulation of this contaminant in his body. Over the time of his tour of duty, a bioaccumulation factor probably was in effect wherein with each 'exposure' the level in his body increased. [emphasis added]
- "The document *US Army Environmental Hygiene Agency* (1977) [Pesticide Monitoring Special Study #44-0102-77 **Environmental Sampling** in the Panama Canal Zone 1 December 1976] in their Appendix Table, page 11, itemizes some of the compounds that were target chemicals for laboratory analysis. The very fact that 2,4,5-T and Silvex [an insecticide, also a carrier of TCDD) (http://pmep.cce.cornell.edu/profiles/herb-growthreg/fatty-alcohol-monuron/fenoprop/silvex-2-79-canc.hrml] were target analytical variables **confirms that these compounds were expected to be found when tests were applied to environmental samples, thus affirming their use in the PCZ….** Given the aforementioned facts, it is my professional opinion that [Veteran's] tour of duty in the PCZ 1974-1977 offered **a high probability of exposure to the dioxin TCDD**."

Dr. Dwernychuk cites multiple official references. The full list is provided at the end of his article.

Dioxins not only stay in the soil, they stay in the human body.

The article titled **Estimates of the half-life of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin in Vietnam Veterans of Operation Ranch Hand*, a study performed by the Air Force and the CDC, states, "The persistence of 2,3,7,8-TCDD for years in exposed persons has been a consistently observed finding. In 13 persons with definite occupational exposures that ceased 16-30 years ago, all had persistently high serum 2,3,7,8-TCDD concentrations ranging from 30-40 ppt to over 700 ppt. … no evidence was found that half-life dependence on initial 2,3,7,8-TCDD concentration." Basically, the amount of your initial concentration of exposure does not change the half-life degradation of 16-30 years, **which explains the latency period between exposure and development of disease.**

So, in addition to the direct exposure to herbicide/pesticide chemicals during 1971-74, Mr. Couzens had the residual exposure from the previous years of spraying DDT, Chlordane, applying arsenic, 2,4-D and 2,4,5-T. When you add the yearly figures for 1958-1970, you have a **total exposure of millions of pounds of "tactically utilized" herbicides and pesticides that had collected in the soil at Fort Kobbe and the adjoining military facilities and in the drinking water the military drew from Lake Gatun**.

Veteran Couzens is documented to have completed Jungle Warfare Training at Fort Sherman (copy submitted). Veteran Clark's declaration states he was in the PCZ for three (3) weeks of Jungle Warfare Training located at Fort Sherman—"During this time we lived and stayed in the jungle, drinking from and bathing in the streams." I have multiple statements from other Veteran who went through Jungle Warfare Training and witnessed "spraying" and similarly described experiences.

"**TCDD in soil can remain a toxic component of the environment for over 100 years (Paustenbach, et al. 1992, Journal of Toxicological and Environmental Health, 36:103-149). Since TCDD and other chemicals last 100 years, if they were applied to areas in the PCZ the 1960's and 70's and Mr. Couzens arrived in the PCZ in 1971 and traveled to these same areas of the PCZ in his work for the Army until 1974, it would be reasonable to presume he was exposed to these chemicals, either directly through spraying or indirectly, such as through soil or water contamination.**

3. Nonpresumptive Status

No one who lived or served in the PCZ is qualified for presumptive status unless they were a mechanic working on C-123 aircraft between 1971 and 1973. However, the Federal Circuit has held that even if a veteran is found not to be entitled to a regulatory presumption of service connection, the claim must still be reviewed to determine if service connection can be established on a direct basis. Stefl v. Nicholson, 21 Vet. App. 120 (2007); Combee v. Brown, 34 F.3d 1039, 1043 (Fed. Cir. 1994). See also 38 U.S.C. § 1113(b); 38 C.F.R. § 3.303(d) (the

availability of service connection on a presumptive basis does not preclude consideration of service connection on a direct basis).

Thus, when looking at non-presumptive claims (aka Direct Claims), VAROs should request information from the appropriate repository regarding whether there was any spraying, testing, transporting, storage, or usage of **herbicide agents** (used separately or included in pesticides, insecticides, and/or herbicides) and/or jet fuel, solvents, or other toxins in the Panama Canal Zone. The VARO should evaluate the evidence submitted by the Veteran to show any spraying, testing, transporting, storage, or usage of pesticides, insecticides, and/or herbicides in the Panama Canal Zone, applying 38 CFR § 3.307.a.6.i

(6) ***Diseases associated with exposure to certain herbicide agents.***

(i) For the purposes of this section, the term "herbicide agent" means a chemical in an herbicide used in support of the United States and allied military operations in the Republic of Vietnam during the period beginning on January 9, 1962, and ending on May 7, 1975, specifically: 2,4–D; 2,4,5–T and its contaminant TCDD; cacodylic acid; and picloram.

Sadly, the only research that VAROs perform is to contact MRRC, which only looks at the 2019 DOD Location list and Unit Histories. As indicated above, Unit histories are created to build morale—not report herbicide spraying, which was a function of the Public Health department of the Panama Canal Zone Government, under the authority of the US Army.

4. Shipping, Testing, Storage, or Usage of Pesticides in the War on Mosquitoes in Panama

The VBA is to **evaluate claims for pesticide exposure based on Testing and Storage Location**s. However, the DoD does not include Panama in their 2019 list of sites where pesticides were tested and stored. This conflicts with documentation of testing of various pesticides (insecticides, herbicides) by the Department of Agriculture, Department of the Navy, and the Department of the Army.

Shipping

Confirmation of shipping and testing by the Army in Panama provided by the testimony of former Lt. Charles Bartlett. He was **operations officer and a research and development officer in the US Army Chemical Corps with the chemical laboratories at Fort Detrick for ten years, overseeing their work with herbicides**. "I have with me today a document called a miscellaneous publication number 15, it's the proceedings of the **3rd Defoliation Conference on August 10 and 11 in 1965**. The **document was published in September 1966 by the Department of the Army**, Fort Detrick, Frederick Maryland. … [I]t indicates that Agent Orange and other military herbicides were used and tested and shipped to may locations in the United States … and also was tested in a number of tropical climate analogues, that is a **vegetation area that might match South East Asia jungle environments.** And **those locations were in** Puerto

Rico and in **Panama** …" He continues: "In the late 1960s, several hundred drums was **shipped to Panama** and … a smaller amount was used in testing programs. All of the material was originally shipped, at least the Bill of Lading called for shipment to Fort Clayton in canal zone. … **At the end of that testing program a quantity of, a number of 55 gallon drums were left in Panama, extensively under the control of Fort Clayton and so that, those drums remained in Panama for an indefinite period and were never shipped out of Panama, were left there permanently in Panama. And available for use by anybody who needed it because at that time there was no idea at all that there was anything harmful about Agent Orange**." … **Yes [it was known to be Agent Orange]. It was shipped, we shipped it from Fort Detrick … to Panama … in the typical black drum with the orange stripe,** and it was for our testing program under ARPA order 423 … Advanced Research Projects Agency, which was funding these tests, research and development program at that time. And so **we shipped Agent Orange to Panama**." He later explains how the exposure rate was higher in Panama than in Vietnam. "When the material was applied by ground means, that is trucks or compression pump up sprayers or some such thing that the soldier could use on the ground, the actual application rate was far, far higher than ten gallons per acre." Also submitted along with the testimony of Mr. Bartlett is a document from the Department of the Army from the US Garrison in Panama dated June 20, 1997. "This is the use of herbicides in Panama …from '70 to '74 they do list 2-4-D for control of broadleaf leaves, …".

The 1958-59 Pesticide Situation Report from the Department of Agriculture reports:

> Insecticides, fungicides and weed killers are expected to be in ample supply in 1959. … Production of pesticides in 1958 was well above the 1957 level, on the basis of the limited data available. Increased production of DDT, the aldrin-toxaphene group, and many materials recently in commercial manufacture more than offset the reduced output of benzene hexachloride, copper sulfate, 2,4-D and 2,4,5-T. … Exports of 2,4-D and 2,4,5-T were in 1958 for the first time reported separately from other herbicides. Exports of pesticides are now published in more detail than prior to 1958. DDT led in dollar value of exports in 1958, with other 'polychlor' insecticides nearly as high."

Department of Commerce records confirm the shipment of 2,4-D and 2,4,5-T to Panama during the time period the Veteran was serving in Panama from 1971 to 1974. In fact, I have Department of Commerce records confirming the shipment of DDT, organophosphorus insecticides, fungicides, and herbicides from 1958 through the 1980s.

American military forces of the 21st century must be able to deploy and operate effectively around the globe, making testing in the tropics essential. Heat, humidity, solar radiation, insects, fungus, bacteria, rainfall, and numerous other factors combine synergistically to reduce the performance of men, machines, and materials in the tropics quickly. The artificial environments recreated in test chambers can be useful in some aspects of the testing process, but there is no substitute for the synergistic effects of Mother Nature. Only in the natural tropic environment do all negative factors come together to work at the same time. It's worth remembering that wars are not fought in test chambers.

United States military tropic testing began in 1923, when the Panama Canal Zone was used as a test station for studies on plants and animals. However, severe failures of military equipment in the Southwest Pacific during World War II significantly expanded the tropic testing workload. Testing equipment performance and battlefield concepts continued at full capacity through the long years of the Vietnam War. The need for tropic testing continues today.

Shipments of insecticides and herbicides were shipped to and through the Panama Canal on a regular basis. Page 11 of the submitted GAO report "GAO-19-24 Agent Orange" contains information about the **herbicides being shipped to and used on military installations outside**

of Vietnam. Obviously, Panama is outside of Vietnam. **In this report, the GAO confirms that the Military Sea Transportation Service, which directly chartered merchant vessels to carry herbicides during the Vietnam War, traveled through the Panama Canal. The herbicides, such as Agents Orange, Blue and White were stored vertically on pallets in compartmented internal storage spaces on the vessels.** The following vessels are known to have traveled through and stopped in the Panama Canal while carrying herbicide agents: *SS Gulf Shipper, SS Aimee Lykes, SS Buckeye Atlantic,* and *SS Overseas Suzanne. [emphasis* added] The GAO also note **an inconsistency between the amount of herbicides loaded in US versus the amount of herbicides off-loaded in Vietnam, with the implication being that herbicides were dropped off in the places where these merchant ships stopped: Panama**, Guam, Okinawa, Thailand. The PACT Act of 2022 confirmed Guam and Thailand as ports receiving shipments with 'tactical herbicides' being stored on bases, despite the DoD swearing that no tactical herbicides were shipped or stored outside of Vietnam. Evidence exists of herbicide storage in Okinawa and Panama as well. Presumption has just not been conceded as of this writing.

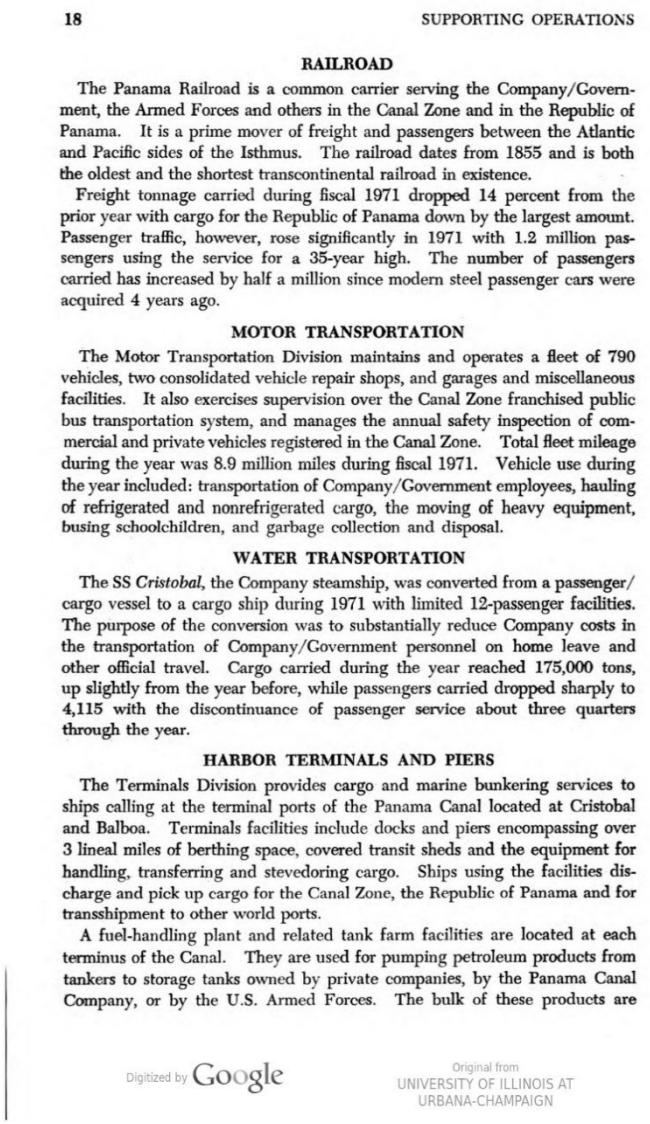
The GAO "Report to Congressional Addressees" dated November 2018, titled *Agent Orange: Actions Needed to Improve Accuracy and Communication of Information on Testing and Storage Locations found:*

> "Tactical herbicides were stored vertically on pallets in these holds. The first large shipments of Agent Orange took place on the SS Adabelle Lykes, SS Elizabeth Lykes, and SS Mayo Lykes, traveling from the port of New Orleans, Louisiana, through the Panama Canal."
>
> "Herbicide manufacturers marked 55-gallon drums for shipment to Vietnam. DOD then arranged for the transport of these drums by train from the manufacturers to several U.S. ports. From the U.S. ports, the herbicides were shipped to Southeast Asia. The quantity of Agent Orange reported to have been loaded onto the SS Gulf Shipper is not divisible by 55, raising questions about the reliability of some of the numbers in the records we were able to obtain. … In addition to the stop in Guam, the SS Gulf Shipper also stopped in Panama on the way to Vietnam."
>
> "In addition to the tactical herbicides used during the Vietnam War era, the U.S. military also used commercial herbicides to manage vegetation on its installations. … Commercial herbicides, conversely, were widely available worldwide for use in vegetation management at military installations, to include controlling vegetation adjacent to flightlines or along perimeter fencing. Federal agencies developed federal specifications for these products to ensure that they met specific requirements, and these specifications were approved by the Commissioner, Federal Supply Service, in the General Services Administration for use by all federal agencies. According to DOD officials, during the Vietnam era there was no requirement for DOD to retain records concerning the use of commercial herbicides on military bases beyond 5 years. DOD officials also stated that DOD catalogued these herbicides available for use on military installations in the federal supply schedule under federal supply classification group 68, which contains chemicals and chemical products."
>
> "In reviewing supply catalogues from that time period, DOD officials identified more than 35 different commercial herbicides that were listed in the federal supply system for use on DOD

installations between 1960 and 1973. Some of these commercial herbicides contained 2,4-D; 2,4,5-T; or both, although they were not in the n-butyl form used in Agent Orange. These included at least 4 commercial herbicides that contained some form of 2,4,5-T, the component that contained the contaminant 2,3,7,8-TCDD. In addition, numerous commercial herbicides that were not in the federal supply system but were being widely used elsewhere for agriculture purposes contained the form of n-butyl 2,4,5-T found in Agent Orange and thus its associated contaminant, 2,3,7,8-TCDD. According to DOD officials, the commercial herbicides used on installations were mixed with diesel or water and sprayed by hand or truck. Tactical herbicides, however, were formulated for aerial spraying by fixed-wing aircraft or helicopter without being diluted."

"When the U.S. military was employing these tactical and commercial herbicides during the Vietnam War era, U.S. EPA had not yet been established, and the U.S. Department of Agriculture had oversight of comercial herbicides. The Federal Insecticide, Fungicide, and Rodenticide Act of 1947, then administered by the U.S. Department of Agriculture, governed the marketing and use of these commercial herbicides. Until amended in 1972, the Federal Insecticide, Fungicide, and Rodenticide Act review process was designed as a consumer protection measure that focused primarily on a product's effectiveness, rather than on concerns about health or the environment."

The ports used by the military were Cristobal and Balboa. These were under the control of the Panama Canal Zone (PCZ) government, under the auspices of the US Army.



18 SUPPORTING OPERATIONS

RAILROAD

The Panama Railroad is a common carrier serving the Company/Government, the Armed Forces and others in the Canal Zone and in the Republic of Panama. It is a prime mover of freight and passengers between the Atlantic and Pacific sides of the Isthmus. The railroad dates from 1855 and is both the oldest and the shortest transcontinental railroad in existence.

Freight tonnage carried during fiscal 1971 dropped 14 percent from the prior year with cargo for the Republic of Panama down by the largest amount. Passenger traffic, however, rose significantly in 1971 with 1.2 million passengers using the service for a 35-year high. The number of passengers carried has increased by half a million since modern steel passenger cars were acquired 4 years ago.

MOTOR TRANSPORTATION

The Motor Transportation Division maintains and operates a fleet of 790 vehicles, two consolidated vehicle repair shops, and garages and miscellaneous facilities. It also exercises supervision over the Canal Zone franchised public bus transportation system, and manages the annual safety inspection of commercial and private vehicles registered in the Canal Zone. Total fleet mileage during the year was 8.9 million miles during fiscal 1971. Vehicle use during the year included: transportation of Company/Government employees, hauling of refrigerated and nonrefrigerated cargo, the moving of heavy equipment, busing schoolchildren, and garbage collection and disposal.

WATER TRANSPORTATION

The SS *Cristobal*, the Company steamship, was converted from a passenger/cargo vessel to a cargo ship during 1971 with limited 12-passenger facilities. The purpose of the conversion was to substantially reduce Company costs in the transportation of Company/Government personnel on home leave and other official travel. Cargo carried during the year reached 175,000 tons, up slightly from the year before, while passengers carried dropped sharply to 4,115 with the discontinuance of passenger service about three quarters through the year.

HARBOR TERMINALS AND PIERS

The Terminals Division provides cargo and marine bunkering services to ships calling at the terminal ports of the Panama Canal located at Cristobal and Balboa. Terminals facilities include docks and piers encompassing over 3 lineal miles of berthing space, covered transit sheds and the equipment for handling, transferring and stevedoring cargo. Ships using the facilities discharge and pick up cargo for the Canal Zone, the Republic of Panama and for transshipment to other world ports.

A fuel-handling plant and related tank farm facilities are located at each terminus of the Canal. They are used for pumping petroleum products from tankers to storage tanks owned by private companies, by the Panama Canal Company, or by the U.S. Armed Forces. The bulk of these products are

Testing

In testimony at a VA hearing on Jones' case in November 1997, **Charles Bartlett, former operations officer for herbicide research at the Army biological research-and-development laboratories at Fort Detrick, MD, stated that Agent Orange was shipped to Panama in the late 1960s for tests. 'All of the material was originally shipped…to Fort**

Clayton in (the) Canal Zone. That was an area under U.S. control, and it was a safe area with vegetation similar to Vietnam, and so we wanted to test it there,' he said, adding that a number of drums were left there after the tests." [emphasis added]

The full **testimony provided by Mr. Charles W. Bartlett**, former research and development officer with the chemical laboratories at Fort Detrick, Maryland, mentioned **in the DIC claim of Mrs. Jones for her husband Donald B. Jones who served in Panama.** The full transcript includes the following:

- "Let the record show that Ms. Jones in accompanied by her representative from the TVC, Mr. Juan Ferreris and also by a witness, Mr. Charles M. Bartlett." (transcript page 1)
- Mr. Ferreris: "And your professional education is related to chemical, analysis chemistry of this kind of field, sir?" (transcript page 4)
- Mr. Bartlett: "Yes. I was trained at the University of Oklahoma. … I went to the **University of Oklahoma and I have a bachelors degree in botany and chemistry**. And then I continued on in **graduate school at that university … studying plant physiology**. At that time, after my graduate work was completed I did have a ROTC commission in the US Army chemical corps and …, after I finished my graduate work, I went to the **officer basic training program at Fort McClellan Alabama in the chemical corps.** And then I was **assigned to the army's biological research and development laboratories** in their ____ division at Fort Detrick in Frederick, Maryland. And at that time[,] I discovered that the army had an interest in herbicides which coincided with my training in herbicides in graduate school. And so, … after … my assignment … to Fort Detrick and arrival there, I … began working in the herbicide research development program. At that time the Army had a responsibility for herbicide research and development. And for the next ten years I was an operations officer and a research and development officer with the chemical laboratories. And I traveled to many tropical locations testing and formulating these chemicals." (transcript page 4) [emphasis added]
- Mrs. Jones: "… he said that they used to, I don't know if you've ever been down in Panama but they are, the **buildings at the telecommunications are up on hills and they are thick cement walls, and they have huge chain link fences around 'em and they keep these chain link fences in**, about how many feet Mr. Bartlett?" (transcript page 2) [emphasis added]
- Mr. Bartlett: "**Usually several hundred feet or perhaps several hundred yards outside the perimeter. They try to control the vegetation to keep, for security purposes primarily.**" (transcript page 2) [emphasis added]
- Mr. Bartlett: "These Stratcom facilities are strategic communications facilities in Vietnam and other parts of the world were very, very important to the Vietnam war effort and were, enjoyed the highest priority for herbicide use. And so we saw the use of herbicides around Stratcom or strategic communications facilities in several parts of the world." (transcript page 11) [emphasis added]
- Mrs. Jones: "So it was not only limited to Vietnam, it was actually within the United States and Mr. Bartlett has further evidence to Justify that support that Agent Orange was not only in Vietnam." (transcript page 3)

- Mr. Bartlett: "I have with me today … a document called a miscellaneous publication number 16, it's the proceedings of the 3rd Defoliation Conference on August 10 and 11 in 1965. The document was published in September 1966 by the Department of the Army, Fort Detrick, Frederick Maryland. And in that document of which I have extracts here, and I have the original document in front of me, it indicates that **Agent Orange and other military herbicides were used and tested and shipped to many locations in the United States** … **and was tested in a number of tropical climate analogues, that is a vegetation areas that might match South East Asia jungle environments**. And those **locations were** in Puerto Rico and in **Panama**, and in the Apalachicola National Forest in Florida." (transcript page 6)
- "In the late **1960s, several hundred drums were shipped to Panama and of that material in Panama a smaller amount was used in testing programs. All of the material was originally shipped, at least the Bill of Lading called for shipment to Fort Clayton in canal zone. That was an area under US control and it was a safe area with vegetation similar to Vietnam and so we wanted to test it there. At the end of that testing program a quantity of, a number of 55 gallon drums were left in Panama, extensively under the control of Fort Clayton and so that, those drums remained in Panama for an indefinite period and were never shipped out of Panama, were left there permanently in Panama. And available for anybody who needed it because at that time there was no idea at all that there was anything harmful about Agent Orange."** (transcript page 6)
- "Question by Mr. Ferreris: "So **it was known to be Agent Orange**?" Response by Mr. Bartlett: "**Yes**".
- "**It was shipped, we shipped it from Fort Detrick. We shipped it to Panama and it was in the typical black drum with the orange stripe and it was for our testing program under ARPA order 423, ARPA, A-R-P-A is Advanced Research Projects Agency which was funding these test, research and development program at that time**. And so **we shipped Agent Orange to Panama.**" (Transcript page 6) [emphasis added]
- Mr. Bartlett: "The research and development work went forward with helicopter spraying and grown spraying in heavily forested areas in the United States … So we began to look for safe areas, that is non-combat zone areas where we could test these herbicides. **And at that time there was Agent Purple and Agent Orange, and another, Agent White, and Agent Blue**[18], which was ____ acid and other material." (transcript page 10) … "We also looked at the canal zone or Panama because the property there and the vegetation was thick and lush and somewhat similar to what it would be in Vietnam. So the work went forward there. It was mostly low altitude aerial spraying primarily with helicopters and a lot of the work at that time was also conducted on the ground. Now the recommendation for aerial spray was the use of about ten gallons per acre if you were doing it through aerial means. **When the material was applied by ground means**, that that is trucks or compression pump sprayers or some such thing that the soldier could use on the ground, **the actual application rate was far, far higher than ten gallons per acre.** And so **typically we saw, especially in the hands of unskilled applicators we found areas where the application rate was high enough that you could see greasy, a**

[18] **Agent Blue** is a mixture of two arsenic-containing compounds, sodium cacodylate and cacodylic acid.

greasy sheen on the foliage or vegetation and so, the exposure rate was much higher then would be even typical of Vietnam applications which was done by C-123 aircraft." (transcript page 11) [emphasis added]

- Mrs. Jones: "I have this document from the Department of Army from the US Garrison in Panama. … This is the use of herbicides in Panama. This is dated June 20, 1997 and in this use of herbicides in Panama from '70 to '74 they **do list 2-4-D** … **Burmacile** and I as Mr. Bartlett can tell you, a lot of the people that did this were not educated and that's one of the reasons they did do the color coding, isn't it? Mr. Bartlett: "Yes." Mrs. Jones: "… the engineer would say you go pick up, you go get this color drum and you use this for this plant and that's how it was actually done." (transcript pages 11-12)
- Mrs. Jones: "… presumptive service connection for … exposure to certain herbicidal agents … this is 3.307. 'For the purpose of this section the term herbicide agent means a chemical in an herbicide used in support of the Unites States and allied military operations.' This says in the Republic of Vietnam during the Vietnam era, which my husband served in the Vietnam era. Specifically 2-4-D, 2-4-5-T and it's contaminate T-C-D-D, casalic acid and … " Mr. Bartlett: "Cacodylic acid." (transcript page 12)
- Mr. Bartlett: "In about 1981 or '82, I received a phone call from Washington D.C. and was told that the justice department was involved with a lot of **Agent Orange litigation** and they were looking for a chemical corp officer who was still, who had been involved initially in all the work, and I was asked if I would come to Washington D.C. to work with the justice department, to assist them in the discovery process to address the Agent Orange litigation. **I did go to Washington … I remained there for two and a half years and became the director of their Agent Orange litigation support** later called support center. … It was our job to discover the documents that would that lead to … see if some defense could be mounted for the US government against the many, several billions of dollars worth of claims at that time that were being launched by the … veterans who were claiming exposure to Vietnam and subsequent health damage. **We did amass some three million documents as a result of that work**, and at the end of 1985 I retired from the military." (transcript page 5) [emphasis added]

The Tropic Testing Center was located on Fort Clayton, and their history indicates they were involved initially in the testing of "plants and animals". Later they became involved in the testing of equipment, including the testing of chemically infused mosquito netting and clothing. Determining the specifics of which plants and animals were tested or details of testing is still under research.

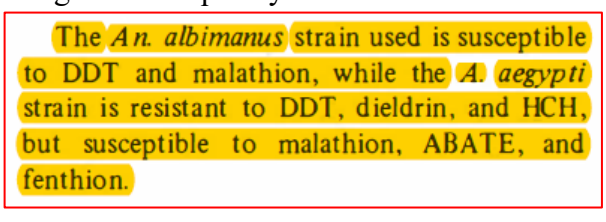
BVA Citation Number A22024163, Docket Number 220816-268044, Decision date 11/29/2022, contains testimony from the claimant that supports the Army's website statement:

> The Veteran asserts that during service from 1966 to 1968 he was stationed at Fort Clayton in Panama with the Tropic Test Center Test Evaluation Command and assigned to the motor pool; that his job involved operating all motor vehicles in the motor pool; that the Tropic Test Center was located in a highly secured compound in the jungle; that some officers in his unit were scientists who tested various insecticides and defoliants such as malathion and Agent Orange; that he was exposure to these chemicals when deploying the chemicals in the secured compound. In addition, he also reported that he was exposed to gasoline, AVGas, diesel fuel, and large amounts of solvents to clean engines and parts. He believes that his exposure to these chemicals is a contributing factor to his type II diabetes. See 03/07/2019 document entitled "Correspondence"; and 11/09/2020 document entitled "VA 21-4138 Statement in Support of Claim".
>
> The Veteran's service personnel records confirm that he was stationed at the US Army Tropic Test Center in Fort Clayton, Canal Zone from September 1, 1966 to March 27, 1968. See 09/24/2018 document entitled "Military Personnel Record" at 14, 41-42. His Military Occupational Specialty (MOS) was light vehicle driver. His records contain an Army Materiel Command Certificate of Achievement for exceptionally meritorious service from August 31,1966 to April 15, 1968 while serving as a Driver and Motor Maintenance Sergeant for the Support Division, U.S. Army Tropic Test Center. See 03/07/2019 document entitled "Military Personnel Record."

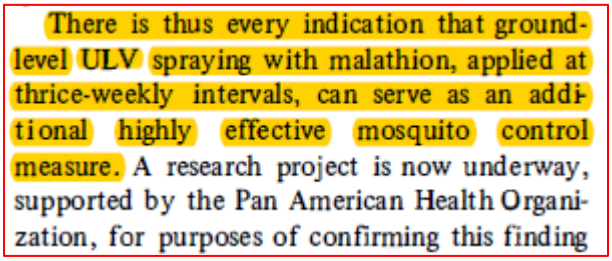
At his April 2016 hearing (BVA Citation 1819326, Docket #. 05-33 561, Decision date 03/30/2018), the claimant "testified that Agent Orange canisters were shipped to Panama and stored in the jungles. April 2016 hearing transcript, page 4. **He testified that he guarded canisters of Agent Orange during Operation Reahara.** Id. at 7-8. He said that **he also saw airplanes spraying the jungles with Agent Orange at which time he had to wear his gas mask**. Id. at 8-10." Of note, "Veteran served in the Panama Canal Zone during his active service from June 1973 to June 1975."

The *Research Note* for the USDA and USFS dated December 1981 documents testing was first started in 1943 on Barro Colorado Island on BHC, trichlorobenzene, **sodium arsenite**, pentachlorophenol, sodium flurosilicate, copper ammo-nium fluoride, aldrin, **chlordane**, dieldrin, and heptachlor [all pesticides]. Most of these have no half-life and are toxic. We know from other documents that chlor-dane was used on bases for pest control. Note that MANY of these chemicals are listed on the Department of the Army Supply Bulletin as being available in 1968, which is when Mr. Clark was in Panama. The article titled ***Health Dangers of Chlordane***, page 2, links chlordane exposure to diabetes and "**is especially harmful to the thyroid; chlordane is one of the most toxic chemicals in this regard.**"

Evidence shows that Malathion was tested by the Panamanian government, published in 1975, followed by additional testing. It also shows that mosquitoes in Panama had become resistant to DDT, dieldrin, and HCH, which means these three insecticides were being used in sufficient strength and frequency to create that resistance.



The *An. albimanus* strain used is susceptible to DDT and malathion, while the *A. aegypti* strain is resistant to DDT, dieldrin, and HCH, but susceptible to malathion, ABATE, and fenthion.



There is thus every indication that ground-level ULV spraying with malathion, applied at thrice-weekly intervals, can serve as an additional highly effective mosquito control measure. A research project is now underway, supported by the Pan American Health Organization, for purposes of confirming this finding

US Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD; *Pesticide Monitoring Special Study No. 44-0102-77, Environmental Sampling in the Panama Canal Zone,*

1 December 1976: "**This is a report evaluating the pesticide residue data obtained from environmental samples of water, sediment, and soil collected during CY [calendar year] 73 – CY 75 from the Canal Zone for their adequacy in preparing an environmental pesticide profile**. … This report also discusses the nature and scope of pest management operations in the Canal Zone." BACKGROUND: "**The necessity for pesticide use as a component of pest management programs is generally well established and is particularly recognized in a tropical area such as the Canal Zone.** Although specific data regarding recent pesticide use has not been made available, a consolidated report from USA Forces Command for FY 72 indicates an estimated 88 productive man-years expended in survey, labor, and supervision of pest management operations. Fragmentary data for CY 75 indicates 76 productive man-years committed to pest management operations. … Although the precision of the qualitative data may be low, these data support the generalization regarding the importance of pest control in this region." Table 1 shows the total gallons of pesticides, chlordane, DDT, and insecticides with this notation: "In view of the preponderance of mosquito problems in this area and the historical dependence on environmental management, this use of resource is consistent." "The pesticides reported used for these two Canal Zone installations in CY 75 ranged from persistent chlorinated hydrocarbon insecticides, organophosphorus, and carbamate insecticides, chlorophenoxy and uracil herbicides, and aluminum phosphide to the anticoagulants." 2,4-D [**2,4-Dichlorophenoxyacetic acid**] is a member of the phenoxy family of herbicides. In June 2015 the World Health Organization's International Agency for Research on Cancer confirmed its 1987 classification of 2,4-D as a possible carcinogen. … "The environmental Samples received from the Canal Zone during the period CY 73, 74, and 75 were comprised of soil, sediment, and water." Page 8 of the report indicates there are "Pesticide shops" and "Pesticide Storage Areas". The appendix lists the pesticides known to be used in Panama Canal Zone. These include aldrin, chlordane, DDT, dieldrin, heptachlor, … 2,4-D (as methyl ester) and 2,4,5-T (as methyl ester) and silvex [aka,4,5-TCPPA; 2,4,5-TP; 2,4,5-trichlorophenoxypropionic acid; Weed-B-Gon; EPA Pesticide Code: 082501]—**all of which are known carcinogens**. [Emphasis added]

The book *Emperors in the Jungle, The Hidden History of the U.S. in Panama*, by John Lindsay-Poland, includes this testimony regarding the testing of pesticides in Panama:

> "An **Army engineer whose duty it was to take water samples**, he also **found high levels of Agent Orange in the coral reefs on Pacific side of the canal. Lake Gatun, where he witnessed the spraying, spills out of the canal into the Pacific reefs.** He now suffers from peripheral neuropathy, a disease common to veterans exposed to Agent Orange." [Emphasis added]

The above Pesticide Monitoring Special Study No. 44-0102-77 verifies this engineer's testimony of taking water samples.

Storage

The fact that the chemical compound and concentration of dioxin in both the commercial and tactical forms of Agent Orange is confirmed by Dr. Alvin Young, expert witness for the DoD, in his report, *Investigations into Tactical and Commercial Herbicides for the Compensation Service, Department of Veterans Affairs*.

The GAO report continues: "The bulk of materiel used to support U.S. military forces in Vietnam, including tactical herbicides, was transported from the continental United States to Vietnam via ship. The vessels carrying the tactical herbicides generally stopped at foreign ports and sometimes at U.S. ports on the way to Southeast Asia." The GAO report documents several ships that stopped in Panama for deliveries in the footnotes of pages 6, 7, & 8.

The evidence submitted is just a small portion of the evidence available regarding the testing and storage of pesticides, insecticides, and herbicides in Panama and the Panama Canal Zone. This GAO report states, "In reviewing supply catalogues from that time period, **DOD officials identified more than 35 different commercial herbicides that were listed in the federal supply system for use on DOD installations between 1960 and 1973**. Some of these commercial herbicides contained 2,4-D; 2,4,5-T; or both, although they were not in the n-butyl form used in Agent Orange. **These included at least 4 commercial herbicides that contained some form of 2,4,5-T, the component that contained the contaminant 2,3,7,8-TCDD**. In addition, numerous commercial herbicides that were not in the federal supply system but were being widely used elsewhere for agriculture purposes contained the form of n-butyl 2,4,5-T found in Agent Orange and thus its associated contaminant, 2,3,7,8-TCDD. According to DOD officials, the commercial herbicides used on installations were mixed with diesel or water and sprayed by hand or truck. Tactical herbicides, however, were formulated for aerial spraying by fixed-wing aircraft or helicopter without being diluted." In the footnotes on page 3, the GAO notes, "**THE DIOXIN IN THE COMMERCIAL FORM OF THE HERBICIDE IS THE SAME AS THE DIOXIN IN THE TACTICAL FORM OF AGENT ORANGE.**" (***GAO Report to Congressional Addressees**, page 11) [emphasis added]

Usage

Usage of pesticides in the Panama Canal Zone has already been discussed in the historic section. Usage will now be explored in depth.

The Presence of Herbicides in the Panama Canal Zone:

> **There is no requirement that claimant's disability claims of exposure to herbicides should be denied because the exposure occurred in the Panama Canal Zone or that such claims should be restricted to the U.S. military's use of herbicides in Vietnam or DMZ Korea, as the VA appears to assume.**

The book *Emperors in the Jungle, The Hidden History of the U.S. in Panama*, by John Lindsay-Poland,

An article by Tod Robberson entitled *U.S. Tested Agent Orange in Panama, Reports Say*, published in The Dallas Morning News August 20, 1999:

> **The United States military conducted secret tests of Agent Orange and other toxic herbicides in Panama during the 1960s and 1970s, potentially exposing many civilians and military personnel to lethal chemicals, according to documents and eyewitness accounts. According to these accounts, hundreds of barrels of Agent Orange were shipped to Panama at the height of the Vietnam War, then sprayed on jungle areas to simulate the battlefield conditions of Southeast Asia.** The U.S. Southern Command, the U.S. military authority in Panama, said it was unaware of any tests involving Agent Orange there. …**The Veterans Affairs Department (VA) has acknowledged that the use of Agent Orange or similar toxic herbicides contributed to the deaths of at least three U.S. servicemen stationed in Panama in the 1960s and '70s, said Bill Russo, of the Vietnam Veterans of America.** Their survivors are receiving service-related death benefits as a result. One such case was that of Army Spec. Donald Jones, whose survivors say he was exposed to Agent Orange while serving in Panama from 1971 to 1974. He died in 1997 of non-Hodgkins lymphoma. The VA agreed that Jones had been exposed to the herbicide, said his widow, Pamela Jones of Pleasanton, Texas.

Some of Robberson's article takes its documentation from the book *Emperors in the Jungle.* The book *Emperors in the Jungle, The Hidden History of the U.S. in Panama, by John Lindsay-Poland, includes evidence from multiple sources on the topic of pesticides in Panama:

> "At least nine witnesses have confirmed that the military sprayed heavily with Agent Orange in an area of Fort Sherman known as the "drop zone" in the late 1960s and early 1970s."
>
> "A veteran who has a medical claim before the Veterans Administration wrote to Panamá Update in June that **he saw U.S. Special Forces drop Agent Orange onto Fort Sherman in 1969 or 1970 and "watched the jungle disappear over the next few days."** **[Claimant has a certificate verifying Veteran's completion of Jungle Training School at Fort Sherman.]**
>
> "One of the veterans awarded benefits because of his exposure to Agent Orange was Joseph Oppedisano, who served with the Army in Panama in 1956-58. … while in Panama he became very sick after training with chemical agents. On January 4, 1958, **the entire island of Flamenco where he was stationed was defoliated**, Oppedisano told Panamá Update. "We had about ten million fish die. They got stuck on the rocks and made a stink," he said. He thought it was a secret military test. He and other soldiers on the island became violently ill and were hospitalized. One of those soldiers, Israel Jewetz, testified that "**the areas where we were barracked were sprayed with chemicals every day to control insect populations and prevent malaria and yellow fever outbreaks**." Oppedisano developed hairy cell leukemia as a result of his exposures." [Emphasis added]

5. "New information is also emerging about the **heavy use of other kinds of pesticides in military bases in Panama besides Agent Orange, such as DDT and Chlordane, which were sprayed in residential areas of the Canal Zone, often daily, against ter-mites.** Both pesticides are banned in the United States. According to a preliminary study commissioned by Panama, "Though there is not enough data to establish a concise exposure scenario, there are plenty of indicators that demonstrate a significant human health hazard exists." The study, which took samples from Corozal and Clayton, concluded that "**DDT, DDD, and DDE were all found in high quantities" on the two bases**." [Emphasis added]

> "According to Raul Duany, spokesman for the US Southern Command, if Agent Orange was sprayed, 'it wouldn't pose a threat today because it should have dissipated by now.' However, the dioxin [TCDD] in most Agent Orange—the toxin that causes disease—remains in the soil for decades. **The retired officer who ordered the use of Agent Orange in Vietnam as a defoliant contradicted Duany's claim. 'It does not dissipate', said Admiral Elmo R. Zumwalt Jr., 'If it's true that Agent Orange was tested in Panama, it is clear that the spokesman was wrong about the residual stuff.'"** [emphasis added]
>
> **[Note: Admiral Elmo R. Zumwalt Jr died of non-Hodgkin's lymphoma as a result of his personal Agent Orange exposure.]**

I understand the VA relies heavily on a "Memorandum for the Record" from the Department of the Army, JSRRC, dated May 6, 2013, which denies the use of herbicides in the Panama Canal Zone. It states, "…the JSRRC has not identified evidence of record that the **tactical herbicide**, Agent Orange (AO) was used, stored, tested, or transported within the country of Panama or the Canal Zone." [emphasis added] It stated further that "At this time the JSRRC research has produced no evidence to support the potential for exposure to Agent Orange in the country of Panama or the Canal Zone." In view of the evidence above, and additional argument and evidence below, this memo is not accurate**. Herbicides were shipped to the Panama Canal Zone and the evidence will show they were used there extensively.**

The table showing Department of Commerce records for shipments of pesticides to Panama indicates that while the Veteran, Paul M. Couzens, was present in the Panama Canal Zone during his military service, a total of over 7 million pounds of herbicides and insecticides were received in Panama, with 1,608,613 pounds of that total being insecticides. Almost 500,000 pounds of identified 2,4-D and 2,4,5-T were imported during the time Veteran was stationed in Panama.

Veterans Law Judge P.M. DiLorenzo spoke to the issue of whether herbicides were used in the Panama Canal Zone in a decision dated April 24, 2020 (Citation Nr: A20006849; Docket No. 191210-47806), page 5-6. Judge DiLorenzo stated:

> "The **Veteran also submitted a list of exports by the United States Government Accountability Office and United States Department of Commerce**, which details numerous shipments of herbicides 2,4-D and 2,4,5-T to Panama during his active duty service [1971 – 1974]. *See* Undated Correspondence received by VA on March 12, 2020; *see also* March 2020 Representative Statement (summarizing the findings). **While these documents do not prove that the Veteran was exposed to herbicides, they do show that herbicides were in Panama at the same time as the Veteran. The Board observes that 2,4-D and 2,4,5-T are included within VA's definition of 'herbicide agent' for purposes of establishing presumptive in-service herbicide exposure.** See 38 C.F.R. 3.307(a)(6).
>
> "**A May 2013 memorandum from the United States Department of the Army and Joint Services Records Research Center** indicates that there is no evidence that the tactical herbicide Agent Orange was used, stored, tested, or transported to Panama or the Panama Canal Zone. **The Board observes, however, that this memorandum is directly contradicted by the reports of the Government Accountability Office and Department of Commerce.**"

Evidence is being submitted to prove herbicides were <u>shipped</u> to Panama and were <u>used</u> by the U.S. military in the Panama Canal Zone while they were in service.

BVA Citation 9935776, DOCKET NO. 94-35 279, Decision Date: 12/23/99, documents testing of tactical chemical agents in PCZ. The testing of mustard gas or Lewisite, "an arsenic compound" were confirmed to have been conducted on service personnel during the 1940s.

Of record is a copy of a January 1993 newspaper article regarding the reported conclusions of a scientific panel in a study conducted under the auspices of the National Academy of Sciences. The panel reportedly concluded that the U.S. government conducted secret gas-chamber tests on thousands of soldiers during World War II that continued to cause a host of devastating illnesses among survivors. The report offered confirmation that mustard gas was tested on servicemen in the U.S. during the 1940s and that thousands had suffered under a vow of silence since that time. The servicemen reportedly tested gas masks or crawled across contaminated fields, never realizing the long-term risks of toxic chemical exposure. Thousands of veterans reportedly participated in trials exposing them to mustard gas or Lewisite, an arsenic compound.

"Unknown thousands of others reportedly also endured potentially harmful chamber and field tests at Edgewood Arsenal; Camp Sibert, Alabama; Bushnell, Florida; Dugway Proving Ground,

Utah; and San Jose Island in the Panama Canal Zone. The book *panama* states that the PCZ was known for storage of tactical chemical weapons, including mustard gas and Lewisite." … "Based on a VA-funded study conducted by the Institute of Medicine, the VA recognized several conditions including skin cancer as being linked to significant mustard gas exposure, and had already recognized several conditions including chronic conjunctivitis, chronic keratitis, and corneal opacities as being associated with mustard gas exposure."

The report "*Test Tube Republic: Chemical Weapons Tests in Panama and U.S. Responsibility*" verifies the United States had an active chemical weapons program in Panama from at least 1930 until 1968. "From 1930 to 1946, this program focused on canal defense. **From 1943 until 1968, the program aimed to test chemical munitions under tropical conditions.** Dozens of tons of mustard gas and phosgene were stockpiled at a number of sites in Panama, particularly from the 1930s to the 1950s. Unused and dud chemical munitions were also abandoned in Panama." The report was authored by John Lindsay-Poland of the Fellowship of Reconciliation, with the active collaboration of the Chemical Weapons Working Group, Earthjustice Legal Defense Fund, Greenpeace, Panamanian Center for Research and Social Action (CEASPA) and Center for Latin American Studies (CELA).

The report provides valuable history of chemical weapons storage and testing in the PCZ.

> Chemical weapons were a component of US canal defense tactics from the canal's early years. The canal was completed in August 1914, only days before the outbreak of World War I, the war in which mustard gas was used for the first time ever in battle. The United States, without gas masks of its own and with chemical warfare activities fragmented in four departments, was not well prepared to face massive gas attacks.
>
> General William Sibert, the Army engineer who had designed the Gatun locks in Panama, commanded the first division of US troops to go overseas in the war, sailing for France in June 1917. Within a year, Sibert, a "staunch advocate of all forms of chemical warfare," was made director of a newly consolidated Chemical Warfare Service. He brought the agency's disparate activities together, so that by the end of the war the United States was producing more lethal gas than all other belligerents combined.
>
> After the war Sibert became a vocal proponent of the continued development of chemical weapons. "When the armies were provided with masks and other defensive appliances, something less than four percent of the gas casualties were fatal," Sibert ruminated. "These figures, I think, meet one of the chief objections brought against the use of gas—that of humanity. So far from being inhumane, it has been proved that it is one of the most humane instruments of warfare, if we can apply the word humane to the killing and wounding of human beings." In 1921 the Chemical Warfare Service was told to draw up plans for defense of the Canal Zone and other US outlying possessions. The first chemical defense plans were thus drawn up in 1923 and would be updated every year through at least 1946. The plan involved bombing with mustard gas the trails and routes that led inland from landing beaches on both the Atlantic and Pacific coasts, spraying the beaches, and firing chemical mortars at military targets as well.
>
> Another chemical weapons supporter, Major General Preston Brown, came to the helm in Panama in 1930. At this time the military maintained a chemical company of 2 officers and 77 men. Brown believed that in case of a land invasion, troops could use gas defensively as they retreated through the jungle.
>
> The US entry into World War II both increased military sensitivities to the Canal's vulnerability to attack, and brought with it whole new areas of responsibility and control. Besides defending the canal using chemical munitions, the military planned to use smoke pots that burned oil or chemical blends in order to visually screen the canal should enemies attack the canal by air. Several hundred of the smoke pots were sent to the Canal Zone in 1942.

> Documents show at least four tests in Panama with live chemical munitions from 1964 to 1968 (VX gas-filled M-23 mines, rockets and projectiles, and sarin rockets). The tests were part of a range of tests under Arctic, desert and tropical conditions to which chemical munitions were usually subjected. Twenty-four M23 mines were shipped to each site in late 1963 or early 1964. Each mine contained 10.5 pounds of VX agent. Since ten milligrams of VX agent constitutes a lethal dose, each one had enough nerve agent for nearly half a million lethal doses.
>
> The mines were stored outdoors for between 30 days and more than two years, depending on the "storage cycle" assigned to each mine. Finally, each mine was detonated, and the report available indicates that the VX mines may have been detonated with live agent inside. The report states: "During each cycle, three mines (VX or simulant-filled) will be subjected to a firing test to determine the functionability of mines and components." Despite the reference to simulant, the materials list for this test does not include any simulant, although some warheads may have been shipped to test sites with simulant, as a control on the experiment.
>
> The United States discontinued production of VX agent, as well as the M55 rocket, in 1968. Sarin (GB) production ceased in 1957, but it has remained in the US stockpile until the present day.

Multiple tests were conducted in the PCZ. The Tropic Testing Center states they performed tests on plants and animals. There is a direct correlation between testing and the Panama Canal Zone. There is no reason to doubt the veracity of hundreds of veterans who have documented testing and/or usage of pesticides in the PCZ.

SCIENTIFIC EVIDENCE FOR PESTICIDES/HERBICIDES/INSECTICIDES

The article titled *Long-Term Environmental Impacts of Pesticide and Herbicide Use in Panama Canal Zone* notes "Malathion was used" …

> "DDT, dichlorodiphenyltrichloroethane, is colorless, tasteless and an almost odorless crystal chemical compound. DDT was one of the first chemicals used as a widespread pesticide. After WWII it was used in agriculture and households until it was banned in the United States in 1972. … Agricultural use of DDT was banned in the United States in 1972. However, DDT was sprayed extensively in the Panama Canal Zone (not officially part of the United States) after 1972. DDT remained effective in killing mosquitoes and dramatically reduced malarial infections. From the 1950s to the 1980s more than 40,000 ton/yr of DDT were used in worldwide agriculture and mosquito control. During this time period, the World Health Organization (WHO) was the largest purchaser of DDT in the World. DDT was manufactured by 15 different chemical companies, including Monsanto, Ciba, and Montrose Chemical. Worldwide use was banned in 2004."

The article titled *Occupational Pesticide Exposure, Impaired DNA Repair, and Diseases* lists the diseases associated with commercial pesticides—including herbicides. Hypertension, Type 2 Diabetes Mellitus, and Parkinson's Disease are listed as diseases associated with commercial pesticides.

The article titled *Long-term Health Effects of the Occupational Exposure to DDT* by Cocco, Blair, et al, confirms that "DDT and its metabolites break down slowly, they have a long persistence in sediments and soils." Thus, they are a health concern. The chart on page 5 shows an increased incidence of diabetes from exposure to DDT. Veteran was diagnosed with type 2 diabetes mellitus in 2011; he is not insulin dependent.

In the article titled *Dichlorodiphenyltrichloroethane (DDT) induced extracellular vesicle formation: a potential role in organochlorine increased risk of Parkinson's disease*:

> Parkinson's disease is a progressive neurodegenerative disease that affects primarily dopamine neurons in the substantia nigra, whose main treatment consists in drugs that increase dopamine receptor stimulation (Aloisi et al. 2011, Connolly and Lang 2014). A number of studies have demonstrated that rural living and exposure to certain pesticides, such as dichlorodiphenyltrichloroethane (DDT), highly increase the chances of developing Parkinson's disease (Van der Mark et al. 2012, Saeedi Saravi and Dehpour 2016). DDT is an organochlorine known for its pesticide properties and for its negative effects on human health. This compound, by preventing the activation of the voltage gated sodium channels, causes an uncontrolled neuronal firing that is known to provoke important muscle spasms which in turns lead to death of insects (Dong 2007). It was widely and abundantly used between the 1940s and the 1970s and finally banned in most countries of the world for its toxicity to the endocrine system (Mnif et al. 2011).
>
> Nevertheless, DDT is still routinely used in some developing country, most of them in Africa, to fight mosquitoes that carry malaria (Channa et al. 2012). Furthermore, due to its extremely long half-life (up to 30 years), DDT is linked to several health and social problems which are due to its accumulation in the environment and its biomagnification properties in living organisms (Mansouri et al. 2017). In this review, we will summarize data consistent with DDT induced vesicle formation and we will discuss how this phenomenon could explain the increased risk of Parkinson's disease in patients previously exposed to this pesticide and other organochlorine derivatives.

The article titled *Organochlorine Pesticide Levels and Risk of Parkinson's Disease in North Indian Population* states:

> Neurodegenerative diseases form a subset of pathologies that are characterized by a progressive loss of neurons paralleled by the emergence of misfolded proteins in various cell types, the significance of which is still being debated [1]. Parkinson's disease (PD) is the second neurodegenerative disorder in importance after Alzheimer's disease, in which the movement-regulating cells of the brain get disabled, leading to tremors, slowed movement, balance problems, speech, and behaviour changes. **The cause of PD remains elusive, but environmental chemical like pesticide exposures have been postulated to be involved in the etiology of PD** [2, 3]. Worldwide, more than 25 million tons of pesticides are used every year, and 99% of these pesticides are being released aimlessly into the environment [4]. In India, pesticides are frequently used for agriculture development and protection/control of diseases like malaria, filariasis, dengue, Japanese encephalitis, cholera, and so forth. Synthetic organic pesticides are used to control weeds, insects, and other organisms in agricultural and nonagricultural settings. India is one of the few remaining countries still engaged in the large-scale manufacture, use, and export of some organochlorine pesticides (OCPs) (such as p,p□ - dichlorodiphenyltrichloroethane (DDT), hexachlorocyclohexane (HCH), and pentachlorophenol) for agriculture and vector control. Despite this, few data are available on OCP levels in the urban atmosphere of India [5]. OCPs are persistent pesticides and concentrated up in the food chain. They can be detected in the diet including drinking water.

Department of Defense Knew Herbicides Were Toxic to Human Beings

According to the **Herbicide Manual for Noncropland Weeds**, dated March 1965, published by the Agricultural Research Service, US Department of Agriculture, in cooperation with Bureau of Yards and Docks, Department of the [US] Navy, page 36, "*For some situations, mixtures of two or more chemicals are more effective than single-chemical herbicides. Proprietary mixtures are combinations of chemicals that (1) provide a quick knock-down of vegetation* ***plus a residual toxicity in the soil*** *... Caution.—Observe the precautions as given for each chemical in the mixture.*" [italics and emphasis added] This tells me that the **US Department of Agriculture** as well as the **US Navy** knew that the herbicides were toxic and that there was a residual effect in the soil. Also, they knew there were precautions, but it is uncertain whether or not these precautions were conveyed to the servicemen doing the mixing and spraying. Pages 3-5 of this same report says, "The person who mixes and applies the spray or spreads the dry product could be poisoned from swallowing the herbicide, from skin absorptions, or from inhalation. … (a) if the concentrate or spray is swallowed, induce vomiting immediately. … The toxicity of herbicides varies widely. … (b) Absorption by the skin and irritation of skin and eyes can largely be prevented. Keep exposure to a minimum. … For the more readily absorbed chemical and those that are irritating, wear clean clothing that covers the body. [Pictures show Veterans working in PCZ without shirts.] Remove clothing after it has become contaminated with the chemical. Use synthetic rubber gloves. … If the spray or dust is spilled on the skin, wash thoroughly with soap and water; if in the eyes, wash with plain water and see a doctor. … (c) Inhaling vapors, dusts, and spray mists can also be avoided. Use a mask … [Veteran was never provided a mask.] [Page 5] "**Drift hazards are greatest when herbicides that affect the leaves of plants are used. These may be of the growth-regulating types, such as 2,4-D, 2,4,5-T,** and silvex … **Drift occurs not only with volatile herbicides, such as the high-volatile esters of 2,4-D and 2,4,5-T, but also from a spray that has been atomized into a mist by high pressure and small nozzle opening whether the formulation is volatile or not.**" [emphasis added] NOTE: Veteran and buddy statements describe fellow veterans using high-pressure nozzles from the back of a tank truck to spray the herbicides. The bottom of page 5 shows a table of lethal doses. 2,4-D and 2,4,5-T are both rating 3, which corresponds to 1 ounce to 1 pint of the herbicide being a lethal dose for a 150-pound man.

Drift hazards are also mentioned in the 1990 Navy memorandum: Pesticides are transported great distances by air and water, and some do not break down readily.

membranes, visceral organs, and the mind. While aware of the immediate hazards, no one knows enough about the long-range effects on human health resulting from increasingly widespread exposure to pesticides. In contrast to most other contaminants, pesticides are deliberately introduced into the environment as a killing agent to perform various beneficial functions. Among the pesticide characteristics which contribute to this diffuse exposure are mobility, persistence and bioaccumulation. Pesticides are transported great distances by air and water, and some do not break down readily. The most poisonous family of pesticides are those in the organophosphorus group (i.e. Malathion). They become inactive quickly and were thought to have few if any long-term effects. But workmen exposed to small but regular doses by inhalation or skin contact have shown symptoms of nerve involvement and emotional disturbances. However, inhalation is unlikely due to low vapor pressure. No data is available on latent toxicity.

In 1990 they may not have known the long-term effects, but in 2023 we do. The Herbicide Manual from 1965 contradicts the US Navy's claim that "inhalation is unlikely due to low vapor pressure."

Tactical versus Commercial Herbicides

Any good argument must begin with a definition of terms.

Definition of Pesticide:

Per the **National Institutes of Health**, "A pesticide is any substance used to kill, repel, or control certain forms of plant or animal life that are considered to be pests. **Pesticides include herbicides for destroying weeds and other unwanted vegetation, insecticides for controlling a wide variety of insects,** fungicides used to prevent the growth of molds and mildew, disinfectants for preventing the spread of bacteria, and compounds used to control mice and rats."[19] [emphasis added]

The EPA website, https://www.epa.gov/minimum-risk-pesticides/what-pesticide, defines what a pesticide is for the US Government. According to the **Environmental Protection Agency (EPA)**:

Pesticide law defines a "pesticide" (with certain minor exceptions) as:

- Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. [Pests include insects or weeds.]

[19] https://www.niehs.nih.gov/health/topics/agents/pesticides/index.cfm

- Any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant. [herbicide]
- Any nitrogen stabilizer.

Section 2(u) of the Federal Insecticide, Fungicide, and Rodenticide Act (Also referred to as U.S. Code Title 7, Chapter 6, Subchapter II, Section 136 - Definitions) expands on this definition.

The EPA qualifies a product as likely to be a pesticide if the labeling or advertising:

- Makes a claim to prevent, kill, destroy, mitigate, remove, repel or any other similar action against any pest.
- Indirectly states or implies an action against a pest.
- Draws a comparison to a pesticide.
- Pictures a pest on the label.

Except in limited circumstances, any substance falling within this definition of a pesticide must be registered by the EPA before it can be legally sold or distributed in the United States.[20]

EPA definition of pesticides includes herbicides, fungicides, and insecticides. **DoD and DVA do not deny the use of insecticides** such as DDT and Malathion for mosquito control and DDT and Chlordane for termite control. The DoD debates the use of "tactical herbicides" in the PCZ.

Definition of Tactical:

The Merriam-Webster Dictionary defines "Tactical" as an adjective. (https://www.merriam-webster.com/dictionary/tactical)

1 : of or relating to combat tactics: such as
a (1) : of or occurring at the battlefront
a *tactical* defense
a *tactical* first strike
(2) : using or being weapons or forces employed at the battlefront
tactical missiles
b of an air force : of, relating to, or designed for air attack in close support of friendly ground forces
2 a : of or relating to tactics: such as
(1) : of or relating to small-scale actions serving a larger purpose
(2) : made or carried out with only a limited or immediate end in view
b : adroit in planning or maneuvering to accomplish a purpose

Based on these definitions, all insecticides and herbicides used in Panama were used on a tactical basis—they were strategically implemented in the War on Mosquitos.

[20] https://www.epa.gov/minimum-risk-pesticides/what-pesticide

VA's Argument:

The VA's currently-available Public Health article "Facts about Herbicides," https://www.publichealth.va.gov/exposures/agentorange/basics.asp, makes a differentiation between "commercial" and "tactical" herbicides and states that "The U.S. Department of Defense developed these tactical herbicides specifically to be used in 'combat operations.' They were not commercial herbicides purchased from chemical companies and sent to Vietnam. Tactical herbicides also were used, tested, and stored in areas outside of Vietnam."
The misinformation about "tactical" versus "commercial" herbicides from the DoD was initially put forth in a publication by Alvin Young, Ph.D, *The History of the U.S. Department of Defense Programs for Testing, Evaluation, and Storage of Tactical Herbicides*. Dr. Young is a researcher who decided that there was a difference between "tactical" and "commercial" herbicides, and that only the "tactical" ones were used by the U.S. military. His conclusion was wrong. This conclusion has been perpetuated by the VA in the December 2006 Public Health article, by the JSRRC, and in the VA's decisions on claimants' claims of pesticide exposure. The only difference between the two besides their names: one was sprayed as-is from the air, and the other was mixed with diesel fuel or water and sprayed by people carrying tanks or using spray trucks on land. This difference is discussed below.

According to the DoD, the "commercial" herbicides were mixed with diesel fuel or water and sprayed by hand or by truck. "Tactical" herbicides, however, were formulated for aerial spraying by fixed-wing aircraft or helicopter without being diluted. **The only difference is that the "tactical" herbicides were not diluted or mixed with any other substance(s).** The initial chemical compounds are the same. However, they are then adding in the component of diesel fuel, which includes the toxin "benzene", which also produces diabetes.

In view of the evidence above, and additional argument and evidence below, this memo is not accurate**. Herbicides were shipped to the Panama Canal Zone and the evidence will show they were used there extensively.**

If the VA kept the definition to "a harmful defoliant chemical," they would be in compliance with EPA and other federal rule-making agencies. The VA inappro-priately narrows the definition of herbicide by specifying which components the herbicide can contain because there is documentation that other toxic herbicides were used in Panama IN ADDITION TO herbicides containing 2,4,5-T, TCDD, 2,4-D, cacodylic acid, and/or picloran—the components of the "Rainbow Herbicides". Also, the VA fails to include additional toxic chemicals that were part of the "Agents" such as arsenic, which was in Agent Blue, and which was also used in Panama. NOTE that some of the "commercial" herbicides identified as being used in Panama definitely contain 2,4-D, 2,4,5-T, TCDD, cacodylic acid, and/or picloram, as well as arsenic/arsenite/arsenate.

VIII.i.1.B.1.b.
Definition:
Herbicide Agent

Per 38 CFR 3.307(a)(6)(i), ***herbicide agent*** means a harmful defoliant chemical, such as Agent Orange, used in support of U.S. and allied military operations in the RVN during the period beginning on January 9, 1962, and ending on May 7, 1975, that contained the following components:

- 2,4,5-T and its contaminant, TCDD (dioxin)
- 2,4-D
- cacodylic acid, and
- picloram.

Examples:

- Agent Orange (2,4,5-T and 2,4-D)
- Agent White (2,4-D and picloram), and
- Agent Blue (cacodylic acid).

In addition, numerous commercial herbicides that were not in the federal supply system but were being widely used elsewhere for agricultural purposes contained the form n-butyl 2,4,5-T found in Agent Orange and its associated contaminant 2,3,7,8-TCDD [Dioxin]. According to the DoD, the "commercial" herbicides were mixed with diesel fuel or water and sprayed by hand or by truck. "Tactical" herbicides, however, were formulated for aerial spraying by fixed-wing aircraft or helicopter without being diluted. The only difference is that the "tactical" herbicides were not diluted or mixed with any other substance(s). Thus, the memo discriminating between the two categories, "commercial" vs. "tactical," is incorrect.

The thirteenth annual edition of *Pesticide Handbook 1961* by Donald Frear, Ph.D, Professor of Agricultural and Biological Chemistry, printed from the College Science Publishers, Pennsylvania State University, begins with:

> "Selective herbicides are those which kill certain types of plants (weeds) without serious injury to other desirable types growing in the same area. Until recent years, **only a limited number of selective herbicides was available, and these were not always satisfactory**. **The discovery of 2,4-D (2,4-dichlorophenoxy acetic acid), however, has made available an excellent selective herbicide, and this compound is now widely used**. Various forms and formulations of 2,4-D are now available [on a commercial basis] … **A related compound, 2,4,5-trichlorophenoxy acetic acid, is effective** in killing woody plants, trees, shrubs, and brambles."

From this handbook we see that preparations containing 2,4-D and 2,4,5-T were commercially available herbicides, considered "an excellent selective herbicide", and were "widely used". This contradicts Dr. Alvin Young's assumption that commercial applicators would not use 2,4-D and 2,4,5-T. Further, **these were herbicides available through the federal supply system.**

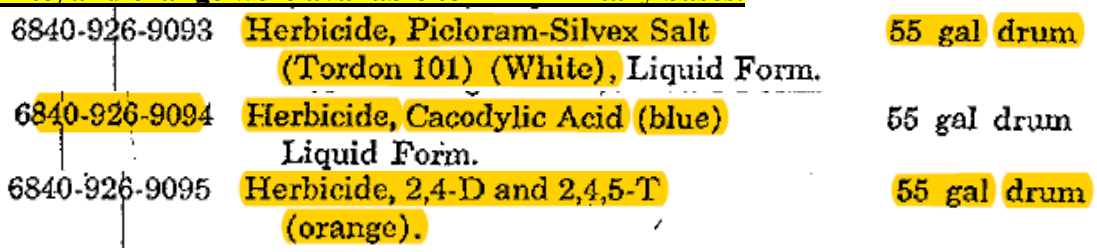
Multiple government documents provide a detailed listing of which pesticides, insecticides, and herbicides were available to the installations for general use without oversight.

Agricultural Handbook No. 269, *Herbicide Manual for Noncropland Weeds*, published by the Agricultural Research Service, U.S. Department of Agriculture, in cooperation with the Bureau of Yards and Docks, Department of the Navy, March 1965 (page 20) states that "Emulsifiable concentrates [of herbicides] are usually liquids in which the chemical is dissolved in one or more water-insoluble solvents such as oil or benzene and to which an emulsifier is added. When the emulsifiable concentrate is added to water and agitated, the mixture is broken into fine droplets. The emulsifying agent causes the fine droplets of oil to be suspended in the water to form an emulsion. The esters of 2,4-D, 2.4.5-T, and silvex are examples."

Supply catalogues show that DoD officials identified more than 35 different **commercial** pesticides/ herbicides/insecticides that were listed in the federal supply system for use on DoD Installations between 1960-1973. **The Armed Forces Pest Management Board (AFPMB) was in charge of spraying on ALL bases**. The 12/15/1968 Armed Forces Pest Management Board memorandum states, "All items of supply for the control of pests are considered to be standard stock if they appear in the Federal Stock Catalogs." The letter provides references to the Herbicide Manual for Noncropland Weeds and the "2,4-D, 2,4,5-T, and Related Chemicals for Woody Plant Control, Report Number 16. Some of these commercial herbicides contained 2,4-D, or 2,4,5-T, or both. Thus, these 2,4-D and 2,4,5-T are considered standard stock for military bases.

Army Supply Bulletin SB 3-40 from 1969 shows ALL of the various herbicides and insecticides available to ALL Army installations, foreign and domestic. Since they are Federal Stock, they do not require special permission for use—just order and use. Insecticides include DDT, Chlordane, and Malathion, which have all been identified by the DoD, DVA, US Army, and scientific publications as having been used in Panama. Several of the herbicides on this list contain 2,4-D and/or 2,4,5-T, picloram, and cacodylic acid—ingredients listed by 38 CFR § 3.307 as qualified herbicide agents.

Army Supply Bulletin SB 3-40 specifically identifies Federal stock No. 6840-926-9094 is "Herbicide, Cacodylic Acid (blue)"; Federal stock No. 6840-926-9093 is "Herbicide, Picloram-Silvex Salt (Tordon 101) (White)"; and Federal stock No. 6840-926-9095 is "Herbicide, 2,4-D and 2,4,5-T (orange)". All of these are available only in 55-gallon drums. **So, yes, herbicides blue, white, and orange were available to ALL military bases.**

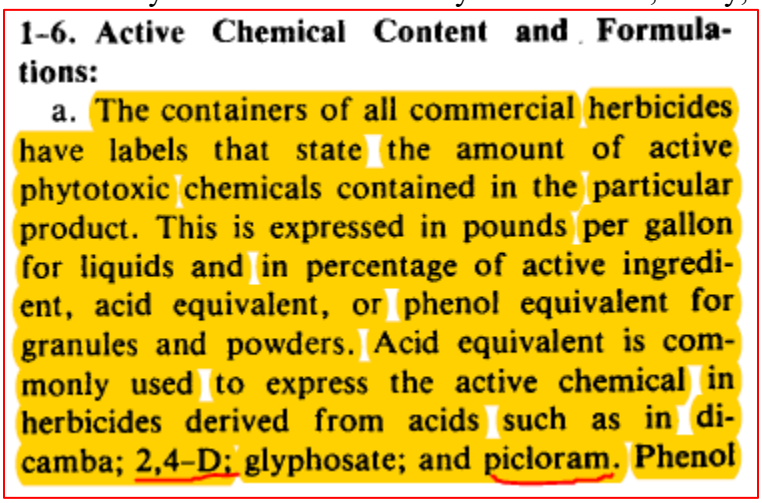


6840-926-9093	Herbicide, Picloram-Silvex Salt (Tordon 101) (White), Liquid Form.	55 gal drum
6840-926-9094	Herbicide, Cacodylic Acid (blue) Liquid Form.	55 gal drum
6840-926-9095	Herbicide, 2,4-D and 2,4,5-T (orange).	55 gal drum

(The Department of Defense appears to have forgotten these documents.) On page 1 of the Supply Bulletin, Point #3 states "**Supplies listed herein will normally be utilized at**

Department of the Army installations and for troop supply." [emphasis added] These items were meant for use by facility engineers as an *herbicide for grounds keeping (i.e. brush and weed control) and not for operational or tactical use*. See also "Archives Search Report Findings for Field Testing of 2, 4, 5-T and Other Herbicides: Fort Detrick." U.S. Army Corps of Engineers St. Louis District, at 8 (April 4, 2012) (emphasis added) The US Army Field Manual ***Tactical Employment of Herbicides***, [their title, not mine] "The purpose of this manual is to provide doctrinal guidance for the tactical employment of herbicides at division, brigade, and lower levels. This manual discusses technical and operational factors governing the use of herbicides in military operations. It also presents—Physical and chemical properties of agents ORANGE, BLUE, and WHITE and information on storage, handling, and methods of disposal." This manual was distributed to "**NavPackEngCom Caribbean Div**"; the PCZ was in the Caribbean Division; so, this document was distributed to the PCZ. Why would it be sent if not for use and application?

Joint publication by the Departments of the Air Force, Army and the Navy dated 24 May 1989 titled *Weed Control and Plant Growth Regulation* "provides Department of Defense personnel with guidance and technical information on controlling weeds in noncropland, turf, ornamental plantings, and aquatic sites; and using plant growth regulators (PGR)" …for use of herbicides at ALL military installations utilized by the Air Force, Army, and Navy.



1-6. Active Chemical Content and Formulations:

a. The containers of all commercial herbicides have labels that state the amount of active phytotoxic chemicals contained in the particular product. This is expressed in pounds per gallon for liquids and in percentage of active ingredient, acid equivalent, or phenol equivalent for granules and powders. Acid equivalent is commonly used to express the active chemical in herbicides derived from acids such as in dicamba; 2,4–D; glyphosate; and picloram. Phenol

NOTE: Dicambia is listed on the Army Supply Bulletin SB 3-40, discussed below. "[U]se of the herbicide dicamba was associated with increased risk of liver and intrahepatic bile duct cancers."[21] Dicambia has been banned in the United States.

Natural Resources Land Management publication TM 5-630 NAVFAC MO-100.1 AFM 126-2, is a publication by the Departments of the Army, The Navy, and The Air Force dated July 1982. Table 11-1 is "*Effective Herbicides for Landscape Planting*" and Table 11-2 is "*Effective Herbicides for Edging and Spot Sterilization*". Table 11-1 includes 2,4-D and table 11-2 includes Picloram. Please remember that 2,4-D became available in the 1940s and was VERY popular as a commercial herbicide.

[21] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7660157/

11-3.1.1.1. Precautions. Both contact and systemic herbicides are used around woody plants and ground covers. However, caution should be taken to spray only unwanted weeds and grasses and not the foliage of landscape plants. Furthermore, selective herbicides which may be safe for many plants may be toxic to some species. For example, Dacthal is safe for most ground covers but toxic to ajuga. The phototoxicity warnings on pesticide container labels should be carefully observed. Herbicides commonly used to kill broadleaf weeds in turf are often toxic to woody plants. Among these are the phenoxy compound (2, 4-D) and Dicamba (Banvel D). These should not be used in tree and shrub areas. Also, soil sterilants, such as Atrazine, Borate Sodium Chlorate, Diuron (Karmex), Fenuron, and arsenical compounds, should not be used near landscape planting since they break down slowly and leave toxic residues in the soil.

11-3.11.2. Edging and Spot Sterilization. Herbicides termed soil sterilants not only provide complete kill at application but also remain in the soil for varying periods of time during which they kill any introduced seeds or plants. Soil sterilants must be used with extreme caution in landscape planting since their transport in water runoff after rain or irrigation or their drift during application may result in injury to desirable plants. The more commonly used herbicides for edging and spot sterilization are listed in table 11-2.

(pg 11-4)

The U.S. Department of Commerce, Bureau of Census, *Schedule B Commodity by Country—Domestic Merchandise* provides records of commodities shipments from the U.S. to other countries as part of the census documentation. The chart below shows the commodity records of the shipment of herbicides into Panama during the time of the Veteran's first tour of military service in the Canal Zone. Department of Commerce records shows delivery of pesticides, herbicides, and insecticides to Panama from 1971 to 1974. Note that the headings sometimes changed, and so Plant Growth Regulator can include 2,4-D and 2,4,5-T because they are plant growth regulators.

Pounds of Pesticides Shipped to Panama by Year					
Heading	**1971**	**1972**	**1973**	**1974**	**Totals**
Herbicides, 2,4-D & 2,4,5-T		188,422	88,672	211,576	**488,670**
Herbicide preps, NEC or NSPF	397,850	945,475	1,310,628	2,174,707	**4,828,660**
Plant Growth Regulators				75,394	**75,394**
Organophosphorus insecticides		38,400	132,337	78,161	**248,898**
Polychlorinated insecticides (DDT)		96,400	275,573	296,371	**668,344**
Insecticides NSPF		66,706	144,232	480,433	**691,371**
TOTALS BY YEAR	**397,850**	**1,337,375**	**1,953,415**	**3,318,626**	**7,001,337**

The table above indicates that while the Veteran was present in the Panama Canal Zone during his first tour of military service, a total of over seven million pounds of pesticides was received there.

DDT and Malathion and Chlordane were in the Army Supply Bulletin as insecticides. Dioxins and benzene are in herbicides that were available to all military installations in Panama. All of these are known to have been tested and used in Panama. DDT is known to cause diabetes and neuropathy. The previously submitted medical journal article titled *Occupational Pesticide Exposure, Impaired DNA Repair, and Diseases* with the included Tactical vs Commercial chart, shows very little difference between the list of diseases for "Tactical" versus "Commercial" herbicides. That is because the chemical compounds and toxins are the same for both.

Same dioxin in both formulas:

Both the "commercial" and "tactical" formulas contain the same form of "TCDD" (dioxin) which is the main offending compound that causes so many health problems for those exposed to these herbicides. *According to the VA Public Health bulletin Research on Health Effects of* ***Herbicide Exposure, "Dioxin is a highly toxic substance found in Agent Orange and some other herbicides[22].*** *Studies suggest that this chemical may be related to a number of cancers and other health effects in humans. VA and other Federal Government Departments and agencies have and continue to conduct extensive research evaluating the health effects of Agent Orange exposure on U.S. Veterans. … You also may want to conduct a search on Agent Orange through the U.S. National Institutes of Health's PubMed [https://www.ncbi.nlm.nih.gov/pubmed/]." [emphasis added]*

The VA Public Health Bulletin Research on Health Effects of Herbicide Exposure also states: ***"The dioxin TCDD was an unwanted by-product of herbicide production. TCDD is the most toxic of the dioxins and is classified as a human carcinogen by the Environmental Protection Agency."***

The DoD contends that only commercial herbicides were used in Panama, but they have not been forthcoming with a list of commercial herbicides used in Panama. However, the scientific report titled ***Long-term Effects of Pesticides in Panama*** by Dr. Olson confirms the use of Chlordane, DDT, and Malathion and then documents the use of arsenic, arsenate, and various arsenic-containing herbicides as well as 2,4-D and 2,4,5-T, which are the major ingredients in Agent Orange. As noted above, the GAO report notes **"The dioxin in the commercial form of the herbicide is the same as the dioxin in the tactical form of Agent Orange."**

Laws and Opinions:

The DoD has consistently claimed there were no tactical herbicides from the Vietnam War used in, tested in, or stored in Panama. The following evidence contradicts that claim. However, I remind you that 38 CFR § 3.307 defines and specifies the requirements for a direct claim.

> **(6)** ***Diseases associated with exposure to certain herbicide agents.***
>
> **(i)** For the purposes of this section, the term "herbicide agent" means a chemical in an herbicide used in support of the United States and allied military operations in the Republic of Vietnam during the period beginning on January 9, 1962, and ending on May 7, 1975, specifically: 2,4–D; 2,4,5–T and its contaminant TCDD; cacodylic acid; and picloram.
>
> (Authority: 38 U.S.C. 1116(a)(4))

The DoD has never denied the use of insecticides in Panama, they have simply tried dodging VA claims by attempting to differentiate between tactical and commercial herbicides. That argument does not hold up in court. In the Court of Appeals for Veterans Claims Vet. App. No. 15-1525, a claim about herbicide use outside of the Republic of Vietnam, the judges rendered the following opinions. Note, however, that this decision is not precedent setting.

[redacted] The Secretary alleges the Court overlooked the distinction between herbicides in general and "herbicide agents" as defined in 38 C.F.R. § 3.307(a)(6)(i) (2016). The Secretary's arguments are baseless, as more fully explained below.

The Secretary nonetheless asserts that the Court failed to appreciate the distinction between herbicides in general, which he claims "were and continue to be routinely used," and "herbicide agents" as defined in 38 C.F.R. § 3.307. Sec. Mot. at 2-6. But in this case, there is no difference between the two: the Board expressly found that the herbicides used throughout the facility "included those noted in 38 C.F.R. § 3.307, such as 2-4D; 2, 4, 5-T; and picloram." R-14. The herbicides the Board determined were used facility-wide fall under the definition of "herbicide agents." R-14; 38 C.F.R. § 3.307(a)(6)(i). Those favorable findings are not subject to review and they defeat the Secretary's argument. 38 U.S.C. § 7261(a)(4).

The Secretary also attempts to distinguish between "tactical" herbicides and "commercial" herbicides. Sec. Mot. at 6. As argued above, the Board's factual finding as to the chemical composition of the herbicides used defeats this argument. But there are several other reasons this argument is unpersuasive and inaccurate.

First, the Secretary's reliance on the distinction between tactical and commercial herbicides is nothing more than post-hoc rationalization. *Martin v. Occupational Safety & Health Review Comm'n*, 499 U.S. 144, 156 (1991) ("'[L]itigating positions are not entitled to deference when they are merely appellate counsel's 'post hoc rationalizations' for agency action, advanced for the first time in the reviewing court."). The Board did not base its decision on this distinction. R-13-15. Its acknowledgement that it was discussing herbicides that met the definition of herbicide agents under 38 C.F.R. § 3.307 made any discussion of tactical versus commercial herbicides unnecessary. *Id.*

Second, neither the plain language of the regulation nor the statute distinguish between "tactical" and "commercial" herbicides. 38 U.S.C. § 1116(a)(3); 38 C.F.R. § 3.307(a)(6)(i). Rather, they both define "herbicide agent" as "a chemical in an herbicide" and used in support of operations in the Republic of Vietnam from January 9, 1962 to May 7, 1975. 38 U.S.C. § 1116(a)(3); 38 C.F.R. § 3.307(a)(6)(i). The

Secretary conceded in the previous Joint Motion for Remand in this case that the terms "tactical" and "commercial" are not found in the applicable VA statute or regulations. R-29-30. Therefore, any requirement that the Veteran be exposed to "tactical" herbicides places an additional burden on the Veteran that is not found in the law, and therefore illegal. *See Massey v. Brown*, 7 Vet.App. 204, 208 (1994)

No support exists for the Secretary's contention that so-called commercial herbicides did not contain the "agents" to which the presumption applies. Sec. Mot. at 6. Instead, the exact opposite is true. As noted, the term "herbicide agent" means specifically "2,4-D; 2,4,5-T and its contaminant TCDD; cacodylic acid; and picloram." *See* 38 C.F.R. 3.307(a)(6)(i). Therefore, if a so-called "commercial" herbicide contained any of those compounds, as a matter of law it satisfies the meaning of "herbicide agent" for the purposes of presumptive service connection.

The Secretary also tries to distinguish between types of herbicides based on use, but this distinction is irrelevant. The term "tactical" in reference to herbicides merely denotes the tactical "deployment or employment" of herbicides for military operations in tactical situation. *See Army Field Manual 0086* at 5 (Exhibit A). For example, the historical record is replete with evidence of "Agent Orange" and other herbicides being "routinely" used around base perimeters in Vietnam and Thailand, as well as on the Korean DMZ. 38 C.F.R. § 3.307(a)(6)(iv); VA Manual M21-

1.IV.ii.1.H.5. Yet VA recognizes each scenario and location for benefits under 38 C.F.R. § 3.309. This is further illustrated by VA's acknowledgement that a veteran "who did not serve in the Republic of Vietnam, but was exposed to an herbicide agent defined in 38 C.F.R. § 3.307(a)(6) during active military service, has a disease on the list of diseases subject to presumptive service connection, VA will presume that the disease is due to the exposure to herbicides." *Diseases Associated With Exposure to Certain Herbicide Agents*: 66 FR 23166-01, 23166 (May 8, 2001); *see also Taylor v. McDonald*, 27 Vet. App. 158, 163 (2014). Here, the Board found that the herbicides to which the Veteran was exposed contained the agents listed in the regulation. R-14. It does not matter whether it was used for defoliation in combat zone, a stateside military base, or a farmer's field.

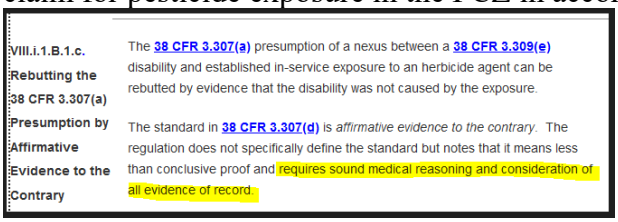
The Secretary also fails to appreciate the extent to which herbicides containing agents listed in section 3.307 were available for procurement by the military. *See Department of the Army Supply Bulletin* at 4 (noting availability of five gallon cans of Tordon 101, a picloram-based herbicide and herbicides containing 2,4-D and 2,4,5-T (*i.e.*, Agent Orange))(Exhibit B). The broad use of these herbicides is further shown by the fact that in "February 1959, the Chemical Corps Technical Committee approved use of 2,4,-D and 2,4,5-T as herbicides for distribution in five gallon cans as an expendable supply item to be available to all users as appropriate. These items were meant for use by facility engineers as an *herbicide for grounds keeping (i.e. brush and*

In the **Court of Appeals for Veterans Claims** Vet. App. No. 15-1525, a claim about herbicide use outside of the Republic of Vietnam, the judges delineate their argument against the Secretary and then end with this statement:

> "The Secretary agrees that exposure to the chemicals listed in 38 C.F.R. § 3.307(a)(6) triggers the presumption of service connection for diseases listed in section 3.309. Sec. Mo. At 2. And **the Board expressly found that the record "confirms facility-wide applications" of herbicides that "included those noted in 38 C.F.R. § 3.307, such as 2-4D; 2,4,5-T; and picloram" R-14**. The Secretary's effort to carve an exception for Mr. Barbett thus fails. Mr. Barbett is entitled to the presumption of service connection based on his exposure to "herbicide agents"."

6. SUMMARY:

This document presents sound scientific and medical reasoning for processing of a DIRECT claim for pesticide exposure in the PCZ in accordance with M21-1:



VIII.i.1.B.1.c. Rebutting the 38 CFR 3.307(a) Presumption by Affirmative Evidence to the Contrary	The 38 CFR 3.307(a) presumption of a nexus between a 38 CFR 3.309(e) disability and established in-service exposure to an herbicide agent can be rebutted by evidence that the disability was not caused by the exposure. The standard in 38 CFR 3.307(d) is *affirmative evidence to the contrary*. The regulation does not specifically define the standard but notes that it means less than conclusive proof and requires sound medical reasoning and consideration of all evidence of record.

Veteran was exposed to multiple chemicals while in the US Army, including solvents for cleaning weapons, and pesticides (which includes insecticides, fungicides, and herbicides) in the form of arsenic, arsenic-based herbicides, DDT, chlordane, 2,4-D and 2,4,5-T, while in Panama Canal Zone as a direct result of the "War on Mosquitoes". The DoD acknowledges the use of insecticides and "commercial herbicides". The GAO notes that commercial and tactical herbicides contain the same offending dioxin components, which is causative for all the presumptive herbicide exposure diseases. Veteran has been diagnosed with type II diabetes mellitus and Parkinson's disease, which are both listed as causes of death. Claimant has submitted medical evidence showing that he has several herbicide-related diagnoses. These claims (for diabetes and Parkinson's Disease) should be considered fully developed and processed accordingly.

Review of the submitted evidence is required by law to provide an equitable and just decision. Thus, due diligence should be given to evaluate all the evidence, to thoroughly review and analyze all evidence being submitted in light of the VCAA Act of 2000, review M21-1, the sworn statements, the medical evidence, and the additional documentary evidence being submitted. I realize there is a LOT of evidence, but that further supports the validity of this claim.

- US government documents proving herbicides were shipped to Panama:
  - **Department of the Army Supply Bulletin** dated September 18 1968 (SB 3-40)
  - **Department of Commerce** Schedule B Commodities Reports
  - United States **Government Accountability Office** (GAO) report confirms that the Military Sea Transportation Service directly chartered merchant vessels to

carry herbicides (Agents Orange, Blue and White) during the Vietnam War; some stopped in Panama as they traveled through the Panama Canal. There are discrepancies in amounts loaded in US and amounts delivered to RVN, suggesting offloading of herbicides in various ports of call. Guam has already been confirmed as receiving herbicides from such ships. This report also notes that the dioxin in commercial herbicides is exactly the same as the dioxin in tactical herbicides, contradicting the VA's argument about tactical versus commercial.
    - **Herbicide Manual for Noncropland Weeds**, dated March 1965, published by the Agricultural Research Service, **US Department of Agriculture**, in cooperation with **Bureau of Yards and Docks, Department of the [US] Navy**.
    - **VA Public Health bulletin** titled "Research on Health Effects of Herbicide Exposure"[23]
- Expert testimony was given to the VA
    - Former Lt. Charles Bartlett testified that Agent Orange was tested and stored in Panama.
    - Dr. L.W. (Wayne) Dwernychuk, an Environmental Scientist and Agent Orange Specialist, in the claim of Gene Tornoe, who also served in the Panama Canal Zone, showing that AO stays in the soil for 50-100 years.
- Peer-reviewed scientific and medical journal articles also refer to additional government documents and provide additional evidence of environmental and health effects of insecticides and herbicides.
- Multiple sworn statements from Veterans who served in the PCZ provide corroborating evidence of observations. While at different bases and/or times, their testimony also corroborates the ongoing nature of the tactical policies in the "War on Mosquitoes".
- CAVC and BVA judges provide opinions on the use of testimony and the VA's arguments regarding herbicides.

Based on expert testimony, government documents, and scientific evidence, the Claimant avows that pesticides/herbicides were present and used in the Panama Canal Zone during the time of her husband's military service. Veteran was exposed to multiple pesticides that are associated with, linked to, and/or result in diabetes mellitus and Parkinson's Disease: arsenic, DDT, Chlordane, Malathion as well as 2,4-D and 2,4,5-T. There is solid evidence of exposure and resultant disease. **Based on 38 CFR § 3.307, there is no requirement that claimants' disability claims of exposure to herbicides should be denied because the exposure occurred in the Panama Canal Zone or that such claims should be restricted to the U.S. military's use of herbicides in Vietnam or DMZ Korea, as the VA appears to assume.**

A February 17, 2022, letter from Raymond Kelley, DVA VSO liaison, confirms approval of the request of the petition for rulemaking from the Military-Veterans Advocacy for an extension of presumption of herbicide exposure to include the Veterans who served in the Panama Canal Zone from January 1, 1958, to December 31, 1999. This time frame includes Veteran's tour of duty. To date, the VA has not made a ruling.

[23] https://www.publichealth.va.gov/exposures/agentorange/research-studies.asp

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  - "The Big Picture: Soldiers in Panama" US Army recruiting movie; describes the duties of soldiers in Panama, from the National Archives
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  - Tropic Regions Test Center, printout of website; history of US military tropic testing; https://www.atec.army.mil/ypg/trtc.html
  - National Institute of Environmental Health Sciences, *Pesticides*
- **Government documents/reports for pesticide exposure**
  - Letter dated September 1, 2016 from Beth Murphy, Director of VA Compensation Services, VA to Congressman Carter, confirming use of Malathion as an insecticide
  - *Department of the Army Supply Bulletin, HERBICIDES, PEST CONTROL AGENTS, AND DISINFECTANTS*, (SB3-40) 9/18/1968 confirms which insecticides, herbicides, and fungicides were available to ALL installations
  - *Tactical Employment of Herbicides*, Department of the Army, December 1971
  - 12/15/1968 Armed Forces Pest Management Board memorandum
  - *Archives Search Report Findings for Field Testing of 2,4,5-T and other Herbicides*, Fort Detrick, Frederick, MD, 4 April 2012 https://www.scribd.com/document/120014805/Fort-Detrick-History
  - Memorandum for the Record, Department of the Army, JSRRC, dated May 6, 2013
  - *Investigations into Tactical and Commercial Herbicides for the Compensation Service, Department of Veterans Affairs* by Alvin Young Consultants (pg 13 confirms dioxin chemistry and concentration are same)
  - *Proceedings of the 3rd Defoliation Conference* on August 10-11, 1965; published September 1966 by the Department of the Army, Fort Detrick, Frederick, Maryland
  - *Research Note SO-280*, US Dept of Agriculture & US Forest Service, Southern Forest Experiment Station, December 1981

- GAO REPORT to Congress, November 2018: Agent Orange Actions Needed to Improve Accuracy and Communication of Information on Testing and Storage Locations, especially page 11
- *Schedule B Commodity by Country-Domestic Merchandise* 1977-1980 (http://catalog.hathitrust.org/Record/000497548) [from Bureau of the Census]
- Letter to MVA announcing rulemaking for Panama pesticides

- **BVA/CAVC Decisions**
  - CAVC Vet.App.15-1525 decision, Barbett v. Snyder
  - BVA Decision dated April 24, 2020, Citation No. A20006849, Docket No. 191210-47806, by Veterans Law Judge P.M. DiLorenzo
  - BVA Decision dated November 2, 2016, Citation No. 1642161, Docket No. 11-84-593, by Veterans' Law Judge Bradley W. Hennings
  - BVA Citation dated April 13,1999, Citation No. 9833039, Docket No. 97-28-647 by Veterans' Law Judge Ronald R. Bosch
  - Permissible Uses of BVA Decisions
- **Scientific and Medical Research Articles, Books**
  - *Arsenic as an Endocrine Disruptor: Arsenic Disrupts Retinoic Acid Receptor-and Thyroid Hormone Receptor-Mediated Gene Regulation and Thyroid Hormone-Mediated Amphibian Tail Metamorphosis*; Davey, Nomikos, et al; Environ Health Perspect. 2008 Feb; 116(2): 165–172; Published online 2007 Oct 26. doi: 10.1289/ehp.10131; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2235215/
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- *Pesticides and human chronic diseases: Evidences, Mechanisms, and Perspectives*; (abstract only); Mostafalou & Abdollahi; https://www.sciencedirect.com/science/article/abs/pii/S0041008X13000549
- *Health Dangers of Chlordane,* https://explore.globalhealing.com/health-dangers-of-chlordane/
- *Occupational Pesticide Exposure, Impaired DNA Repair, and Diseases,* Kaur & Kaur; Indian J Occup Environ Med. 2018 May-Aug; 22(2): 74–81. doi: 10.4103/ijoem.IJOEM_45_18; with Tactical Vs Commercial disease comparison chart at the end [page 29]
- VA Public Health Bulletin: Agent Orange and Type 2 Diabetes: *Take Charge of your Health* (2016 update)
- VA Public Health Bulletin: *Research on Health Effects of Herbicide Exposure*

- **Expert Testimony, Sworn Declarations**
  - Expert Testimony, Dr. Wayne Dwernychuk, dated 08/02/2016, with Curriculum Vitae
  - Expert Testimony, former Lt. Charles Bartlett, transcript of full testimony presented under oath before the BVA in the appeal of Donna Jones, widow.
  - Form 10210 (4/10/2023) and Sworn Declaration from Bobby Joe Terry, along with BVA Citation Nr. A21015822, Decision date: 10/15/2021, VLJ Jennifer White [testimony of BJT and WL are "probative"]
  - Sworn Declaration from William Loring for Paul Couzens
  - Notarized letter from Eric Dziekan to Commander Wells with pictures of AO barrels in Panama in 2020
  - Sworn Declaration from Mrs. Nickisch dated 11/08/2022
  - Sworn Declaration from Patrick J. Clark dated 10/22/2022
  - Sworn Declaration by Michael E. Doyle date 11 November 2019