A Chemical War without End: Agent Orange in Vietnam

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The Vietnam War (1961-1975) is known for the massive bombings of North Vietnam. More insidious, however, yet less well-known to the general public, was the chemical war waged from 1961 to 1971against South Vietnam. An immense environmental disaster and a human catastrophe taking numerous forms: health, economic, socio-cultural …, it had dramatic consequences which are still felt today. The American government and the chemical companies involved have eluded their responsibilities. For years, a conspiracy of silence has obscured the toxicity of the defoliants used. Those responsible have the effrontery to continue denying it today. Humanitarian aid is incommensurate with the needs. It is at the government level that support for Vietnam must be organized and the demand for just reparations must be made.

During the Vietnam War, from 1961 to 1971, American aviation sprayed defoliants over Southern Vietnam to chase from the jungle the combatants taking shelter there, to cut the Ho Chi Minh trail by which weapons, supplies and medication came down from the North, to facilitate surveillance of roads, coastlines and waterways and to destroy the rice paddies, forcing villagers into "strategic hamlets" and thus depriving the guerillas of food and aid[1].
More than 77 million[2] liters of defoliants were released by plane (95%), by helicopter, by boat, by tanker truck, and by men with backpack sprayers. More than 2,500,000 hectares were contaminated by these defoliants, the best known of which is Agent Orange. It contains dioxin, one of the most violent and most indestructible poisons known.
Millions of Vietnamese, soldiers, civilians, men, women, children, were injured by the spreading of Agent Orange/dioxin. Tens of thousands died on the spot. Two to four million survivors, according to the Vietnamese Red Cross, frequently present serious pathologies (cancers, leukemia, diabetes, skin diseases, including chloracne…) Ill or apparently healthy, individuals in contact with Agent Orange often give birth to severely handicapped children. Sometimes it is their grandchildren who are affected, without our understanding yet the mode of transmission.

The Facts

The Devil's Rainbow[3]

Agent Orange is a product which was used in the United States as a weed killer along roads and railway tracks, but in solution ten to twenty times less concentrated than in Vietnam. It is a mixture of equal parts of 2, 4-dichlorophenoxyacetic acid (written as 2,4-D) and 2, 4, 5-trichloro-phenoxyacetic acid (2, 4, 5-T), synthetic growth hormones which cause plants to die.

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[1] Buckingham, W. A. Jr, 1982, *Operation Ranch Hand: the Air Force and Herbicides in Southern Asia 1961-1971*, Office of United States Air Force History, Washington DC.
[2] According to Stellman, J. M., Stellman, S. D., Christian, R., Weber T. et Tomsallo C., 2003, The Extent and Patterns of Usage of Agent Orange and Other Herbicides in Vietnam, Nature, vol. 422, 17 April, p.681 sq. The figures given by these authors seem to be the most reliable, but they vary depending on the source consulted. The figures initially indicated by the Vietnamese authorities were considerably under-estimated.
[3] The Devil's Rainbow, title of the book by Jean R. Williams, Australian activist against the Vietnam War. 2nd edition, 2000, by SCVVAA (Sunshine Coast Vietnam Veterans Association of Australia)

Dioxin[4] is a manufacturing byproduct of 2, 4, 5-T, whose concentration depends on the process used: the faster one wants to go, and the higher the temperatures used, the more dioxin is formed[5]. Its toxicity in laboratory animals, rodents and fish is measured in infinitesimal quantities of the order of a millionth or billionth of a gram per kilo of weight. The lethal dose for man is not clearly defined but is considered to be around 0.1 mg per kilo.

If the name "Agent Orange" has become emblematic, to the point of becoming synonymous with "defoliants", that is because it was the one most widely used (2/3 of the sprayings) but it was not the only one. With it, Agent White, Agent Pink, Agent Green, Agent Blue and Agent Purple constituted what the American Army called the rainbow herbicides.

Agent White was a mixture of 4 parts to 1 of 2, 4-D and Picloram, contaminated by hexachlorobenzene and nitroamines, all known carcinogenic agents.
Agents Pink and Green were 2, 4, 5-T and contained dioxin.
Agent Purple was, like Agent Orange, a mixture of equal parts of 2, 4-D and of 2, 4, 5-T, even more seriously contaminated by dioxin.
All were defoliants and were preferably sprayed over the forests and the mangroves, but also over the countryside and the rice paddies.
Agent Blue contained cacodylic acid, a component of arsenic. It was used for crop poisoning.

The names given to the products came from the colored band painted on the 200 liter drums that contained them. No other mark identified them and instructions given to manufacturers prohibited them from marking "poison" or other customary indications of toxicity. The soldiers handling the herbicides were unaware of their nature and the danger. We will bring this point up again later.

A Long Preparation

As early as the 1940's, the American Army was interested in perfecting new chemical weapons and had discovered, in particular, the herbicidal properties of 2, 4-D and of 2, 4, 5-T. Use in Japan was being considered, but with the dropping of the atomic bomb and the Japanese surrender, this project became pointless. The Monsanto Corporation participated in this project. The ARPA (Advanced Research Project Agency) of the Defense Department, had carried out experiments to determine the ideal proportions of the mixtures and the optimal quantities to be sprayed per surface unit (28 liters per hectare), as well as the means to carry out spraying by planes. It was at the Eglin base in Florida that the Fairchild C 123 planes were modified for this purpose. Agent Orange was used at Gagetown, New Brunswick, Canada[6], in 1956, at Camp Drum, New York, in 1959 and in Southern Vietnam (secretly) in 1959 and 1960. There, the Army's audiovisual service filmed operations for two years and the commentator congratulates himself on the excellent results: 90% of the trees and bushes were destroyed[7].
The Army then set the specifications of 2, 4-D and 2, 4, 5,-T which will later be communicated to the manufacturers of Agent Orange (Monsanto, Dow Chemical, Hercules, Thompson, Diamond and Uniroyal) and included in the contracts.[8]

[4] This is "Seveso" dioxin with the formula 2, 3, 7, 8-tetra-chloro-dienzo-para-dioxin or TCDD. There are numerous other dioxins and chemically similar products, including PCB's but TCDD is the most toxic.
[5] As early as the 1950's, the German firm Boehringer used a process which avoided the formation of dioxin by "cooking" the product at low temperature for 13 hours. The American firms used very high temperatures which allowed reducing the "cooking" time to 20 minutes.(George Smoger, Veterans' Association lawyer in a public declaration on 5 March, 2009).
[6] In 1966, Canada obligingly made its forests available to the United States for full scale testing.
[7] Robin M.-M., 2008, Le monde selon Monsanto, Paris, Editions La Découverte/ARTE Editions, p. 52
[8] United States Court of Appeal for the Second Circuit, Feb. 22, 2008, docket 05-1953-cv.

Operation Ranch Hand

Defoliants were not the only chemical weapons used in Vietnam. There was also napalm, CS gas – a teargas lethal at high pressure in a confined space, used with the *Mighty Mite* blower against persons hiding in underground shelters-, neurotoxic gasses, phosphorous bombs … To this we must add the bombings, occasionally intense, as in the A Luoi valley, Cu Chi or at Ben Tre, the city that "had to be destroyed to be saved". But it is the defoliants which have had the most lasting and the most dramatic consequences: nearly 40 years after the stoppage of spraying, Agent Orange is still killing.
The entirety of the program proposed to the government of the Republic of Vietnam was called "Trail Dust". It was intended, on the one hand, to clear the area around land and river communication routes and, on the other, to destroy Viet Cong (sic) crops. It included spraying herbicides by various means and, from 1967 onwards, anti-malaria spraying on and around American bases for which malathion, now prohibited because of its high toxicity, had been used (Operation Flyswatter).[9]

The part entrusted to aviation was given first the name of "Operation Hades", the name of the god of the underworld, but it was soon considered preferable to use a term that was not quite so transparent. Operation Hades became "Operation Ranch Hand". What could be more normal than a ranch hand using herbicides?
The Fairchild C 123 planes were camouflaged, and had removable identification markings. Those used for crop destruction had South Vietnamese identifiers and one of the crew members was Vietnamese (Operation "Farmgate"). The crew dressed in civilian clothing.

It was in November, 1961, that President Kennedy authorized Operation Trail Dust and its sub-programs. The data provided by J. M. Stellman[10] and her Columbia University colleagues retrace the escalation of this chemical war. From August to December, 1961, testing was carried out in Southern Vietnam (with dinoxol and trinoxol). The first cargos of defoliants arrived in Saigon in January, 1962[11]. Systematic military spraying of herbicides began in September, 1962 (Agent Purple). From 1962 to 1964, Agents Purple, Pink and probably Green were used, a total of around 2,400,000 liters. These releases of defoliants, though still limited, were extremely harmful because of the high TCDD content of the products and the concentration of the spraying over a small surface area.
In 1965, Agent Orange joins the act for some 2 million liters. In 1966, 8 million liters, and 2 million liters of Agent White. 1967 marks the culminating point: 19 million liters in total, including 12 of Agent Orange, 5 of Agent White and 2 of Agent Blue. 1968 is at almost the same level (18 million liters in total) as well as 1969 (17 million liters). In 1970, a significant decrease (4 million liters). The spraying of defoliants stops in 1971, after a final dumping of a million liters.

In total, in spite of the missing data and inconsistencies in delivery slips as well as in the spraying mission reports, Stellman *et al*. estimate[12] that around 50 million liters of Agent

[9] Young A.L. 2009, The History, Use, Disposal and Environmental Fate of Agent Orange, Singer, p. 112 sq. Young considerably minimizes the importance of defoliant spraying, denies their harmful effects and declares that the victims, both Vietnamese and American, confused the spraying of defoliants with anti-mosquito spraying.
[10] Stellman J.M *et al*, o.c.
[11] Id. ibid. According to an agreement concluded in 1962, the herbicides became the property of the Republic of Vietnam upon being unloaded in Saigon, which "does not facilitate the accounts of the US Army".
[12] In addition to the data of the HES, Stellman and her Columbia University colleagues used the « HERBS file » (Herbicide Report System, Data Management Agency, US MACV, 1970) completed by the analysis of pilot mission reports found in the archives. They thus created a computer program, the Geographic Information System (GIS) which allowed specifying the effects of spraying, mission by mission and constitutes a tool for other studies. It is placed at the disposal of researchers without charge under the name of the *Vietnam Herbicide Exposure Assessment System* © (see Environmental Health Perspectives, vol. 111, No. 3, March, 2003).

Orange (Types I and II), 20.5 million liters of Agent White, and 2.4 million liters of Agents Pink, Green and Purple (with a particularly high dioxin content), were sprayed over Southern Vietnam, i.e., the equivalent of 370 kg of pure dioxin. To that, we must add 5 million liters of Agent Blue (arsenic-containing compound). At the beginning of the program, there were 6 C 123 planes, 25 at the end of the program. They carried out 20,000 missions, reaching a figure of 600 per month in 1967-1968 (except during the '68 Têt Offensive). Certain objectives were sprayed as many as ten times.
In 1967, American advisors and South Vietnam authorities had created a data base, the Hamlet Evaluation System (HES), identifying the hamlets[13] concerned and their population. These data, though incomplete, cite 20,500 hamlets and the populations of half of them. At a minimum, there were 2.1 million victims but their number may be as high as 4.8 million.

Outside of Vietnam

The first Ranch Hand missions outside of Vietnam took place in Laos, in December 1965, along the Ho Chi Minh trail and the Sihanouk trail (from Laos to Cambodia), both North and South of the 17th parallel. 210 missions sprayed at least 1.8 million liters of Agent Orange but the data are incomplete. There were also crop destruction missions using Agent Blue.

In Cambodia, the official doctrine was to avoid spraying herbicides, either directly or as a result of the drifting of toxic clouds. Nevertheless, some ten missions sprayed around 160,000 liters of Agent Orange, enough to devastate 5,500 hectares. In May, 1969, Cambodia accused the United States of having sprayed herbicides on several occasions and having defoliated 71,000 hectares, as scientific missions had observed. Nonetheless, the Cambodian evaluation seems exaggerated as it would have required more than half of the Ranch Hand missions in April-May 1969. The controversy cannot be settled, since the region was entirely devastated by B52 bombings[14] in 1970.

The Consequences

That Vietnam was able to survive the war and then to recover in spite of the embargo imposed by the US until 1995 forces admiration. That its economy's recent growth rate of 7% - 9% per year and still 5.5% this year despite the recession – ranking it among the first in the world, gives an impressive image of its development. But Vietnam is still a poor country, indeed, very poor: its GDP *per capita* is 900 dollars per year. Its GDP is equivalent to 3% that of France. The consequences of the war and the enduring impact of the spraying of defoliants over the South of its territory are an enormous burden for it.

Nature Devastated

The Geneva Agreements established, as is known, a demarcation line, the Demilitarized Zone (DMZ) between the North and the South at the 17th parallel, at the thinnest part of the country where the Laotian border is hardly 70 km from the sea.

[13] It is known that in the Vietnamese countryside, the widely dispersed habitat is organized in hamlets. The "village" is not a small town, but essentially an administrative territory constituted of 5 to 15 hamlets.
[14] A US Air Force report, declassified by President Clinton in 2000, reveals that the bombing of rural areas of Cambodia close to the Vietnamese border began in 1965. These bombings were clandestine. 2,700,000 tons of bombs were dropped in the course of 230,000 missions targeting 114,000 objectives. The "Menu" program of 18 March 1969 to 26 May 1970 was an extension of these attacks, with carpet bombings by B52's: the "breakfast" phase having given satisfactory results, the other phases (lunch, snack, dinner, dessert and supper) were authorized by Nixon. (Taylor, O. and Kiernan, B. *Bombs over Cambodia*, The Walrus, October 2006).

From the 17th to the 11th parallel, i.e., approximately over 2/3 of the surface area, extend the Central Highlands (between 500 and 1,000 m in altitude) and mountain ranges oriented N-W / S-E (the Truong Son range -ex- Annam range-, and the Mang and the Bach Ma ranges…) which drop precipitously into the eastern sea as at the famous Hai Van pass, or onto narrow coastal plains. The highest summit is Pu Si Linh (3076 m). The valleys of hundreds of rivers and mountain streams cut through the massifs.

The Dense Tropical Forest

Woody vegetation covers around 60% of Southern Vietnam, i.e., 10.4 million hectares. The major part is constituted of a dense tropical forest (5.8 million hectares) principally on the Central Highlands where tall timber trees protect the lower levels, consisting of trees, bushes, shrubs, creepers, grasses and flowers. More than a million hectares of this forest were destroyed by the repeated spraying of defoliants[15]. We find there an abundant fauna, with elephants, tigers, rhinoceros, including the rare Java rhinoceros, antelopes, gaurs, birds, snakes (pythons), butterflies and a multitude of other insects. The defoliation of large trees devastated this complex ecosystem, their death resulting in that of the rest of the vegetation and the death or flight of animals toward neighboring Laos. Numerous precious and rare forest species have disappeared (*Pseudocarpus macrocarpus, Sindora siamensis, Hopea odorata*…). Bamboo and other plants without great value overran the impoverished land. 100 million m^3 of timber were lost.[16]
The stripped hillsides were invaded by high grasses nicknamed "American grass" as tenacious as quack-grass and like it, capable of regrowing from the fragment of a root. Such grasses smother all other vegetation and prevent natural regrowth (*Pennicetum polystachym*).
Deforestation affected numerous river drainage basins on steep terrain which then become destructive torrents, and vast areas where the soil is no longer maintained in place by vegetation undergo massive erosion due to rain-water run off. Land-slides occur, leaving the laterite bare and cutting off roads. The effects of current climate change, marked by particularly heavy monsoons and rain out of season, are aggravated by the consequences of deforestation to the point of compromising the efficacy of "Live with Floods" plans which previously had saved lives: hamlets are no longer simply flooded by high water but buried under unpredictable mud- and land-slides The local microclimate has been modified and it is even thought that the modification may be of greater scope.

Woodland areas have been reconstituted and continue to be so. But real "reforestation", the recreation of a complete forest as a balanced ecosystem, with all its diversity, is a difficult, long and costly undertaking. After clearing the soil of dead wood, rapid-growth trees, like the acacia, are planted. They are without great interest, but in their shade, after about three or four years, it is possible to plant and see thrive precious young indigenous species, coming from tree nurseries, particularly from Hué, set up with the collaboration of the French Nord-Pas de Calais Region, and which produce tens of thousands of plants per day. Sophisticated management, with accompanying gardening techniques, must control the bushes and shorter plants and promote their growth while avoiding the stifling of young trees. Several millions of hectares of tropical forest have thus successfully been replanted, following the example of the work at the Ma Da Forest Farm. Nevertheless, there is much yet to be done and the available resources are very limited[17].

[15] Westing, A., H. *Herbicides in War: Past and Present*, in Westing, A., H., ed., 1984, *Herbicides in war, the long-term Ecological and Human Consequences*, SIPRI, Taylor & Francis, London and Philadelphia.
[16] Phung Tuu Boi, Tran Quoc Dung, Le Van Cham, 2002, *Effects of Chemical Warfare upon Vietnamese Forest Resources (1961-1971)*, Vietnam-United States Scientific Conference on Human Health and Environmental Effects of Agent Orange/Dioxin, Hanoi, March 3-6 2002.
[17] The Vietnamese authorities must still combat voluntary deforestation due to the smuggling of timber (see the film of Vuong Duc based on the novel by Nguyen Huy Thiep, *Les coupeurs de bois*) or due to a need for agricultural lands.

From the 11th parallel to the point of Ca Mau (close to the 9th parallel) extends a low-altitude (0 to 200 m) region of some 4 million hectares, Vietnam's principle rice production area, irrigated by the Mekong delta. This area is covered by both mangroves and cultures.

Swamp Forests, Mangroves and Melaleuca Forests

The mangrove is a "swamp forest", a forest growing in coastal marshes, in brackish or in salt water. It is formed by diverse species, the most interesting being *Rhizophora*. All species are fragile, and a single spraying of herbicides is sufficient to destroy them. The mangrove area is criss-crossed by canals and arroyos and numerous hamlets are accessible only by pirogue. The mangrove is home to an intense aquatic animal life: palmipeds, turtles, fish and crustaceans. It is a spawning and breeding area for migratory species that come there to reproduce. It protects the low lying coast from erosion by wind, waves, tides and currents. Of the 500,000 hectares of mangroves, 150,000 were destroyed by the spraying of herbicides. Fortunately, the mangrove regenerates itself more quickly than the dense forest. The inhabitants have taken their fate in hand and, on the whole, the mangrove has been recreated. Animal and plant species have reappeared and are thriving. Crocodiles prosper. A promising sign: cranes have returned to the Plain of Reeds. Several large natural reserves such as Can Gio are becoming tourist destinations.
The Melaleuca[18] forests are semi-flooded forests found only in the Mekong Delta. They cover 250,000 hectares in the floodable regions. 120,000 were destroyed but, here again, the population has set about replanting Melaleucas, the only trees able to grow in the acid soil.
Thus, after more than twenty years of difficult and dangerous work in the empoisoned marshes, the Vietnamese have succeeded in eliminating some of the consequences of the American war[19].

Cultivated Land

During the war, 236.000 hectares of agricultural land were destroyed by the spraying of chemical products in Southern Viet Nam, as well as 8,000 hectares in Laos. These sprayings resulted in the immediate destruction of 300,000 tons of food, often leaving the population without sufficient nourishment. In addition, around 30% of the rubber tree plantations were destroyed[20]. The eroded soil lost its nutriments, and, less fertile, required using fertilizers harmful to the fish and crustaceans that normally live in the rice paddies and constitute a by no means negligible part of the peasants' food resources. Progressive recultivation was complicated by the presence of unexploded munitions, bombs and anti-personnel mines, that injured – and are still maiming – numerous victims.[21].

Hot Spots

Over 40 years, the soil has been sufficiently washed by rain so that today the greater part is free of dioxin. Non soluble in water, it has contaminated mud and plankton.
It remains, however, dangerously present in certain "hot spots". It is thus that are named the former American bases where pollution by dioxin remains intense not only because of

[18] The Melaleuca is known in French as *arbre à thé* (Tea Tree) even though it does not bear tea leaves. It is used in Vietnam for its wood and in the traditional pharmacopoeia, in particular as a fungicide, exclusively for external use!
[19] Westing, A.H., Vo Quy, Phaung Tuu Boi, Bui Thi Lang, Dwernychuk, L. W. *Long-term Consequences of the Vietnam War, Ecosystems.* Report to the Environmental Conference on Cambodia, Laos, Vietnam, Stockholm, July 2002.
[20] Westing, A., H., 1984, o.c
[21] BOMICEN and VVAF, 2009, Report on Vietnam unexploded ordnance and landmine impact assessment and rapid technical response in six provinces of Nghe An, Ha Tinh, Quang Binh, Quang Tri, Thua Tien Hue and Quang Ngai, Hanoi.

deliberate spraying to clear the area around the bases, but above all because of the numerous leaks which occurred in the storage tanks and the rusty drums abandoned on site. The best known are the airports of Bien Hoa, near Ho Chi Minh-City, Phu Cat and Da Nang. To these must be added the A Luoi valley where the American bases could not be maintained but which was ravaged both by bombings and by defoliant spraying, as well as some twenty other sites[22].
Studies conducted by Lê Cao Dai[23] and by Hatfield Consultants[24] brought to light, at the end of the 1990's, dioxin levels 300 to 400 times higher than normal. A recent study in the city of Da Nang shows that such levels persist[25].

The Human Tragedy

The Health Catastrophe

Poisoning by dioxin has two types of dramatic consequences: serious illnesses and reproduction abnormalities, including birth defects. Descriptions cannot convey the frightening spectacle of the invalids with twisted limbs, shaken by convulsive movements, some of them reduced to a vegetative life, bedridden from their early age and who, however, continue to live – if this can be called living[26]. The children shown to visitors in the Van Canh "Friendship Village"[27] are, dare we say, the privileged: something can be done for them. But nothing can convey the distress of the families in the outlying hamlets of the Central Highlands.

Dioxin enters the body by respiratory route and, in the event of direct spraying, by cutaneous and digestive route. It is stored in adipose tissue as well as in milk. There are, therefore, two types of victims: those who were sprayed or who handled the defoliants and those who were contaminated by polluted food. Dwernychuk has described the food chain involved, from sediments and microscopic animals to fish and to duck and from there to those who consume them.[28]. Infants are contaminated by mother's milk if the mother has been affected, which is why the mean rates of dioxin, in Vietnam, are, all other things being equal, lower in women than in men: women eliminate it when nursing.

Epidemiological studies[29] have brought to light the relation between direct exposure or the presence of dioxin in the blood[30] and cutaneous, digestive, nervous, cardio-vascular and blood

[22] In 2005, the New Zealand government confirmed that a New Zealand firm, Ivon Watkins Dow, had supplied Agent Orange components to the United States Armed Forces during the war. The production purchased by the American military was shipped by boat to the Subic Bay base in the Philippines, which remains severely contaminated.
[23] Le Cao Dai, 2000, Agent Orange in the Vietnam War. History and Consequences, Vietnam Red Cross Society, Hanoi.
[24] See Dwernychuk, L. W., Cau, H.D., Hatfield, C. T., Boivin, T. G., Hung, T. M., Dung, P. T., Thai, N. D., 2002. *Dioxin Reservoirs in Southern Vietnam – A Legacy of Agent Orange,* Chemosphere 457, 117-137.
[25] Hatfield Consultants, November 2009, *Comprehensive Assessment of Dioxin Contamination in Da Nang Airport, Viet Nam: Environmental Levels, Human Exposure and Options for Mitigating Impacts* available at www.agentorangerecord.com/agent_orange_resources/studies_conference_reports/
[26] The photographs, at times almost unbearable, testify to this. See the admirable work of Philip Jones Griffiths, 2003, *Agent Orange, "Collateral Damage" in Vietnam*, London, Trollley Ltd.
[27] Care center for Agent Orange orphans, near Hanoi. This "village" was founded on the initiative of G. Mizo, recently deceased, former GI and is supported by several Veterans' Association of various countries, including ARAC in France.
[28] AAFV, 2006, *L'Agent Orange et la dioxine au Vietnam 35 ans après*, Actes de la Conférence de Paris, Sénat, 11-12mars 2005, CD rom.
[29] These studies are too numerous to be cited here. See the bibliography provided by Jean Meynard, in AAFV, 2005, L'agent orange au Vietnam, crime d'hier, tragédie d'aujourd'hui, p. 62-63 and the papers on this subject (with bibliographies) during the Conférence de Paris, Sénat, 11-12 mars 2005, o.c.:
- Constable, J. *The Early Years of Vietnamese and American Agent Orange Health Research : 1965 – 1983*
- Dwernychuk, L. W.et al., *.Agent Orange/Dioxin hot spots - A legacy of US military bases in Southern Vietnam*

ailments, immune system, endocrine and metabolic disorders, cancers (of the liver, lungs, prostate …) lymphomas and diabetes in particular.
In the offspring of Agent Orange victims, we find an excessive number of miscarriages, still-births, premature births, molar pregnancies (degeneration of the placenta leading to the formation of a formless mass of flesh) and birth defects, including monstrous deformities: hare-lips, missing or atrophied limbs, *spina bifida*, anencephalia, microcephalia, hydrocephalia, blindness, deafness, muteness, mental retardation, idiocy, attention and memory disorders, etc. Sometimes also, neonates initially appear in good health but serious disorders set in subsequently, little by little, leading to early death or to a state of being permanently bedridden. Prenatal ultrasonography is unable to detect these cases.

We are now observing that disabilities and serious malformations are affecting children of the third generation, even if their parents are apparently in good health. Parents who have had a normal child can then have another who is affected, and conversely, a handicapped child may be followed by one in perfect health. Some scientists fear that dioxin may have an action on genes but for the moment, no irrefutable direct proof has been provided.

The number of victims currently alive is not known with accuracy. In April, 2009, the Vietnamese government decided to carry out a general census and for which the Ministry of Health was given the task of setting the criteria defining a "victim." To date, two criteria have been retained: having been exposed to herbicides used by the Americans during the war and presenting one of the illnesses or reproduction disorders listed[31], which is highly restrictive. In fact, three categories of victims should be considered:
- individuals (soldiers or civilians, men, women or children) present in the zones where defoliants were sprayed
- their children (including some now adults) and grand-children
-migrants to the areas of defoliant spraying, in particular for economic reasons, as well as their children and grand-children contaminated by the environment[32].
On the other hand, inhabitants of areas where defoliants were sprayed have emigrated toward other regions. Combatants coming from the North returned there after the peace. Families separated by the DMZ have since come back together, whether in the North or in the South. There are, therefore, victims all over Vietnam and it is not reasonable to limit the survey only to Southern Vietnam.

To the millions of Vietnamese victims, must be added the American veterans and their Canadian, South Korean, New Zealand and Australian allies who handled defoliants without knowing at all that they were dangerous. Herbicides were delivered separately and mixtures were made on site before being loaded, without precaution and without protection, into airplane tanks. Military bases and their surroundings were regularly sprayed with defoliants to eliminate bush growth propitious for ambushes. Soldiers stored rain water for drinking or washing in empty drums[33] and prepared barbecues in them. The Veterans have experienced the same pathologies as the Vietnamese and their children have also been affected.

- Schecter, A., *Agent Orange in Vietnam : A Summary of Dioxin Findings from Vietnam - US Research from 1970-2005*, and two other articles.

[30]Detecting the presence of dioxin in the body requires delicate analyses and only a few laboratories in the world have the capacity. These analyses are very costly (around 1000 dollars each.)

[31] Meynard, J. , *L'Agent orange au Viet-Nam, dégâts et questions soulevées*, in AAFV, 2005, *L'Agent orange au Viet-Nam, crime d'hier, tragédie d'aujourd'hui* , Paris, Tirésias

[32] Gendreau, F., Hénaff, N., Martin, J.-Y., 2006, *Les conséquences démographiques et économiques des épandages d'Agent orange*, *in* AAFV, Conférence internationale, o.c. The authors conducted the first post-war scientific study of internal migrations in Vietnam. They indicate in particular that economic factors have resulted in migrations toward areas that are highly contaminated.

[33] These contaminated drums, transferred to local merchants, caused serious accidents, particularly in Da Nang. US Military Assistance Command Vietnam, *Vietnam Lessons Learned No. 74: Accidental Herbicide Damage* (MACV, APO San Francisco, 15 September 1969).

Under the pressure of Veterans' associations, the American government, which had denied any long term effects of defoliants, has ordered studies and the National Academy of Sciences, beginning in 1994, began drawing up a list of illnesses related to Agent Orange, a list which keeps getting longer. At present, there are seventeen.

The Economic Impact

Destruction of forests, erosion and sterilization of a part of the soil, the disappearance of animal and plant species, are so many hindrances to the country's development. Restoration costs (cleaning, planting …) weigh heavily. Rice[34] or shrimp exports were threatened at a certain time from fear of contamination. But the principal burden is health and aid costs to the most helpless. Hospital equipment is insufficient. Care and prosthetic equipments are needed, adapted equipment is lacking. The country's labor force is diminished. Peasants in the areas devastated have sunk into persistent poverty.
In family structures, the presence of a handicapped person results not only in a lack of earnings, but also in a hindrance to the activities of the others. Early death leaves a great number of widows in charge of children who are at times handicapped, who need assistance which remains inadequate.
Finally, the studies and surveys on the consequences of herbicide sprayings absorb considerable sums[35].

The Social and Cultural Effects

The dense forest of the Central Highlands sheltered semi-nomadic populations of hunters-gatherers. They lived *in* the forest, they lived *on* the forest, which protected them and provided them with food. They have lost their mode of subsistence and have had to adapt, with limited material means, to agricultural techniques which were foreign to them. Their uncultivated territories have been overrun by immigrants coming from the delta in search of land. When the Nature with which they were in close contact, (relation designated at times as animism), was destroyed, they lost their culture as well as the mental equilibrium their living environment provided. "When the Great Banyan died, the Spirit left. No one protects us. We have been abandoned". These words of an elderly woman summarize the moral and psychological drama of those whose spiritual universe collapsed with the forest[36].
The families of victims, wherever they are, are sometimes confronted with a marked isolation, if not hostility. In spite of the efforts made by the authorities to make clear the chemical origin of the disabilities, the conviction that it is for a past fault, possibly in another life or that was committed by an ancestor, has not entirely disappeared. The victims are, therefore, often reproached. And even those who do not accept such explanations are wary: who would want his son or daughter to marry someone who might give him/her handicapped children? The uncertainty as to how these abnormalities are transmitted makes them a permanent threat.
The life stories collected by the CGFED[37] from families affected reveal the pain, incomprehension, the weight of interminable care, the blocked future, and the anxiety about the future of a handicapped child when his parents will be there no longer. This is, moreover, one of the reasons driving them to have other children, in the hopes that a healthy child will take care of the infirm. These stories also show the courage and the dignity of the Vietnamese,

[34] As dioxin is not soluble in water, plants cannot be contaminated except by direct application of the toxic product. (A. Schecter). Today, consequently, fruits and vegetables may be consumed without risk.
[35] Gendreau, F.*et al*, o..c.
[36] Maître, J. et Doray, B. Le vécu des familles victimes de l'Agent orange, in AAFV, 2005, L'Agent orange au Viet-nam, o, c. ; Maître, J. Conséquences socioculturelles des épandages de défoliants, in AAFV 2006, Actes de la Conférence internationale, o.c.
[37] Centre de recherches sur le Genre, la Famille et l'Environnement en Développement, 2004, trad. franç. 2005, *Histoires de victimes de l'Agent orange au Vietnam*, Hanoi, The Gioi.

the affection and tenderness with which the children are surrounded and the energy that the latter show, in so far as possible, in hanging on, in spite of everything.

Inaccessible Care

The Vietnamese government provides modest but useful financial assistance to veterans and their children. It does not extend to grand-children or to civil victims. For a certain time, this assistance has been entrusted to the provinces which provide it according to their means: some are wealthy, others poor, and this has repercussions on the financial aid. The Vietnamese Red Cross[38], present everywhere, also contributes to this assistance, as do Vietnamese foundations like the Fund for Children presided over by Madame Nguyen Thi Binh[39], which supports small day-hospitals in the countryside.
The care that could transform the life of the handicapped is inaccessible. There are numerous cases of those born with the feet or hands oriented backwards or with hare-lips. Simple surgical operations which Vietnamese surgeons fully master could correct these handicaps. But funds are lacking. Appropriate training could offer economic independence. But funds are lacking. The blind, the deaf could participate in rehabilitation programs. But funds are lacking. Prostheses, wheelchairs, appropriate equipment could restore mobility. And what can be said of the more complicated cardiac or bone surgery operations, and of costly treatments? Funds are lacking.

The Refusal of Reparations

There is a principle which says "He who causes wrongs must repair them." The American government and the firms that produced the defoliants have not taken responsibility. All the same, their responsibility is undeniable. To date, however, they have succeeded in avoiding it. Vietnam has not received, and is not receiving, any aid from them. How is this possible?

1984

American veterans, poisoned and suffering from cancers, were the first to react. As law prohibited them from filing suit against the Army or against the government, they brought, in 1978, a Class Action [40] suit against the firms producing the defoliants to obtain compensation. American legal tradition allowed them to hope for success: indeed, smokers with lung cancer had obtained and continue to obtain indemnification from cigarette manufacturers. The industrial accident at Seveso in 1976 had attracted attention to dioxin. But Monsanto organized its defense and contested that dioxin was carcinogenic. Three scientific reports, supervised by Dr. G. Roush, Medical Director at Monsanto, were published in 1980, 1983 and 1984 in authoritative scientific journals. All concluded in the safety of the product[41]. The plaintiffs and their lawyers were afraid of losing and in 1984 they accepted an out-of-court settlement: 180 million dollars paid into an indemnification fund against withdrawal of the suit and a commitment to not file another. The plaintiffs were doubly duped: the amount seemed high, but after deduction of lawyers' fees and distribution between 40,000 people, the sum becomes derisory. Compensation ran from 256 to 12,800 dollars, with an average of

[38] The Vietnamese Red Cross is a complete social service that takes care of questions of housing, community services, education and professional training, aid to the destitute, as well as health issues. It has 5,000,000 members, most volunteers, active into the outermost hamlets.
[39] Former Vice-President of the Republic. As Minister of Foreign Affairs of the PRG, Madame Binh was a signatory of the Paris Peace Agreements in 1973.
[40] In a class action, the decision concerning a small number of cases is automatically applicable to all persons falling into the same category as the actual plaintiffs.
[41] Marie-Monique Robin, 2005, o.c. pp 56-58 et note 24 p. 350

4,000 dollars. But above all, as the Kemmer vs. Monsanto case demonstrated in 1989, the research results had been falsified[42].

Thus, the trial did not take place.

Once the suit had been dropped, the role of Judge Weinstein was limited to setting the respective contributions of the various firms to the compensation fund: 45% for Monsanto, the main producer. The firms thus purchased, at a minimal cost, not being convicted or not getting regrettable publicity, all the more precious in that their reputation was under threat from other scandals[43].

The Long Silence of the Vietnamese

For more than twenty years after the end of herbicide spraying, the Vietnamese did not speak publicly about Agent Orange. It is true that the extent of the health disaster only became known little by little. Nevertheless, this attitude can be surprising. It was attributed to their desire to have the embargo lifted, to normalize relations with the United States and to be admitted into the WTO, all of which certainly played a role. It's true that economic recovery required that exports have a good reputation. Other reasons can also be considered. Victorious Vietnam doubtlessly did not wish to be known as "the country of Agent Orange", a nation of millions of lame and infirm. It could have been tempted to count on its own forces, overestimating them. The subsequent occurrence of cancers and other serious pathologies, the appearance of terrible malformations in the third generation, led it to review its position, as did the more and more pressing appeals for aid coming from the populations that had been victims of herbicide sprayings.
The visit of President Clinton in November 2000 marks a turning point: the question of Agent Orange was brought up with him. But how can reparations be obtained? The authority of international courts is applicable only to nations that accept it. The United States refuses. The only possibility for the Vietnamese was to do as the Veterans had done and to file suit against the chemical firms[44].

The Trial

In 2003, the decision was made to sue the 37 firms which produced the defoliants. To do so, the Vietnamese created an Agent Orange Victims Association, the VAVA, which filed civil suit at the same time as 3, then 28 individual victims. On 30 January 2004, a class action suit was filed against the firms with the free support of two legal firms Constantine P. Kokkoris and Jonathan Moore.

According to American law, to plead before an American court, the Vietnamese must claim Alien Tort Status (ATS) which allows a foreigner to sue for damages in the event of a wrong committed against him/her by an American outside of the United States.
In other words, a first judgment authorizing them to sue the chemical firms is required. They were, in the first instance, refused this right on 10 March 2005. The reason: the use of herbicides is not illegal. They appealed on 18 June 2007 and the Appellate Court confirmed the first verdict: ATS was not applicable. The firms were acting on the order of the

[42] Id., ibid., p 62
[43] In particular, the Times Beach scandal. This town was so seriously contaminated after the use on its streets of road surfacing containing industrial sludge from a Monsanto plant that on 22 February 1983, the American government purchased the entire town and wiped it off the map. Id. ibid., p.42 sq.
[44] On this complex issue, see the analyses of Monique Chemillier-Gendreau, 2005, Justice et réparations, *in* AAFV, L'agent orange au Vietnam, o.c.et 2006, Le droit applicable aux déversements d'agent orange et les responsabilités civile et pénales, in AAFV, *L'Agent Orange et la dioxine au Vietnam 35 ans après, o.c.*

government and are thus protected from being sued. Agent Orange was used only to protect American soldiers (22 February 2008). A request was then submitted to the Supreme Court of the United States on 26 October 2008. Its purpose was to obtain the cancellation of the Appellate Court verdict (which would have led to starting up the process again from scratch). This request was quickly rejected without comment on 27 February 2009.
Thus, in spite of the numerous demonstrations of support which took place during the five years, both in the United States and in the rest of the world, the first trial was lost. The Vietnamese cannot[45] sue the firms.

The Agent Orange trial will not take place.

Should the affair have been pursued? Indisputably, yes. It was the only thing possible and it had to be tried.
It did, at the least, put the question of Agent Orange out in public and it made millions of people in the world aware of it. Beyond the case of Vietnam, the issue of chemical warfare was brought to public attention.

American veterans who had not been involved in the settlement of 1984 had filed suit, like the Vietnamese victims. Their case was dismissed in the same way, by the same court, the same day. At present, they are attempting action through their representatives. Their government grants them, stingily, indispensable medical aid and care free of charge, in the absence of a French type social security system of medical coverage: 100,000 files are awaiting settlement. The Veterans have denounced the failures and illicit actions of the governmental agency in charge of their case, the Veterans Agency, the regrettably famous "VA" which they accuse of waiting for them to die so that the question can be settled.[46]
The Veterans have invoked the Vietnam War and its consequences to support their opposition against the war in Iraq, alongside Iraq war veterans.

Questions Remain

Holding a trial against the defoliant manufacturing firms would have allowed raising the crucial questions and perhaps answering them:

- Were the health consequences of the spraying of defoliants known when they were ordered?
- What are the current scientific proofs of their pathogenic character?

Who knew?

As far as the chemical companies are concerned, the answer is without ambiguity: they knew, but had agreed with each other to conceal the truth. The evidence has come to light little by little and the inquiry of Marie-Monique Robin concerning Monsanto leaves no room for doubt.[47] Similarly, Dow Chemical concealed the results of the research of in-house scientists[48].
In 1965, the first sprayings of Agent Orange strictly speaking began. We have seen as indicated earlier that its dioxin content was enormous, because of the haste with which 2, 4, 5-

[45] The Justice Department had intervened publicly to enjoin the court to reject the Vietnamese request since accepting it would have allowed all former enemies of the United States to file complaints concerning the way in which war was waged upon them. See the decision text at:
http://www.warlegacies.org/Agent%20Orange/USGovStatement.pdf, p.16 sq.
[46] See Wilcox F. A. 1999, Waiting for an Army to Die : the Tragedy of Agent Orange, Seven Locks Press, Santa Ana, CA, USA
[47] Robin M-M, 2008, o.c, chapters 2 and 3.
[48] Doyle J. 2004, Trespass against Us: Dow Chemical and the Toxic Century, Common Courage Press, Monroe, Maine, USA, ©Environmental Health Fund, ch.3 and 4.

T was manufactured, but there was no question of losing such a large deal: through a secret agreement, the firms decide not to disclose the information "which might be misinterpreted or which might be used inappropriately"[49]. The results of subsequent research were falsified or dissimulated, at times with complicity within governmental agencies.

The question is not so clear for the American government: everything depends on the date. When Kennedy authorized the spraying of defoliants in 1961, he specified that they must be without danger to human health. In 1965, the firms' secret was apparently still well-guarded. In any event, neither American soldiers nor their superiors knew anything. In 1965, Admiral Zumwalt, who commanded the American fleet in Vietnam, requested herbicide spraying to protect the squadron of his son, then patrolling in the delta, from ambushes. In 1969, doubt is no longer permitted; however, herbicide sprayings continue for two years more.
Admiral Zumwalt's son died of cancer after having conceived a little handicapped boy. The Admiral then took the lead of protests against the spraying of herbicides and the secret surrounding their nature. In 1990, he drafted a voluminous, well documented report and sent it to the authorities. This report was classified "secret" and was not disclosed until recently.[50]
The protests of scientists as early as 1965, first in the United States and subsequently in the international scientific community, the Russell Tribunal, constituted in 1966, have not been heard. It is difficult to believe that they haven't raised any questions among American political leaders.

What does science say?

After the end of the war, the amount of research increases[51], including the Ranch Hand study in the United States, launched in 1980 and which is still in progress. In Vietnam, Lê Cao Dai is working in relation with Arnold Schecter, of the University of Texas, who also participated in the Ranch Hand Study. In Canada, in New Zealand works have been published (see note 28). The pathogenic and teratogenic effects of dioxin are increasingly probable. Many scientists today consider them as indisputable.
Why isn't one more affirmative? This is due to the method used in research, the only one possible[52]: it is epidemiological research which brings to light the relation between exposure to dioxin and a given pathology. Now two variables, A and B, can be correlated for three reasons: either A influences B, either B influences A, or they are without direct relation but are both influenced by a third term. For example, all phenomena that increase with time are correlated with each other. That is why statistics manuals teach that bringing to light a correlation is not sufficient to establish causality. It is necessary to examine the likelihood of the three cases in question. Do cancers influence exposure to dioxin? No. Can we find a third factor which would influence both exposure to dioxin and the appearance of cancers? No. It can therefore be affirmed, beyond all reasonable doubt[53], that exposure to dioxin causes cancer. But those who stubbornly deny the consequences of dioxin, by repeating *ad nauseam*, says W. Dwernychuk – that "correlation is not causality" are not reasonable people.

The Denial

The chemical firms persist, shamelessly, in a total denial.
In 2004, in an interview in Cropwatch, Jill Montgomery, spokes-person for Monsanto, stated "We are sympathetic with people who believe they have been injured and understand their

[49] V.K. Rowe, letter to Ross Milholland, 24 June 1965 (Dow Chemical archives)
[50] Admiral E.R. Zumwalt, Jr, 1990, Report to Secretary of the Department of Veterans Affairs on the Association between Adverse Hhealth Effects and Exposure to Agent Orange.
[51] Some research is kept secret. There is also falsified research payed for by the firms.
[52] The results of experimental studies on animals meet objections if they are extended to humans.
[53] Beyond all reasonable doubt only: formally, the existence of a third factor, so well hidden that it passed unnoticed, cannot be excluded. Examples of this type of blunder enliven courses in statistics.

concern to find the cause, but reliable scientific evidence indicates that Agent Orange is not the cause of serious long-term health effects."[54]
Bob Pierce, another spokes-person, responded to the Thanh Nien Daily on 8 August 2009t[55] that decades of health research "have not brought to light conclusively the existence of a link of cause and effect between the sprayings and the illnesses considered."

The American authorities are somewhat more subtle but insist on the fact that there are only correlations available. Former American ambassador to Vietnam, Michael Marine, explained that the payments made to American veterans were done so on the benefit of the doubt and that there weren't any Agent Orange victims in the United States but only soldiers who had served their country well and who needed help. Another former ambassador, M. W. Michalak, congratulating the work of the Dialog Group, urged it to ground itself on serious scientific studies. The United States considers that no internationally recognized scientific study establishes a link between Agent Orange and birth defects.[56]

Little by Little

The Dialog Group, created four years ago, brings together American and Vietnamese specialists to study the consequences of the spraying of herbicides. It publishes an annual report. Last year it set up a working group on environmental damage and this year[57] one on health.
The United States has released 6 million dollars for the decontamination of the former Da Nang base, one of the "hot spots".[58] From 1989 to 2007, the United States gave 43 million dollars in aid for the handicapped.[59]
On 4 June 2009, a 5-member Vietnamese delegation was received by the House of Representatives and pleaded for increased aid to Agent Orange victims. They were met by an open welcome and signs of sympathy, but Eni Faleomavaega, President of the Asia Pacific sub-committee, encouraged the Vietnamese to be patient: "their case is a difficult one."

Conclusion

It is time for those responsible for the spraying of defoliants and their dramatic consequences for Vietnam to assume the consequences. Chemical firms obtained immense profits from the sale of defoliants to the American Army. The United States is a wealthy nation. Both must repair the wrong that has been done.

The damage caused to nature is obvious, indisputable: the United States wanted to destroy the forest. It succeeded. It wanted to destroy the crops and poison the rice paddies. It succeeded. Providing the means to repair the damages does not require further studies

Even admitting that certain points concerning health must be further specified, a sufficient amount of knowledge has already been obtained to justify compensation for the wrongs suffered by millions of individuals and by the Vietnamese nation. True, scientific research is still necessary, in particular to bring to light the mechanism of action of dioxin on the human

[54] http://www.corpwatch.org/article.php?id=11638
[55] Reply to Jon Dillighan and An Dien, Thanh Nien Daily (The Youth Journal, Ho Chi Minh-City)
[56] AFP press release, 10 September 2009
[57] All date references indicated in this paragraph are in relation to the year of initial publication of this paper in French, i.e. 2009.
[58] According to Vietnamese estimates, ten times more would be required. By way of comparison, the American Government obtained from the firm Hercules, one of the manufacturers of Agent Orange, 120 million dollars to decontaminate the site of one of its former plants that had been abandoned without cleaning.
[59] Nevertheless, all funds have been used by American civil servants and their contractors. Nothing has reached Vietnam or the Vietnamese. (M. F. Martin, Vietnamese Victims of Agent Orange and US-Vietnam Relations, Congressional Research Service Report, May 28, 2009., p.8)

body, the only way to surmount the "inadequacy" of correlational proof. This research has begun. It requires urgent financing. This research alone will tell us if the genetic heritage in Vietnam, and therefore of all humanity, has been affected. This research alone will allow understanding how it is that third generation victims are still coming into the world. This research alone will allow putting an end to the anxiety of young couples who fear that in loving each other, they will give birth to monsters.

The Vietnamese are doing all that is possible to help the victims. For twenty years, the Red Cross and, more recently the VAVA, have participated, particularly by organizing events whose profits are devoted to the victims. But this is not enough.
Foundations, humanitarian associations of numerous countries, including from the United States, are doing their best to help Vietnam heal its wounds, but their resources are incommensurate with the needs.

It is at the governmental level, and first at the level of the United States government, that the question of support for Vietnam must be raised and that the demand for just reparations must be made.