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Frequently Asked Questions About Agent Orange/Dioxin

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What is Agent Orange: Agent Orange was one of a class of color-coded herbicides that U.S. forces sprayed over the rural landscape in Vietnam to kill trees, shrubs and food crops over large areas. Agent Orange was a 50/50 mixture of two individual herbicides, 2,4-D and 2,4,5-T. It remained toxic over a short period -- a scale of days or weeks -- and then degraded.¹ The production of Agent Orange was halted in the 1970s, existing stocks were destroyed and it is no longer used.² More than 43 million litres (11,360,000 gallons) of Agent Orange were used in Vietnam from 1965-1970. In addition more than 30 million litres of Agent White, Blue, Purple, Pink and Green were also sprayed.³

What is dioxin: Dioxin is a member of the class of persistent organic pollutants (POPs) which resulted from the deliberately accelerated production of 2,4,5-T, one of the components of Agent Orange.⁴ The chemical companies that produced the herbicides claimed they were unaware of the dioxin contaminant, however many dispute this claim. Estimates as to the amount of dioxin in the herbicides vary because each manufacturer and each batch of 2,4,5-T had different levels of the dioxin contaminant. Researchers have estimated that anywhere from 130–366 kg of dioxin was dumped in Vietnam.⁵

What are the health effects of dioxin: Dioxin can shorten the life of humans exposed to it and is associated with severe degradation of health in this and, potentially, future generations. Dioxin is toxic over a long period -- a scale of many decades -- and does not degrade readily. Dioxin is not absorbed by plants nor is it water soluble. It can attach to fine soil particles or sediment, which are then carried by water downstream and settle in the bottoms of ponds and lakes. It continues to adversely affect people who eat dioxin-contaminated fish, molluscs and fowl produced around a handful of point sources of dioxin called dioxin "hot spots."⁶ The highest level of dioxin recorded in a human in Vietnam was in a person fishing in the lake on the Da Nang airbase, over 1000 ppt.⁷

What are the environmental effects of Agent Orange and the other herbicides: The effects persist in the form of ecologically degraded landscapes in parts of the hilly and mountainous areas of Vietnam. The pre-war forests that existed in most of these areas took hundreds of years to reach an ecologically-balanced mixture of large numbers of species of flora and fauna. Natural regeneration would take centuries to reproduce those landscapes. In addition, in some of the sprayed areas, soil erosion and landslides have sharply lowered soil nutrient levels and altered the topographical features of the landscape. These changes have encouraged a few species of invasive grasses of low value. Active replanting with species of trees and shrubs which are ecologically viable and have economic value will require substantial and sustained long-term investment.⁸

What can be done to address dioxin's impacts: Dioxin's continuing impact can be slowed or halted by genetic counselling, cutting the dioxin exposure pathways in the human food chain and by environmental remediation of contaminated sites. The adverse effects of dioxin on human health can be ameliorated in most cases if detected early, but they cannot be fully corrected in some cases by any amount of time or money. If dioxin permanently alters the intricate internal cellular and chemical balances involved in maintaining good human health, there is serious risk of life-long health problems which may ultimately lead to mortality.⁹

When were Agent Orange and the other herbicides sprayed in Vietnam: The first testing of the herbicides in Vietnam was conducted in August 1961. The U.S. Air Force aerial spraying program, Operation Hades (later renamed Operation Ranch Hand), took place from January 1962 until February 1971 accounting for 95% of the herbicides sprayed. The U.S. Chemical Corps and other allied forces sprayed the remaining 5% by helicopters, trucks and hand, mostly around the perimeters of military bases.¹⁰ The U.S. government stopped the spraying of all herbicides in October 1971. However the South Vietnamese military continued to spray various herbicides until 1972.¹¹

How much of Vietnam was sprayed: The herbicides were sprayed over about 24% of southern Vietnam. As a result 3,104,000 hectares (5 million acres) of upland and mangrove forests were destroyed and about 500,000 acres of crops were destroyed (an area the size of Massachusetts). Thirty-four percent of the regions were sprayed more than once with some of the upland forests sprayed more than four times.¹² Parts of Laos and Cambodia along the border of Vietnam were also sprayed.

What happened to the remaining barrels of herbicides after the spraying ended: Starting in September 1971, in a project called Pacer Ivy, remaining stocks of the dioxin-contaminated herbicides in Vietnam were gathered at Da Nang, Bien Hoa and Tuy Hoa airbases. If the barrels were damaged, South Vietnamese military soldiers re-barreled the herbicide into new 55-gallon drums. The damaged empty barrels were disposed of in local landfills, whereas the 'usable' barrels were steam cleaned and given to the South Vietnamese Air Force. In April 1972, after the re-barreling was finished, approximately 1,387,100 gallons of Agent Orange was shipped to Johnston Island in the south pacific. In 1977, 845,000 gallons of dioxin-contaminated herbicides stored at the Seabees base in Gulf Port, Miss., were re-barreled and shipped to Johnston Island. A total of 8.6 million liters (2,271,879 gallons) were destroyed in the South Pacific in 1977 on the incinerator ship *M/T Vulcanus*.¹³

What diseases has the U.S. government found to be associated with the wartime herbicides: In 1991 Congress passed Public Law 102-4 which required the National Academy of Sciences to review the medical and scientific research on the health affects of exposure to the herbicides used during the war in Vietnam.¹⁴ The Institute of Medicine (IOM) reviews the studies on all the individual compounds in the herbicides used and the dioxin contaminant in 2,4,5-T. They issue biennial reports called "*Veterans and Agent Orange*." The most recent report was released in July 2009. To date the IOM has found sufficient evidence of association between exposure to the herbicides and soft-tissue sarcoma, non-Hodgkin's lymphoma, chronic lymphocytic leukemia, Hodgkin's disease and chloracne. They also found that there is limited or suggestive evidence of an association between exposure to the herbicides and laryngeal cancer, respiratory and prostate cancers, multiply myeloma, AL amyloidosis, peripheral neuropathy, Porphyria cutanea tarda, hypertension, type II diabetes, spina bifida in the offspring of those exposed and, most recently, to Parkinson's disease and Ischemic heart disease.¹⁵ The Department of Veterans Affairs (VA) allows for compensation for all of the diseases except for Parkinson's disease, Ischemic heart disease and hypertension.¹⁶

What birth defects does the VA compensate veterans for: The VA allows for compensation for children of male veterans with spina bifida and for children of U.S. female veterans who served in Vietnam with Achondroplasia, cleft lip and cleft palate, congenital heart disease, congenital talipes equinovarus (clubfoot), esophageal and intestinal atresia, Hallerman-Streiff syndrome, hip dysplasia, Hirschsprung Disease, hydrocephalus due to aqueductal stenosis, hypospadias, imperforate anus, neural tube defects (including spina bifida, encephalocele, and anencephaly), Poland syndrome, pyloric stenosis, syndactyly

(fused digits), tracheoesophageal fistula, undescended testicle and Williams syndrome. However the compensation for a female veteran's children with birth defects is for service in Vietnam and not specifically linked to exposure to the herbicides or to the dioxin in the 2,4,5-T. ¹⁷

What diseases and birth defects do Vietnamese scientists and agencies believe are associated with exposure to the herbicides: The Vietnam Red Cross lists the following diseases as associated with exposure to dioxin: acute, chronic and subacute peripheral neuropathy, chloracne, type II diabetes, hepatoma, lipid metabolism, lung cancer, Hodgkin's lymphoma, non-Hodgkin's lymphoma, malignant multiple myeloma, porphyria cutanea tarda, sarcoma, prostate cancer, reproductive abnormalities, and respiratory cancers (bronchial, tracheal, and laryngeal). ¹⁸ Among the birth defects that the Vietnamese believe are associated with exposure to the dioxin-contaminated herbicides are many congenital deformities including achondroplasia, cleft lip and cleft palate, clubfoot, hydrocephalus, neural tube defects (including spina bifida, encephalocele, and anencephaly), syndactyly (fused digits), musculature malformations and paralysis and some developmental disabilities.

How many people are believed to be exposed to the dioxin-contaminated herbicides in Vietnam: Researchers have estimated the number of Vietnamese civilians who lived in the sprayed regions at the time of spraying, according to population records, to be 2.1–4.5 million. ¹⁹ However, this number does not include those who traveled through the sprayed region such as soldiers from the north and south of Vietnam, and Vietnamese who worked on military bases where the herbicides were sprayed and/or stored. Foreign and Vietnamese scientists are still gathering information on the number of Vietnamese who may have been exposed to dioxin after the war at the limited number of 'dioxin hotspots' in southern Vietnam.

The U.S. Department of Veterans Affairs presumes that any of the 2.8 million U.S. veterans who 'had their boots on the ground' in Vietnam from 1962–1975 were exposed. However, this number also does not include the Vietnam–era veterans who served in the Navy off the coast of Vietnam or those who flew over the territory of Vietnam from bases or aircraft carriers outside of Vietnam, nor does it include anyone who may have been exposed outside of Vietnam where the dioxin-contaminated herbicides were used/tested/sprayed (i.e., Korea, Thailand, Cambodia, Laos, Puerto Rico and various places in the U.S.). Also not included in estimates of those exposed are the U.S. civilians who may have been in Vietnam during the time of spraying.

How many people have suffered adverse health affects from the dioxin: There are no accurate numbers for those who have been affected by the dioxin. However the Vietnam Red Cross estimates that up to 3 million Vietnamese have been affected, of which 150,000 are children with birth defects. ²⁰ The Vietnamese government currently provides a monthly stipend to over 200,000 Vietnamese who are believed to be affected by the toxic herbicides. ²¹ The Vietnam Association of Victims of Agent Orange is currently conducting a survey to identify those who suffer from an illness or birth defect believed to be caused by the herbicides. The U.S. Department of Veteran's Affairs has not released data on the number of U.S. veterans who received disability payments for illnesses linked to the herbicides used during the war.

What is the lifespan of dioxin: The half-life of dioxin depends greatly on where it is located. In humans the half-life is between 11–15 years, though it can be as high as 20 years. The half–life of dioxin in the environment varies depending on what type of soil it is found and how deep it lies. Sun will break down

dioxin so it is believed that the half-life for dioxin on the surface is between 1–3 years depending on the conditions. However, if the dioxin is buried under the surface or deep in the sediment of rivers and other bodies of water, the dioxin half-life can be more than 100 years.²²

What is the ‘safe’ level of dioxin: The standards of what is considered ‘safe’ vary from country to country and vary depending if one is talking about levels of TCDD in food, air, water or soil.²³ The World Health Organization recommends that monthly intake of dioxin is 70 picogram/kg of bodyweight.²⁴ Most exposure to dioxin is through the food chain. Therefore of greatest concern for human exposure to dioxin is its level in the soil and sediment. The general standard in most countries regarding dioxin/furans and other persistent organic pollutants is that soils should not exceed 1000 ppt TEQ in soil and 100 ppt in sediment.²⁵ The U.S. Agency for Toxic Substance and Disease Registry has determined that levels higher than 1000 ppt TEQ in soil require intervention including: surveillance, research, health studies, community and physician education, and exposure investigation.²⁶

What are ‘dioxin hotspots’: Hatfield Consultants (Canada) found that in areas that were sprayed by air, the dioxin broke down in the tropical sun or was washed away by the monsoonal rains, leaving low residual dioxin in the soil.²⁷ However, they found that ‘dioxin hotspots’ do exist in areas where the herbicides were stored, leaked or spilled and leached into the soil or where it was transported via soil particles and settled in the sediment of nearby, rivers, lakes and ponds. Research is still being conducted in Vietnam to identify the level of dioxin in the suspected ‘hotspots’ on the former U.S. military bases, primarily those where the Ranch Hand program was based. Vietnamese officials believe that there are up to 25 potential ‘dioxin hotspots.’²⁸ Hatfield has conducted preliminary surveys and has identified, at a minimum, three significant ‘hotspots’, though others may exist.²⁹ The Vietnamese and Hatfield have determined that Da Nang, Phu Cat and Bien Hoa air bases are significant ‘hotspots’ in need of immediate remediation. Dioxin levels have been found to be as high as 365,000 ppt on the Da Nang base, 185,000 ppt on the Bien Hoa base and 236,000 ppt in the former herbicide storage area on the Phu Cat base.³⁰ The average level of dioxin found in the soil of industrialized nations is less than 12 ppt.³¹

How long does it take to clean up the ‘hotspots’ and what is the cost: Remediation time and cost varies depending on the level of severity of contamination, the type of soil that is contaminated and end use of the area contaminated. The first step is to construct barriers around the ‘hotspots’ to keep the local population from being further exposed. Second, containment measures, such as constructing concrete caps, drainage ditches and sediment tanks, must be taken to prevent the dioxin from being transported from the original contamination site to secondary sites. Hatfield and their Vietnamese counterpart, the Committee 33, have found that there are 234,780 cubic meters of soil and sediment at Bien Hoa, Da Nang and Phu Cat in need of remediation. They estimate that remediation will cost around \$58,695,000.³²

What is the U.S. position on “Agent Orange”³³: The U.S. has consistently stated that there is no scientific evidence linking “Agent Orange” to adverse health effects found in Vietnam.³⁴ The U.S. government recognizes that the issue has hindered the ‘normalization’ of relations with Vietnam and in recent years U.S. officials have begun to dialogue with Vietnamese counterparts about the issue.³⁵

What has the U.S. done to help the Vietnamese address the impacts of the dioxin-contaminated herbicides: In 2002 the U.S. and Vietnam held a joint scientific conference, Human Health and Environmental Effects of Agent Orange/Dioxins, in Hanoi and signed a research memorandum of

understanding. The two countries then began exchanges between scientists. Unfortunately the negotiations over a joint research project fell through in 2005. In 2003 the U.S. Environmental Protection Agency began a \$2.4 million project cooperating with the Vietnamese to investigate the severity of the dioxin 'hotspots' at the Da Nang airbase with the funds going to U.S. government agencies and their contractors. Starting in 2006, the Joint Advisory Committee made up of key government agencies from Vietnam and the U.S. began holding yearly meetings regarding the health and environmental impacts of Agent Orange/dioxin.³⁶ In 2007, Congress allocated \$3 million to "address remediation of dioxin hotspots in Vietnam and to support public health programs in the surrounding communities."³⁷ A second allocation of \$3 million was included in the FY2009 Foreign Operations spending bill. To date the U.S. Agency for International Development, the implementing agency for the funds, has distributed \$1 million to three non-governmental organizations for programs to support those with disabilities in the Da Nang area.³⁸ The bulk of the remaining \$5 million has not yet been released.³⁹ None of the U.S. funds have gone directly to the Vietnamese.

What have non-governmental organizations (NGOs) done to address Agent Orange/dioxin in Viet Nam:

The lead NGO on this issue has been the Ford Foundation, which has provided \$11.5 million in grants in Vietnam to "develop treatments and support centers for Vietnamese who have been exposed, test for and contain dioxin-contaminated soils, restore landscapes and educate the public and policy makers in the U.S."⁴⁰ Ford has also been a leader in the philanthropic community to increase awareness about Agent Orange/dioxin and to encourage new donors such as UNICEF, The Atlantic Philanthropies and the Bill & Melinda Gates Foundation to get involved. The Vietnam Association of Victims of Agent Orange, with chapters throughout Vietnam, was established in 2004 in order to raise support for those believed to be affected by Agent Orange. Similarly the Vietnam Red Cross also raises funds to support the needs of those believed to be ill or disabled from the herbicides. There are numerous foreign organizations - including the War Legacies Project, the Vietnam Veterans of America Foundation, the East Meets West Foundation, The Da Nang-Quang Nam Fund, Catholic Relief Services, CHEER Vietnam, Children of Vietnam and Vietnam Assistance for the Handicapped - that have been providing rehabilitation, education, income generation and other services to the disabled in Vietnam, including those believed to be impacted by Agent Orange. However these programs only reach a small number of those in need.

¹ For toxicity information on 2,4, 5-T see http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC34514 for 2,4-D see http://www.pesticideinfo.org/Detail_Chemical.jsp.

² Dwernychuk, Wayne and Bailey, Charles, "Clarity on Two Terms" July 7, 2009., <http://www.warlegacies.org/Agent%20Orange/Clarity.pdf>.

³ Young, Al *The History, Use and Disposition and Environmental Fate of Agent Orange* (New York, NY: Springer, Science and Business Media, 2009) 67 and 5. Also Stellman, J. et al "The Extent and Pattern of Usage of Agent Orange and other Herbicides in Viet Nam," *Nature*, 422 (2003): 682.

⁴ Dwernychuk, Wayne and Bailey, Charles. Agents Pink, Purple and Green also contained 2,4,5-T and therefore dioxin.

⁵ Samples from the barrels of Agent Orange stored at Gulfport, Miss., and Johnston Island were tested by the U.S. military in 1977 with a range of < 3 to a high of 50 ppm. Researchers used these levels to estimate how much dioxin was in the herbicides sprayed in Vietnam. Stellman estimated 221-366 kg, Gough 167kg, Young 130 – 144 kg and Westing 170kg.

⁶ Dwernychuk, Wayne and Bailey, Charles.

⁷ In comparison people in industrial nations such as the U.S. have a baseline of 2-5 ppt dioxin in their blood.

⁸ Dwernychuk, Wayne and Bailey, Charles.

⁹ Dwernychuk, Wayne and Bailey, Charles.

¹⁰ Stellman, 681-2.

¹¹ Young, 4.

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- ¹² Vo Quy, "Statement to the House Subcommittee on Asia, the Pacific and Global Environment," June 4, 2009. , <http://www.internationalrelations.house.gov/111/quy060409.pdf>.
- ¹³ Young, Al See Chapter 4.
- ¹⁴ <http://www7.nationalacademies.org/ocga/laws/PL102-4.asp>.
- ¹⁵ National Academy of Sciences, *Veterans and Agent Orange: Update 2008* Washington, DC (2009.): 7 – 8. http://books.nap.edu/openbook.php?record_id=12662&page=8.
- ¹⁶ <http://www.publichealth.va.gov/exposures/agentorange/diseases.asp#veterans>
- ¹⁷ http://www.publichealth.va.gov/docs/agentorange/reviews/ao_newsletter_aug08.pdf.
- ¹⁸ Michael Martin, "Vietnamese Victims of Agent Orange and U.S.-Vietnam Relations" Congressional Research Service Report. (May 2009) pg 17 <http://www.warlegacies.org/CRSAO.pdf>.
- ¹⁹ Stellman: 684-685. <http://www.warlegacies.org/nature01537.pdf>.
- ²⁰ Tom Fawthrop, "Vietnam's War against Agent Orange" BBC News June, 14, 2004. <http://news.bbc.co.uk/2/hi/health/3798581.stm>.
- ²¹ Statement by Ambassador Ngo Quang Xuan to the House Subcommittee of Asia, Pacific and Global Environment. June 2009: Page 3. <http://www.internationalrelations.house.gov/111/xua060409.pdf>.
- ²² Wayne Dwernychuk, Hatfield Consultants e-mail exchange with Susan Hammond, War Legacies Project.
- ²³ Dioxin is not water soluble so in general it would not be found in water unless the dioxin particles are clinging to other fine particles in the water that have not been filtered out.
- ²⁴ "Dioxin and their Effects on Human Health" WHO Fact Sheet #225. November 2007, <http://www.who.int/mediacentre/factsheets/fs225/en/index.html>.
- ²⁵ ppt = parts per trillion. TEQ = Toxic equivalents a method of measuring dioxins and dioxin like compounds. TCDD, the most toxic of these compounds, has a value of 1 TEQ and the other less toxic are measure as a fraction of 1.
- ²⁶ Hatfield Consultants "Summary of Dioxin Contamination at Bien Hoa, Phu Cat and Da Nang Airbases, Viet Nam." PowerPoint presentation for the meeting of the U.S.-Vietnam Dialogue Group On Agent Orange/Dioxin, Washington, DC June 2009. <http://www.warlegacies.org/Hatfield-Dioxin-Presentation-DC-052809.pdf> .
- ²⁷ Wayne Dwernychuk et al. "The Agent Orange Dioxin Issue in Vietnam: A Manageable Problem." Paper Presented at Dioxin 2006, Oslo, Norway <http://www.warlegacies.org/OsloPaper2006.pdf>.
- ²⁸ Vo Quy, "Statement to the House Subcommittee on Asia, the Pacific and Global Environment," June 4, 2009. , <http://www.internationalrelations.house.gov/111/quy060409.pdf>.
- ²⁹ Hatfield Consultants "Summary of Dioxin Contamination at the Bien Hoa, Phu Cat and Da Nang Airbases, Viet Nam." PowerPoint Presentation, Washington, DC. 2009. <http://www.warlegacies.org/Hatfield-Dioxin-Presentation-DC-052809.pdf>.
- ³⁰ Committee 33 PowerPoint Presentation: "Overcoming consequences of toxic chemicals/dioxin: A difficult and long-term task." April 2009 http://www.warlegacies.org/Committee33_0209.pdf.
- ³¹ <http://www.atsdr.cdc.gov/toxprofiles/tp104-c5.pdf> pg 380.
- ³² Committee 33 PowerPoint Presentation: "Overcoming consequences of toxic chemicals/dioxin: A difficult and long-term task." April 2009 http://www.warlegacies.org/Committee33_0209.pdf.
- ³³ Agent Orange is in quotes because reporters, advocates and government officials often misuse it as shorthand for all the dioxin-contaminated herbicides used in Vietnam.
- ³⁴ HDNET Report Vietnam's Lingering Ghost: Facing the Legacies of Agent Orange. 714 (2009) and World Report http://www.hd.net/worldreport_epguide.html?page=0.
- ³⁵ In November 2006, President Bush and Vietnam's President Triet declared in their Joint Statement that, "further joint efforts to address the environmental contamination near former dioxin storage sites would make a valuable contribution to the continued development of their bilateral relations."
- ³⁶ Scott Marciel, Testimony before the House Subcommittee on Asia, Pacific and the Global Environment, May 2008. <http://www.internationalrelations.house.gov/110/mar051508.htm>.
- ³⁷ Michael Martin; 9.
- ³⁸ The East Meets West Foundation, Save the Children and Vietnam Assistance for the Handicapped.
- ³⁹ \$500,000 of the allocation is being used to finance a staff person responsible for dioxin issues at the U.S. embassy in Hanoi as well as for more exchanges of experts. If their programs are successful, an additional \$1 million is expected to be dispersed to the three NGOs who received the first allocation.
- ⁴⁰ From Charles Bailey's paper "Chronology of Key Events 1993 through June 2009." Among the work that Ford has funded is research by the Hatfield Consultants, 10-80 committee and Committee 33, policy discussions and public education conducted by the U.S.-Vietnam Dialogue Group on Agent Orange and mitigation projects by several U.S. and Vietnamese organizations including the Vietnam Veterans of American Foundation, the East Meets West Foundation, Children of Vietnam and Vietnam Assistance for the Handicapped. Ford has also funded the public education work of the War Legacies Project. For More information go to <http://www.fordfound.org/about/signature/agentorange/issue> .