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Agent Orange

Agent Orange is the code name for a [herbicide](#) and [defoliant](#)—contaminated with [TCDD](#)—used by the [U.S. military](#) in its [Herbicidal Warfare](#) program during the [Vietnam War](#).

According to Vietnamese Ministry of Foreign Affairs, 4.8 million Vietnamese people were exposed to Agent Orange, resulting in 400,000 deaths and disabilities, and 500,000 children born with birth defects. ^[1]

From 1962 to 1971, Agent Orange was by far the most widely used of the so-called "[Rainbow Herbicides](#)" employed in the [herbicidal warfare](#) program. During the production of Agent Orange (as well as [Agents Purple, Pink, and Green](#)) [dioxins](#) were produced as a contaminant, which have caused numerous health problems for the millions of people who have been exposed. Agents [Blue](#) and [White](#) were part of the same program but did not contain dioxins.

Early development

The earliest form of the compound triiodobenzoic acid was studied by [Arthur Galston](#) as a plant growth hormone. The research was motivated by the desire to adapt [soybeans](#) for short growing season. Arthur Galston is widely known for the social impact his work had on science. This defoliant was modeled after Galston's discovery of triiodobenzoic acid in 1943. Galston was especially concerned about the compound's side effects to humans and the environment. ^[2]

Galston found that excessive usage of the compound caused catastrophic defoliation - a finding used by his colleague Ian Sussex to develop a family of herbicides ^[3] (Galston later campaigned against its use in Vietnam). These herbicides were developed during the 1940s by independent teams in [England](#) and the United States for use in controlling broad-leaf plants.

Phenoxy agents work by mimicking a plant [growth hormone](#), indoleacetic acid (IAA). When sprayed on broad-leaf plants they induce rapid, uncontrolled growth, eventually defoliating them. When sprayed on crops such as [wheat](#) or [corn](#), it selectively kills only the broad-leaf weeds in the field, leaving the crop relatively unaffected. First introduced in 1946 in the agricultural farms of Aguadilla, [Puerto Rico](#), these herbicides were in widespread use in [agriculture](#) by the middle of the 1950s.

Chemical description and toxicology

Agent Orange was given its name from the color of the 55 US gallons (210 L) orange-striped barrels it was shipped in. It is a roughly 1:1 mixture of two phenoxy herbicides in iso-octyl [ester](#) form, 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T).

Scientific studies have ascribed numerous negative health effects to Agent Orange, its component compounds, and its manufacturing byproducts ^[4].

Internal memos from the companies that manufactured it reveal that at the time Agent Orange was sold to the U.S. government for use in Vietnam it was known that it contained a dioxin, 2,3,7,8-tetrachlorodibenzodioxin (TCDD), a by-product of the manufacture 2,4,5-T. ^[5] TCDD has been associated with increased neoplasms in every animal [bioassay](#) reported in the scientific literature ^[6]. The National Toxicology Program has classified TCDD as *known to be*

a human [carcinogen](#), frequently associated with [soft-tissue sarcoma](#), non-Hodgkin's lymphoma, Hodgkin's disease and chronic lymphocytic leukemia (CLL) ^{[7][8]}

In a study by the [Institute of Medicine](#), a link has been found between dioxin exposure and diabetes. ^{[9][10]}

Three studies have suggested that prior exposure to Agent Orange poses an increase in the risk of acute myelogenous leukemia in the children of Vietnam veterans. ^[4]

Several studies have shown an increase rate of cancer mortality for workers exposed to 2,4,5-T. In one such study, from Hamburg, Germany, the risk of cancer mortality increased by 170% after working for 10 years at the 2,4,5-T producing section of a Hamburg manufacturing plant ^[6].

Use in the Vietnam War

During the Vietnam war, between 1962 and 1971, the United States military sprayed 77,000,000 litres (17,000,000 imp gal; 20,000,000 US gal) of chemical defoliants in South Vietnam as part of a defoliant program. ^[11] 20 percent of

South Vietnam's jungles were sprayed over a nine year period. ^[12] The first objective was to reduce the dense jungle

foliage so that Communist forces might not use it for cover and to deny them use of crops needed for sustenance. In

1965, 42 percent of all herbicide spraying was dedicated to food crops. ^[12] The second objective was spot clearing in

sensitive areas such as around base perimeters. ^[13] It was also used to drive civilians into [RVN](#)-controlled areas. ^[14]

In 1963, the United States (suspecting the negative effects) initiated a study on the health effects of Agent Orange that by 1967 confirmed that the chemical caused cancer, birth defects and other serious health problems. ^[12] The outcome

of the study had no effect whatsoever on the use of Agent Orange. ^[12]

Effects on health

According to Vietnamese Ministry of Foreign Affairs, 4.8 million Vietnamese people were exposed to Agent Orange, resulting in 400,000 deaths and disabilities, and 500,000 children born with birth defects. ^[1] The most affected zones

are the mountainous area along Truong Son (Long Mountains) and the border between Vietnam and Cambodia. The affected residents are living in sub-standard conditions with many genetic diseases. ^[15]

The use of Agent Orange still has an effect on the citizens of Vietnam, poisoning their food chain and creating concern about its effect on human beings. This chemical has been reported to cause serious skin diseases as well as a vast variety of cancers in the lungs, larynx, and prostate. Children in the areas where Agent Orange was used have been affected and have multiple health problems including cleft palate, mental disabilities, hernias, and [extra fingers and toes](#). ^[16]

Presently the Veterans Administration provides compensation and treatment for several diseases to former military service personnel who were exposed to Agent Orange ^[17]

Perception and information

Until the 21st century much of the data on the effects of Agent Orange in Vietnam, was compiled by Vietnamese scientists in Vietnam and largely unavailable to the worldwide English reader. However, general public perception in

Vietnam is that the effects are severe and clearly visible in children of veterans and people in affected areas. Veterans have become increasingly concerned about the effects of Agent Orange to humans. While in Vietnam, the veterans were told not to worry, and were persuaded that the chemical was harmless.^[18] In the last few years, this opinion has changed, and studies show the true effects Agent Orange has on humans.^[19]

For more than a decade The Hatfield Group from Vancouver, Canada has been researching the long-term environmental effects of Agent Orange. Their extensive research has found that the areas sprayed by Agent Orange during the war no longer contain measurable amounts of dioxin and do not pose a health threat. However, many of the former US military bases in Vietnam where the herbicides were stored and loaded onto airplanes still have high level of dioxins in the soil. These 'Dioxin Hotspots' still pose a health threat to the surrounding communities. The airbases in Bien Hoa, Da Nang and Phu Cat have been put on a priority list for clean-up or containment by the Vietnamese government.^[20]

Acknowledgement by the U.S. Government

In 2002, Vietnam and the US held a joint conference on Human Health and Environmental Impacts of Agent Orange. Following the conference the US National Institute of Environmental and Health Sciences (NIEHS) began scientific exchanges between the US and Vietnam and began discussions for a joint research project on the human health impacts of Agent Orange.

These negotiations broke down in 2005 when neither side could agree on the research protocol and the research project was canceled. However, more progress has been made on the environmental front. In 2003 the first US-Vietnam workshop on remediation of dioxin was held.

Starting in 2005 the [U.S. Environmental Protection Agency](#) (EPA) began to work with the Vietnamese government to measure the level of dioxin at the Da Nang Airbase. Also in 2005 the Joint Advisory Committee on Agent Orange made up of representatives of Vietnamese and US government agencies was established. The committee has been meeting yearly to explore areas of scientific cooperation, technical assistance and environmental remediation of dioxin.

Some talking without any breakthrough came as a result of United States President George W. Bush's state visit to Vietnam in November 2006. In the joint statement between President Bush and President Triet regarding the visit further cooperation on long-term environmental and human health impacts of Vietnam War era dioxin was raised.

In late May 2007, President Bush signed into law a supplemental spending bill for the war in Iraq and Afghanistan that included an earmark of \$3 million specifically for funding for programs for the remediation of dioxin 'hotspots' on former US military bases and for public health programs for the surrounding communities.^[21]

Use outside of Vietnam

Agent Orange was also widely used by the US Military from the late 1940s through the 1970s.^{[22][23]}

United States

In December 2006 a report titled "The History of the US Department of Defense Programs for the Testing, Evaluation, and Storage of Tactical Herbicides," Submitted by Alvin L. Young, Ph. D., for Under Secretary of Defense William Van Houten listed Agent Orange test sites at Fort Gordon (Augusta, Georgia), Fort Chaffee (Fort Smith, Arkansas) and

Apalachicola National Forest (Sopchoppy, Florida). [24] The Veteran Administration has also acknowledged that Agent Orange was used domestically by U.S. forces. [25]

Korea

Agent Orange was used in Korea in the late 1960s. [26] Republic of Korea troops were the only personnel involved in the spraying, which occurred along the demilitarized zone with North Korea.

Canadian Forces Base Gagetown (New Brunswick, Canada)

The U.S. military, with the permission of the Canadian government, tested herbicides, including Agent Orange, in the forests near the Canadian Forces Base Gagetown in New Brunswick in 1966 and 1967. On September 12, 2007, Greg Thompson, Minister of Veterans Affairs, announced that the government of Canada was offering a one-time ex gratia payment of \$20,000 as the compensation package for Agent Orange exposure at CFB Gagetown. [27]

Innisfail (Queensland, Australia)

While it had been speculated that the Australian military may have tested Agent Orange on Innisfail, Queensland, a small town in northern Queensland, between 1964 and 1966, these claims have since been proved false by a Defence Science and Technology Organization investigation. They found that there was a small-scale defoliation trial conducted in the Gregory Falls area near Innisfail in 1966 but it did not involve Agent Orange. Claims the cancer rate was 10 times as high in Innisfail were also proved to be untrue by Queensland Health, who have stated it was caused by media miscalculation. This type of speculation is often used by those who seek compensation as "proof" of the connection between their illness and herbicides, even after the misinformation is revealed.

Guam

There is no credible evidence that Guam was used as a storage facility for Agent Orange.

Brazil

The Brazilian government used Agent Orange to defoliate a large section of the Amazon rainforest so that the multinational corporation Alcoa could build the Tucuruí dam to power mining operations. Large areas of rainforest were destroyed, along with the homes and livelihoods of thousands of rural peasants and indigenous tribes. [28]

Effects of the program

New Jersey Agent Orange Commission

In 1980, New Jersey created the New Jersey Agent Orange Commission, the first state commission created to study its effects. The commission's research project in association with Rutgers University was called "The Pointman Project". It was disbanded by Governor Christine Todd Whitman in 1996. [29]

During Pointman I, commission researchers devised ways to determine small dioxin levels in blood. Prior to this, such levels could only be found in the adipose (fat) tissue. The project compared dioxin levels in a small group of Vietnam veterans who had been exposed to Agent Orange with a group of matched veterans who had not served in Vietnam. The results of this project were published in the Journal of the American Medical Association in 1988. [30]

The second phase of the project continued to examine and compare dioxin levels in various groups of Vietnam veterans including Army, Marines and brown water riverboat Navy personnel.

Litigation

Against manufacturers

Since at least 1978, several lawsuits have been filed against the companies which produced Agent Orange, among them [Dow Chemical](#), Monsanto, and Diamond Shamrock (which produced 5% ^[31]). U.S. veterans obtained a \$180 million settlement in 1984, with most affected veterans receiving a one-time lump sum payment of \$1,200. According to the Department of Veterans Affairs, shortly after the Vietnam War veterans reported various health complications which can be traced to exposure to the chemical Agent Orange.

Hy Mayerson of the law firm [Mayerson Schreiber McDevitt, P.C.](#) was an early pioneer in Agent Orange litigation, working with renown [environmental attorney Victor Yannacone](#) in 1980 on the first class-action suits against wartime manufacturers of Agent Orange. In meeting Dr. Ronald A. Codario, one of the first civilian doctors to see afflicted patients, Mayerson, so impressed by the fact that an M.D. would show so much interest in a Vietnam veteran, forwarded more than a thousand pages of information on Agent Orange and the effects of dioxin on animals and humans to Codario's office the day after he was first contacted by the doctor as described in the book *Waiting for an Army to Die: The Tragedy of Agent Orange* by Fred A. Wilcox ^[32]. Mayerson Schreiber McDevitt, with Sgt. Charles E. Hartz as their principal client, filed the first Agent Orange class action lawsuit, in [Pennsylvania](#) in 1980, for the injuries that soldiers in Vietnam suffered through exposure to toxic dioxins in the Agent Orange [defoliant](#) ^[33]. Attorney Hy Mayerson co-wrote the brief that certified the Agent Orange Product Liability action as a [class action](#), the largest ever filed as of its filing ^[34]. Hartz's [deposition](#) was one of the first ever taken in America, and the first for an Agent Orange trial, for the purpose of preserving [testimony](#) at trial, as it was understood that Hartz would not live to see the trial because of the [brain tumor](#) that began to develop while he was a member of [Tiger Force](#), Special Forces, and LRRPs in Vietnam ^{[35][36][37]}. The firm also located and supplied critical research to the Veterans' lead expert Dr. Ronald A. Codario, M.D., including approximately one hundred articles from toxicology journals dating back more than a decade, as well as data about where herbicides had been sprayed, what the effects of dioxin had been on animals and humans, and every accident in factories where herbicides were produced or dioxin was a contaminant of some chemical reaction. ^[38]

In Congress

In 1991, the US Congress enacted the Agent Orange Act giving the [Department of Veterans Affairs](#) the authority to declare certain conditions 'presumptive' to exposure to Agent Orange/Dioxin enabling these veterans who served in Vietnam eligible to receive treatment and compensation for these conditions. ^[39] The same law required the National Academy of Sciences to periodically review the science on dioxin and herbicides used in Vietnam to inform the Secretary of Veterans Affairs about the strength of the scientific evidence showing association between exposure to Agent Orange/Dioxin and certain conditions. ^[40]

Through this process, the list of 'presumptive' conditions has grown since 1991 and currently the U.S. Department of Veterans Affairs has listed prostate cancer, respiratory cancers, multiple myeloma, type II diabetes, Hodgkin's disease, non-Hodgkin's lymphoma, soft tissue sarcoma, chloracne, porphyria cutanea tarda, peripheral neuropathy, chronic

lymphocytic leukemia, and spina bifida in children of veterans exposed to Agent Orange as conditions associated with exposure to the herbicide. As of October 2009, this list includes B cell leukemias, such as hairy cell leukemia, Parkinson's disease and ischemic heart disease.

On behalf of Vietnam War allies

In [Australia](#), [Canada](#) and [New Zealand](#), veterans obtained compensation in settlements that same year. In 1999, [South Korean](#) veterans filed a lawsuit in the Korean courts. In January 2006, the Korean Appeal Court ordered Monsanto and Dow to pay US\$62 million in compensation. However, no Vietnamese have received compensation, and on March 10, 2005, Judge [Jack B. Weinstein](#) of the [United States District Court for the Eastern District of New York](#) dismissed the lawsuit filed by the Vietnamese victims of Agent Orange against the chemical companies which produced the defoliants and herbicides.

The case was appealed and heard by the Second Circuit Court of Appeals on June 18, 2007. The Court of Appeals upheld the dismissal of the case stating that the herbicides used during the war were not intended to be used to poison humans and therefore did not violate international law. ^[41] The lawyers for the Vietnamese have petitioned the US Supreme Court to consider the case.

U.S. Vietnamese victims class action lawsuit

On January 31, 2004, a victim's rights group, the Vietnam Association for Victims of Agent Orange/Dioxin (VAVA), filed a lawsuit in the [United States District Court for the Eastern District of New York](#) in [Brooklyn](#), against several U.S. companies for liability in causing personal injury, by developing and producing the chemical. Dow Chemical and Monsanto were the two largest producers of Agent Orange for the U.S. military and were named in the suit along with the dozens of other companies (Diamond Shamrock, Uniroyal, Thompson Chemicals, Hercules, etc.). A number of lawsuits by American GIs were settled out of court - without admission of liability by the chemical companies - in the years since the Vietnam War. In 1984, some chemical companies that manufactured Agent Orange paid \$180 million into a fund for United States veterans following a lawsuit.

On March 10, 2005, Judge Jack B. Weinstein - who had defended the U.S. veterans victims of Agent Orange - dismissed the suit, ruling that there was no legal basis for the [plaintiffs'](#) claims. The judge concluded that Agent Orange was not considered a poison under [international law](#) at the time of its use by the U.S.; that the U.S. was not prohibited from using it as a herbicide; and that the companies which produced the substance were not liable for the method of its use by the government. The U.S. government is not a party in the lawsuit, claiming [sovereign immunity](#).

Three judges on the Second Circuit Court of Appeals in Manhattan heard the Appeals case on June 18, 2007. They upheld Weinstein's ruling to dismiss the case. They ruled that though the herbicides contained a dioxin (a known poison) they were not intended to be used as a poison on humans. Therefore they were not considered a chemical weapon and thus not a violation of international law. A further review of the case by the whole panel of judges of the Court of Appeals also confirmed this decision. The lawyers for the Vietnamese have filed a petition to the US Supreme Court to hear the case. On March 2, 2009, the Supreme Court denied [certiorari](#) and refused to reconsider the ruling of the Court of Appeals ^[42].

In order to assist those who have been impacted by Agent Orange/Dioxin, the Vietnamese have established "Peace villages", which each host between 50 to 100 victims, giving them medical and psychological help. As of 2006, there were 11 such villages, thus granting some social protection to fewer than a thousand victims. U.S. veterans of the war in Vietnam and individuals who are aware and sympathetic to the impacts of Agent Orange have also supported these programs in Vietnam. An international group of Veterans from the U.S. and its allies during the Vietnam war working together with their former enemy - veterans from the Vietnam Veterans Association - established the Vietnam Friendship Village ^[43] located outside of [Hanoi](#).

The center provides medical care, rehabilitation and vocational training for children and veterans from Vietnam who have been impacted by Agent Orange. In 1998, The Vietnam Red Cross established the Vietnam Agent Orange Victims Fund to provide direct assistance to families throughout Vietnam that have been impacted by Agent Orange. In 2003, the Vietnam Association of Victims of Agent Orange (VAVA) was formed. In addition to filing the lawsuit against the chemical companies, VAVA also provides medical care, rehabilitation services and financial assistance to those impacted by Agent Orange.

South Korean lawsuit

In 1999, about 20,000 South Koreans filed two separated lawsuits against U.S. companies, seeking more than \$5 billion in damages. After losing a decision in 2002, they filed an appeal.

In January 2006, the South Korean Appeals Court ordered Dow Chemical and Monsanto to pay \$62 million in compensation to about 6,800 people. The ruling acknowledged that "the [defendants](#) failed to ensure safety as the defoliants manufactured by the defendants had higher levels of dioxins than standard", and, quoting the U.S. National Academy of Science report, declared that there was a "causal relationship" between Agent Orange and 11 diseases, including cancers of the lung, larynx and prostate. However, the judges failed to acknowledge "the relationship between the chemical and peripheral neuropathy, the disease most widespread among Agent Orange victims" according to the *Mercury News*.

Canada lawsuit

On July 12, 2005, Merchant Law Group LLP on behalf of over 1,100 Canadian veterans and civilians who were living in and around the CFB Gagetown filed a lawsuit to pursue [class action](#) litigation concerning Agent Orange and Agent Purple with the Federal Court of Canada ^[44].

On August 4, 2009, the case was thrown out of court due to lack of evidence. The ruling was appealed ^{[45][46]}

See also

Aftermath: The Remnants of War (film)

[Depleted uranium](#)

[Environmental issues with war](#)

Gulf War Syndrome

[Operation Ranch Hand](#)

Teratogen

[Thalidomide](#)

U.S. Army Biological Warfare Laboratories

[Vietnam Syndrome](#)

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21. ^ *CRS Report for Congress Vietnamese Victims of Agent Orange and US-Vietnam Relations*
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Further reading

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External links

General

www.vietnam-dioxin.org, an information website on the consequences of Agent Orange and dioxin in Vietnam, Cambodia and Laos.

The Hatfield Group - Research on the environmental impacts of Agent Orange in Vietnam.

The War Legacies Project Information about the long term health and environmental effects of Agent Orange in Southeast Asia and the US. Including information about Agent Orange related environmental and health programs in Vietnam and Court documents from the Vietnamese lawsuit.

"The Boneyard" by Ben Quick, *Orion Magazine* March/April 2008 a personal account of the intergenerational legacy of Agent Orange exposure in Vietnam Veterans

Poisoned Lives

Operation Ranch Hand: Herbicides In Southeast Asia History of Operation Ranch Hand

Agent Orange legal case dismissed - report of the US Federal court ruling on the VAVA suit.

Children and the Vietnam War 30-40 years after the use of Agent Orange, article with pictures

Victim advocacy organizations

Vietnamese Victims of Agent Orange Trust

The orangecarers 2009 65 day agent orange walk/drive On 3 April 2009 started the 65 day walk/drive around Vietnam to create awareness of Agent Orange, and the effects passed on to the children of Vietnam. Follow daily where they have been and where they are going.

Letters from Agent Orange victims in Vietnam and additional information to provide assistance.

Blue Water Navy Vietnam Veterans Association - Advocacy Group and Documentation Library for military herbicide use in Southeast Asia and elsewhere.

Toxicology

NIEHS dioxin fact sheet

Assessment of the health risk of dioxins 1998 by the [WHO](#) and the [IPCS](#) (pdf).

Video

"Agent Orange: 30 Years Later", <http://agentorangefilmjohntrinh.ash.com> an award-winning drama-documentary about the victims of Agent Orange 30 years after the Viet Nam War.

Pulitzer Center on Crisis Reporting Vietnam: War's Lasting Legacy. Video reports from the field on the lingering effects of Agent Orange.

Agent Orange -a personal requiem- --documentary film

The Last Ghost of War Documentary film focusing on the Vietnamese Agent Orange Lawsuit and the impacts of Agent Orange on Vietnam Veterans, citizens of Nitro, WV and the Vietnamese.