

AN EVALUATION OF THE CHEMICAL POLLUTION IN VIETNAM

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INTRODUCTION

During the last several months, newspapers in Vietnam have repeatedly presented information relating to an on-going chemical pollution and its adverse impacts on the health and welfare of the Vietnamese across the country from Lang Son to Ca Mau. The frequent news appeared on the newspapers included contaminations due to untreated wastewater from industrial areas, smuggling of pesticides and herbicides across the Chinese-Vietnamese border, the use of pesticides and herbicides and their impacts in rural areas, and food and/or water poisoning that causes many people to die or to be hospitalized.

Neither the Vietnamese authorities nor the international media appeared to pay much attention on the news, probably because they have been shadowed by information relating to another chemical. That information was the news and reports on pollution from Dioxin, which has been considered as the most toxic chemical on earth. Dioxin was found in defoliants (normally referred to as Toxic Agent Orange in Vietnam) used during the Vietnam War from August 1961 to January 1971. The Dioxin pollution in Vietnam has become popular worldwide after a report written by Dr. Arnold J. Schecter and his associates from University of Texas-Houston School of Public Health was published in the *Journal of Occupational and Environmental Medicine* in May 2000. According to this report "soil samples from the air base at Bien Hoa had dioxin levels as high as 1.6 parts per million, the highest soil level ever measured in Vietnam" (1). Since the results from Dr. Schecter's investigation became available in 1999, Dioxin has been considered by Vietnamese authorities and government-controlled media as the culprit for any on-going problems in Vietnam, even though laboratory analyses and/or clinical studies have not been conducted or completed. These problems vary from environmental pollutions to

birth defects and unknown illnesses (2,3). The Vietnamese government has claimed that "millions of people of Vietnam were exposed" to Dioxin and that many problems such as "... parentally transmitted diseases; reproductive disorders including birth defects, spontaneous abortion, trophoblastic diseases; cancers; and disturbances of the central and peripheral nervous system" have been "...preliminarily explained more accurately and persuasively..." (4). With the help of a few international experts and media, the news on the Dioxin pollution in Vietnam has spread all over the world (5,6,7).



Defoliation along a waterway in Vietnam (35)

The chemical pollution has been an issue and will certainly remain a major issue in Vietnam, at least, in the near future. Through the news and information from the newspaper and television, an average Vietnamese can recognize that the chemical pollution in Vietnam has become worse. This is one of the issues that should be properly solved in a timely manner based on scientific, fair, careful, and thorough studies and investigations. The issue of chemical pollution should be given a very high priority because it is a consequence and a deciding factor of the national development. With limited resources available, measures dealing with the chemical pollution should be carefully selected to optimize their efficiency. To that

end, this paper was prepared to evaluate current conditions of the chemical pollution from Dioxin and other chemicals being used in Vietnam. The evaluation, which was based on data and information available to the author, presents the potential impacts of the chemicals on human health in general, discusses results from previous studies and investigations, and proposes several initial tasks that could be implemented to effectively and efficiently solve the existing chemical pollution problems in Vietnam.

DIOXIN:

A FAMOUS AND CONTROVERSIAL PHANTOM

Dioxin (2,3,7,8-tetrachlorodibenzo-para-dioxin or 2,3,7,8-TCDD) is an undesirable by-product in the manufacture of 2,4,5-trichlorophenoxy acetic acid or 2,4,5-T, a common herbicide used in agriculture worldwide since 1940's, especially in the United States. The myth of Dioxin, however, has only started after defoliants were used in Vietnam in 1960's (8). The myth became more famous and controversial when Dioxin was suspected to cause some health problems for American veterans served in Vietnam. Up to date, the Dioxin controversy is still intense and, at one moment, violent. That was Mr. Poletti's assassination by the Red Brigades in 1980. Mr. Poletti was the production director at the ICMESA when an accident polluted Seveso, Italy and its adjacent communities with Dioxin in 1976 (9). The most famous event was the publication of *Dying from Dioxin: A Citizen's Guide to Reclaiming Our Health and Rebuilding Democracy*. In the book, which was written by an organizer of the Love Canal Homeowners' Association and the "mother of Superfund" in 1995, Dioxin is described as an "evil" that is present everywhere and produced in worrisome amounts by any human activities. "The dioxin story is the story of how science has failed to provide us with answers, how corporations control policymaking and decisions in our society, and how government is silenced. The dioxin includes cover-ups, lies, and deception; data manipulation by corporations and government as well as fraudulent claims and faked studies. For the public, it's a story of pain, suffering, anger, betrayal, and rage, of birth defects, cancer, and many other health problems. It's a story of money and power; of how corporations influence government actions and how this collusion affects public" (10). The author of the book warns that "...environmental exposures have left us 'full' or 'almost full' of dioxin...

Only a few more breaths of urban air and, pow, I may explode!" (11).



Chloracne caused by Dioxin at high levels (35)

Relating to the use of the defoliants in Vietnam, titles of numerous articles and reports on the newspapers and magazines published inside and outside of Vietnam could make readers trembling with fear. The readers could be scared to death after reading the articles or reports. "So the legacy of the use of Agent Orange is more profound than just the damage to the ecosystem. And it is one that has had consequences far beyond the forests of South-East Asia. Indeed, it has followed the American personnel home. Despite much conjecture from chemical companies, an independent scientific review has concluded that there is a significant link between exposure to Agent Orange and serious illness including various cancers, serious skin disorders (chloracne) and liver disorders. But while these cases have received great attention, it should be remembered that rarely did Americans serve in Vietnam for more than a year. For those whose homes were repeatedly dosed with poison, there was no escape. And some estimates now put the figure of children born in Vietnam with dioxin related deformities since the 1960s as up to 500,000. Perhaps the most gruesome legacy of the contaminated herbicide, though, is to be found in a locked room in Tu Du Obstetrical and Gynecological Hospital in Saigon. Here the walls are lined with shelves filled with jars of formalin, containing aborted and full-term fetuses. They are just a sample of the horror that emerged from Vietnam and the hospital has for a long time now been unable to afford the bottles and formalin to preserve more specimens. They

feature double and triple conjoined bodies, faces covered in cancerous growths and other terrible deformities” (12).

The phantom blew out cheeks and rolled eyes to scare international readers in “Birth Defects Plague Vietnamese: Scientists Cite Toxic Herbicide” (13). The article written by staff reporter of the Wall Street Journal states: “It [Agent Orange] saturated areas where the Vietnamese populace, unlike transient American soldiers, lived for years [?]. Agent Orange contained dioxin, a chemical whose risks have been a matter of heated debate but one that many toxicologists now considered among the most hazardous of industrial substances. Vietnamese scientists believe that as many as 500,000 children may have been born with dioxin-related deformities since the mid-1960s. Back in 1972, then-Lt. Col. Tu was a member of North Vietnam’s general staff based in the Demilitarized Zone [DMZ], that misnamed corridor of killing that was supposed to separate North and South Vietnam. After his side captured the DMZ city of Quang Tri, he was ordered south to prepare for the liberation of Hue, a U.S. stronghold [?]. Unknowingly, Mr. Tu and his men slogged through one of the most contaminated war zone in history [?].... As Mr. Tu and his group picked their way south, they ate, drank and breathed the toxin [?].”

When results from the investigations by Hatfield Consultants Ltd of West Vancouver, Canada were released in October 1998 (14) and April 2000 (15), “hot” news flew out of Hanoi through international wire services. At the beginning of “Questions in a village: Did Agent Orange cause Vietnamese birth defects?” on the U.S. News On Line, Michael Satchell wrote: “Something is very wrong in Cam Nghia. One of every 10 children in the Vietnamese village suffers from a serious birth defect. It is a heart-rending catalog of missing and malformed limbs, cerebral palsy, spina bifida, and mental retardation. In other hamlets throughout the former South Vietnam, adult soft-tissue cancers are unusually prevalent. According to the Vietnamese government, pregnant women have elevated rates of reproductive disorders and spontaneous abortions, and there are higher rates of infant deaths due to congenital abnormalities” (16). In “Agent Orange still a fact of life, death in Vietnam” on the Post-Gazette.com, Dr. Dai Cao Le, the executive director of the Agent Orange Victims Fund of the Vietnam Red Cross, said: “The first priority, I believe,

is that there are places still contaminated, and this is affecting people locally... To cleanup these places we need some high technology... very expensive [technology]. The other priority is to continue researching the problem, which has been known to cause miscarriages, stillborn babies, cancer and host of other ailments, and to find ways to help those who suffer” (17). In the “Report Shows Agent Orange Still Contaminates Vietnam” from Hanoi, AP informed “The report by British Columbia-based Hatfield Consultants confirms unusually high levels of dioxin in the soil and food of a central Vietnamese valley that was sprayed with the defoliant” (18). Reuters quoted Dr. Arnold Schechter, a professor of environmental sciences at the University of Texas, in the “Agent Orange Still Hot in Vietnam” stating: “Vietnam has the biggest dioxin contamination in the world [?] and probably the most men women and children contaminated with dioxin [?]. Unfortunately for Vietnam, it is probably the best laboratory in the world to study the effects of dioxin [!]” (19).

Following the international news agencies, the Vietnamese newspapers have published news and reports relating to Dioxin throughout the three regions of the country. The first report entitled “Cam Lo, suffering from dioxin” describes “...heart-breaking circumstances due to effects of dioxin on human lives, especially children born after the war” (20). One of the circumstances looks like this: “The low-roofed hut sits next to a small garden. Its sides are partially covered by bamboo lattices. The family was eating. Their meal includes a small pot of rice, a basket of pennywort greens, and a bowl of anchovy. On the floor, Ms. Loc was holding her grandson on her lap and feeding him with spoons of rice and anchovy. The child is very thin and significantly deformed. His arms were moving uncontrolled... The child opened his mouth but could not swallow, and the rice dropped onto the floor... The woman patiently put grains of rice into her grandson mouth. Ms. Loc, a 90-year old woman, is very thin and undernourished. Her arms are not strong enough to hold the child” (20). Another report describes Dr. Dai Cao Le as “a friend of dioxin victims” who has worked very hard during the last 20 years to “...search and study measures to deal with adverse impacts of Agent Orange and to help million of victims suffering from this terrible poison... He has comfortably traveled through many countries, but it was uneasy for him to walk through Bien Hoa, Da Nang, Thua Thien, Hue,

Can Tho, Ha Noi, Thai Binh, Thanh Hoa, TPHCM [Ho Chi Minh City]... He collected every soil sample and persuaded potentially exposed persons to give blood samples for dioxin analysis. When blood samples had not been analyzed and fat tissue samples could not be collected, he volunteered his fat tissue for dioxin analysis [?]" (21).

Dioxin was considered as a "ghost" lurking behind "Unknown Illness in Long Phuoc." According to Dr. Duc Nguyen Tran, the director of the Disease Prevention Center in the province of Dong Nai, "That is a very strange phenomenon never seen before in Dong Nai. Since scientific investigations on this phenomenon have not been conducted, actual causes of those mysterious deaths are not known. However, the occurrence of deaths right on a depot of ordnance and poisons for chemical warfare is a considerable issue that cannot be ignored" (2). In Quy Nhon, "... to save the next generations from the Agent Orange contamination... the provincial leaders have decided to cleanup the most contaminated area – Section No. 8 of the Bui Thi Xuan Ward..." although "We have learned that the Chemical Command in Ha Noi has collected samples in An Son; however, residents living near these drums of highly toxic chemicals have not been informed the analysis results" (3). Investigation results conducted by the Labor, Disabled Veteran, and Social Service Department of the province of Dong Nai indicated that "... the province has 7,400 victims affected by dioxin contamination" (22). In the North, the number of victims from dioxin contamination reaches 4,920 in the province of Phu Tho and 600 in the province of Thai Nguyen (23).

COMPARISON OF DIOXIN CONTAMINATION IN VIETNAM AND OTHER COUNTRIES

When discussing the Dioxin contamination in Vietnam, almost everyone usually refers to 19 million gallons or 73 million liters of defoliants containing approximately 170 to 180 kg of Dioxin. The defoliants were continuously sprayed over an area of approximately 9,000 square miles or 2.3 million hectares in 10 years between 1961 and 1971. These numbers have really shocked a lot of people, including those who are holding the highest educational degree. Are the levels of Dioxin contamination in Vietnam shockingly elevated? Does Vietnam have the biggest Dioxin

contamination in the world? Let's consider the following factors.

The first factor is the concentration of Dioxin in the defoliants used in Vietnam. Many people argue that the concentration of Dioxin in the defoliants used in Vietnam was higher than that in the herbicides used in the United States. They are correct, but the defoliants were mixed with jet fuel or diesel oil at a ratio from 1:10 to 1:20 before spraying (24). As a result, the average concentration of Dioxin sprayed over the South Vietnam varied from 0.1 to 0.2 ppm (parts per million), if the average concentration of Dioxin in the defoliants used in Vietnam is 2.0 ppm. This concentration was equivalent to that in 2,4,5-T, the most common herbicide used in the United States at that time (0.1 ppm). It is noted that the concentration of Dioxin in the still bottom, which was mixed with waste oil to spray on the dirt roads of Times Beach, Missouri may reach 2,000 ppm (25), i.e. 1,000 times higher than the average concentration of Dioxin in the unmixed defoliants used in Vietnam.



Times Beach, Missouri (35)

The second factor is the amount and duration, i.e. the rate, under which Dioxin was released into the environment. With an amount between 170 and 180 kg over a time period of 10 years, Dioxin was released into the Vietnam environment at a rate varying from 17 kg/year to 18 kg/year. Published data indicates that the release rate was 12 kg/year at Times Beach, Missouri (24 kg in two years) and 10,950 kg/year at Seveso, Italy (30 kg in one day) (26). Therefore, the release rate at Seveso, Italy was 600 times higher than that in Vietnam.

The third factor is the Dioxin dosage in a unit of affected areas. Using the amount of 170 to 180 kg and an area of 2.3 million hectares, the average Dioxin

dosage in Vietnam was estimated to vary from 0.0074 milligrams per square meter (mg/m^2) to 0.0078 mg/m^2 . If the typical application was used (28 liters per hectare), the average Dioxin dosage for each spray was estimated at 0.0056 mg/m^2 , assuming a Dioxin concentration of 2.0 ppm. The average Dioxin dosage at Seveso, Italy was 5.00 mg/m^2 (30 kg over 6 km^2) (27), 900 times higher than that in Vietnam.



Landfill for Dioxin in Seveso, Italy (35)

The fourth factor is the highest Dioxin concentration in soil. In Vietnam, the highest concentration of 1.6 ppm was found at an airbase in Bien Hoa (1). The highest Dioxin concentration reached 5.0 ppm in Seveso, Italy and 33.0 ppm in Times Beach, Missouri (28), which were approximately 3 and 20 times higher than that in Vietnam, respectively.

The fifth factor is the highest Dioxin concentration in human blood. In Vietnam, the highest Dioxin concentration in human blood was found at 271 ppt (parts per trillion) in 1999 (29). In Seveso, Italy, the highest concentration was 1,800 ppt (30). The highest Dioxin concentration found in 872 Ranch Hand veterans from 1987 was 617 ppt (31). The average Dioxin concentration found in workers in 2,4,5-T production plants varied from 125.6 to 331.8 ppt in Germany and from 163 ppt to 202 ppt in Russia (15).

Based on the above scientific factors, the Dioxin contamination in Vietnam is certainly not the biggest Dioxin contamination in the world, and the blood of Vietnamese is certainly not the most contaminated with Dioxin in the world as stated by Dr. Schecter. Even Dr.

Dai Cao Le has admitted that “Overall, the Vietnamese ecosystem contains less dioxin than is found in industrialized countries” (5).

DIOXIN CONTAMINATION AND POTENTIAL HEALTH EFFECTS

Because of the controversy of potential health effects relating to the defoliants used in the Vietnam War, the Italian government took no time to implement several public health measures in the following days after the accident at the ICMESA plant that contaminated Seveso and its vicinity in July 1976. Six years later, in 1982, the U.S. government (through its Environmental Protection Agency (EPA) and Center for Disease Control (CDC)) took immediate actions right after the test result showing 300 ppb (parts per billion) of Dioxin in the Times Beach soil although it was 15 times less than the highest level measured in the soil at Seveso after the 1976 accident (25). The fact that the decision was made public during the town’s annual Christmas dinner indicated the urgency and sensitivity of the U.S. government. One of the actions, of course, was monitoring health effects of potentially exposed residents.

Because the level of Dioxin contamination at Times Beach and Seveso is similar to or greater than that in Vietnam, results from studies and investigations on potential health effects conducted at Times Beach and Seveso may be used as indicators to evaluate the degree of potential effects caused by the use of defoliants on the health of the Vietnamese in sprayed areas.

According to Dr. Paolo Mocarelli, “The Seveso accident is likely the most systematically studied dioxin contamination incident in history and a chance experiment on human beings” (32). The areas of highest contamination were isolated and 736 inhabitants were evacuated two to three weeks after the explosion. Young children, pregnant women, and the elderly living in surrounding areas with less contamination were also evacuated. The non-evacuated residents were prohibited to eat fruits, vegetables, meat, and dairy products from the area. Domestic animals and livestock were destroyed.

“An extensive health surveillance system was put into effect to record a continuing and long term effects of

dioxin exposure on the population. Medical examinations and laboratory tests were performed, pregnant women were closely monitored to record rates of miscarriage and birth defects, and a cancer registry was created to track new cases of cancer. Chromosomal studies of humans in Seveso, who were exposed to a high concentration of dioxin, showed no evidence of chromosome abnormalities due to dioxin exposure. A thorough analysis of the health data from the Seveso population shows that affected residents developed chloracne and minor, reversible nerve change. Clinical studies revealed some impaired liver function, the long-term effects of which are not yet known. No other organs or body functions appear to have been affected, nor was reproduction adversely affected. No cases of cancer related to the incident have been observed but study will continue for many years so that long term effects can be monitored” (32).

“Early health investigations including liver function, immune function, neurologic impairment, and reproductive effects yielded inconclusive results. Chloracne (nearly 200 cases with a definite exposure dependence) was the only effect established with certainty. Long-term studies were conducted using the large population living in the surrounding noncontaminated territory as reference. An excess mortality from cardiovascular and respiratory diseases was uncovered, possibly related to the psychosocial consequences of the accident in addition to the chemical contamination. An excess of diabetes cases was also found. Results of cancer incidence and mortality follow-up showed an increased occurrence of cancer of the gastrointestinal sites and of the lymphatic and hematopoietic tissue. Experimental and epidemiologic data as well as mechanistic knowledge support the hypothesis that the observed cancer excesses are associated with dioxin exposure. Results cannot be viewed as conclusive. The study is continuing in an attempt to overcome the existing limitations (few individual exposure data, short latency period, and small population size for certain cancer types) and to explore new research paths (e.g., differences in individual susceptibility)” (33).

To monitor potential health effects of the residents of Times Beach, a pilot epidemiological study was conducted after the town evacuation and completed in October 1983. This pilot investigation did not turn up evidence suggesting that Dioxin has caused any serious

health problems in 104 participants. “Extensive clinical studies of the Times Beach residents reported in 1986 were similar to the earlier work in that no conclusive evidence of damaging health effects were found. The study compared 154 exposed persons with an unexposed control group of 155 people having similar lifestyles and medical histories. In an extensive battery of over fifty tests, the differences found between the two groups were some subclinical changes in liver function and some depression of the cellular immune function in the exposed group. In neither case, after whatever exposure took place between 1971 and 1983, had there been any evidence of increased liver disease or general illness in the exposed group as of 1986. Researchers will follow up on the effects noted in future years” (28). CDC has established a database to store health data of the Time Beach residents from periodic examination.

Results from the 1997 physical examination of the Ranch Hand Study on 1,000 participants of the Ranch Hand group (with the highest Dioxin concentration in blood of 617 ppt) and 1,300 participants of the comparison group (with the highest Dioxin concentration in blood of 54.8 ppt) in 1982, 1985, 1987, 1992, and 1997 showed that “... adult-onset diabetes and cardiovascular disease seem most likely related to herbicide exposure, biological processes relating herbicide exposure with diabetes or cardiovascular disease have not been described, and until such relationships are found, these statistical findings may not reflect cause and effect” (34).

Although those studies and investigations have not provided any concrete evidence to link adverse health effects other than chloracne with direct exposure to Dioxin, the Vietnamese government and a few international experts such as Dr. Schechter still believe that Dioxin is the primary cause of numerous cancers, birth defects, and all unknown illnesses that are spreading throughout Vietnam. In fact, laboratory experiments indicate that high levels of Dioxin may cause cancers and birth defects in animals; however, there is no conclusive evidence suggesting a direct link between Dioxin and cancers and birth defects in humans. Even in animals, compounds of the Dioxin family have different effects. For example, the 50% lethal dose varies significantly from 1 µg/kg for Guinea pigs to 114 µg/kg for mice and greater than 300 µg/kg for dogs (35). “Humans seems to be much more

resistant to the toxicological and carcinogenic properties of dioxins” (36).

What is the primary suspect if Dioxin is not the culprit? In fact, Dioxin is just one of 451 known and suspected carcinogens listed on the website of Oxford University in England. Many of these 451 carcinogens are pesticides and herbicides being used widely (sometimes improperly) in Vietnam and cigarette smoke! (37). Scientists have identified many risk factors that may increase the chance to get cancer. These factors include tobacco, alcohol, diet, sexual and reproductive behavior, infectious agents, family history, occupation, and environmental and pollution. According to estimates from the American Cancer Society, approximately 40% of the cancer deaths in the United States in 1999 were caused by tobacco and excessive alcohol use and approximately 33% of the deaths were related to diet and nutrition. In the last 20 years, approximately 15% of the world’s cancer deaths have been traced to viruses, bacteria, and parasites (38).

“Every pregnancy carries a background risk of 3-4% for a birth defect. The entire pregnancy has the potential for a birth defect to occur. Malformations are birth defects affecting the structure and occurring during the first trimester of pregnancy. Deformations affect the growth and/or the development of the fetus and occur during the second or third trimester of pregnancy. Birth defects may be affected by different factors. These factors include genetic, environmental and multifactorial/unknown causes. For the most part, 65% of the causes of congenital malformations are unknown. Abnormal genes may produce conditions such as sickle cell anemia, muscular dystrophy, cystic fibrosis and phenylketonuria. Abnormal chromosomes (the ‘package which contain the genes’) may cause conditions such as Down Syndrome or Turner Syndrome. It is estimated that known genetic factors account for 20-30% of birth defects. Environmental factors which can adversely affect the fetus are known as teratogens. Only about 5% of defects result from maternal exposures to teratogens. This includes medications, maternal infections, chemicals, maternal states (i.e., diabetes, seizure disorders, lupus) and other factors” (39).

One of those factors is the mother’s health conditions and nutrition during pregnancy. Low levels of folic

acid, Vitamin B12, and Vitamin B6 have been associated with birth defects, especially neural tube defects (NTDs). In the United States, despite years of public health campaigns advising that taking the B vitamin folic acid can help prevent serious birth defects of brain and spine, most women of childbearing age are still not taking the vitamin in time. “NTDs are among the most serious and common birth defects in the United States. Each year, an estimated 2,500 babies are born with these defects, and many additional affected pregnancies result in miscarriage or stillbirth. The most common NTD is spina bifida, a leading cause of childhood paralysis. To prevent NTDs, all women capable of having a baby should consume a multivitamin containing 400 micrograms of folic acid every day beginning before pregnancy, as part of a healthy diet containing foods naturally high in folic acid, such as leafy green vegetables, orange juice, and beans, and enriched grain products fortified with the vitamin” (40).

INSECTICIDES, PESTICIDES, AND UNCONTROLLED TOXIC CHEMICALS: SILENT KILLERS

Although Dioxin is famous and controversial, it is just a “wandering shadow” that can only scare ghost-fearing people! On the contrary, insecticides, pesticides, flies and mosquitoes’ sprays, and chemicals in untreated industrial wastewater that might gradually kill the Vietnamese people from the North to the South are extremely silent. A horrible silence!

“The effort to feed a growing population and increase food exports (Vietnam is already the world’s third-largest exporter of rice) relies on 20,000 tons of pesticides annually, 80% of which are insecticides, according to a 1995 article by Pham Binh [Binh] Quyen and colleagues in Trends in Analytical Chemistry. In 1990 and 1991, the FAO Intercountry Program Integrated Pest Control in Rice in South and Southeast Asia reported that pesticides were applied more frequently to rice in southern Vietnam (an average of 5.3 applications per crop) than elsewhere in Asia. In northern Vietnam, the average was 1.0 application per crop. Comparatively, China used 3.5 applications, the Philippines 2.0 applications, and India 2.4 applications per crop.

Pesticide handling is primitive at best. Fifteen percent of households store pesticides in their homes, a 1995 Ministry of Health survey found, and the use of protective clothing and respirators is virtually nonexistent, given that the hot, humid climate makes such measures unpopular. When the NIEHS team visited a tea plantation in 1995, it learned that every field worker showed cholinesterase inhibition, a strong suggestion of exposure to organophosphate insecticides.

According to Pham, by 1995 market liberalization has brought 'a greater tendency towards the application of cheaper, more hazardous pesticides and less conformity to the guidelines issued by the Plant Protection Department; some banned pesticides, including DDT and arsenic, are still being use[d].' Seventeen percent of insecticides used in Vietnam are classified as 'extremely hazardous' by the World Health Organization [WHO]. NIEHS team member Ernest Hodgson, head of the department of toxicology at North Carolina State University, says, 'There are some [pesticides] that would be relatively safe – like the pyrethroids – but there doesn't seem to be any kind of concerted effort to encourage their use.'

Ironically, this heavy use of insecticides may be unnecessary. K.L. Heong, of the entomology and plant pathology division of the International Rice Research Institute (IRRI), observed in a study reported at a conference in Hanoi in May 1994 and published jointly by IRRI and the Vietnamese Ministry of Agriculture and Food Industry, that insecticide use patterns in Vietnam 'did not appear to reflect pest situations,' that farmers tended to 'overreact' to visible but innocuous insects, and that 'widespread gaps in knowledge of farmers and unfavorable attitudes of farmers towards natural methods of pest management have encouraged pesticide misuse.'

Insecticides are showing up in the environment and in people. Japanese researcher Hisato Iwata and colleagues reported in a 1994 article in Environmental Protection that airborne levels of DDT in Vietnam and other Asian locations were '2-3 orders of magnitude higher than those in Japan... [the] USA ... and some parts of Europe.' A study by Kurunthachalam Kaanan and colleagues, published in 1992 in the Archives of Environmental Contamination and Toxicology, detected PCBs, hexachlorocyclohexane isomers, DDT,

and aldrin and dieldrin insecticides in animal fat, butter, meat, and seafood samples taken from several locations in Vietnam. Further, the study calculated that the average daily intake of some organochlorines '[was] higher than those observed in most of the developed nations.' What relationship these levels may have to adverse health effects is not currently known as almost no study of the matter has been done, although most scientists agree there needs to be further research.

A 1989 study directed by Schecter, published in Chemosphere, found 4,220-7,300 parts per billion (ppb) of p,p'-DDT in samples of human breast milk gathered from 12 women from southern Vietnam. These levels were 'consistent with recent or ongoing contamination of these women with DDT.' Such studies, however, may not amount to a condemnation of the use of DDT; this use must be seen in context of the need for vector control to prevent spread of disease. Vietnam has the world's fifth-highest incidence of malaria outside of Africa, with 212,000 cases in 1992, according to the WHO. Mosquitoes are also vectors for dengue fever; last July the Vietnamese government announced that already more than 10,000 people had contracted dengue in 1996 and that at least 45 had died. Vietnam faces a tradeoff between trying to contain an environmental disease and allowing environmental contamination.

Although there has been little study of whether high levels of ambient insecticides are causing disease, insecticide-poisoning cases are common in Vietnam's hospitals. Many of these cases are supposedly suicides, but Hodgson says he's never seen a rigorous study of the subject, and suspects that the sheer number of poisonings signals careless handling of insecticides. To control the problem, he suggested better labeling, more protective measures, and farmer education" (41).

That did not include the amount of insecticides and pesticides smuggled through the borders and used improperly. "In March and April of 2000 alone, authorities in the province of Lang Son seized approximately 4 tons of insecticides smuggled through the border... The total amount of insecticides has reached 12,450 tons, together with 19,000 bottles of other chemicals. Since February 2000, the province of Lang Son has also coordinated with the Center of Environmental Treatment of the Ministry of Defense to destroy 10.766.4 kg of pesticides and insecticides...

Most of smuggled pesticides and herbicides are banned in Vietnam such as rat poisons (powder or solution), weight stimulant, monitor, and 558-38%. Many chemicals are not labeled or marked with photocopied labels” (42).

The use of flies and mosquitoes sprays in Vietnam was also reported. “Dozens of insecticides and flies and mosquitoes sprays for indoor applications are available in markets in Vietnam including Ho Chi Minh City. Recently, the public has concerned about the production and distribution of products containing toxic substances. These products kill houseflies, mosquitoes, insects, and human. In Ho Chi Minh City, hundreds markets, supermarkets, and commercial centers are selling a variety of bug sprays such as Raid and Falcon (USA), Plus Kill (Korea), Shieldtox (Singapore), Baygon (Thailand), Bat (Malaysia), and Mosfly (Vietnam)... The presence of banned toxic chemicals in some of these bug sprays has become a concern. The first product is Raid. It contains Dichlorvos (or DDVP), which has been banned in clinical and household products by the Ministry of Health... Raid sprays contain 1% of DDVP by weight. The chemical name of Dichlorvos is Dimethyl Dichloro Vinyl Phosphate (CH_3O_2). [DDVP or Dichlorvos is one of 451 known and suspected carcinogens listed by Oxford University, England].

According to Dr. Chanh Minh Cao, a former director of the Public Health Department of Ho Chi Minh City and a researcher on toxic chemicals and hygiene, DDVP is a compound of phosphorous base similar to other toxic chemicals such as vofatox, malathion, and dipterex... “Decades ago, DDVP was used to control houseflies; however, spraying DDVP was prohibited by the Ministry of Health,” Dr. Chanh said. But decades later, products containing DDVP are now being marketed regardless of human health. Symptoms of DDVP contamination may vary from difficult breathing or sweating to fainting, seizure, heart failure, and ceasing breath. The lethal dose for DDVP is 0.05g. During periods when DDVP was allowed to use as insecticides by our Ministry of Health, applications of DDVP on fruits and vegetables must be stopped at least 40 days before consumption [?].

It is surprised to see insecticides sold in some stores. Raid (1% DDVP) is just “a little brother” of Plus Kill (1.5% DDVP). Mosfly is less toxic than the others but

contains Fenitrothion, a regulated chemical for limited clinical and household applications. Although Fenitrothion is allowed by the Ministry of Health’s regulations for controlling houseflies and mosquitoes outdoor, Mosfly has been marketed for indoor uses (?). According to several scientists, DDVP can remain in the air and sprayed objects up to 7 days, which is long enough to cause respiratory or food poisoning, especially in children” (43).

How about toxic chemicals in untreated wastewater from industrial areas? The Viet Tri industrial complex in the North was built decades ago, but untreated wastewater from various industrial plants in this complex is still released directly into Red River. As a result, the water quality of the river has been significantly affected. “Red River is a natural water source of unstable quality. Due to direct impacts of different wastewater sources from the Viet Tri industrial complex, the water quality of Red River downstream of this complex has changed frequently” (44). Have the chemicals from those wastewater sources and their concentrations been identified and analyzed?

In the South, the conditions appear to be much worse. “Dr. Trinh Le of the Institute of Tropical Technology and Environmental Protection, an experienced expert investigating potential impacts of industrialization, urbanization, and navigation on the Can Gio environment said, ‘wastewater from thousands industrial facilities in 30 industrial areas and from thousands of small factories and businesses in the basin is the source of contamination in the Dong Nai estuary in the district of Can Gio and Ganh Rai Bay. The primary contaminants include unstable and degradable organics from food and drink processing industries such as monosodium glutamate, sugar, instant noodle, frozen seafood, meat, dairy, beverage (beer, soda, and alcohol), and sewage. These industries include Vedan; Ajinomoto; Sai Gon Brewing; Bien Hoa, Tri An, and Long An Sugar Houses; Vinamilk Dairy; and Vissan Foods... Persistent organics such as dyes and phenol lignin from industries such as paper, textile, mechanics, paints, plywood, and distillation are also present... These contaminants are found at Cogido and Tan Mai Paper Mills; at dyeing factories in the Nhon Trach industrial area; and at Thang Loi, Thanh Cong, and Viet Thang Textiles... Additional contaminants include metals (lead and chromium) in wastewater from battery

manufacturers, metallurgies, tanneries, plating, and electronics and oil and grease from mechanical manufacturers, shipyards, metallurgies, and gas stations located within the Dong Nai-Sai Gon river basin” (45). [Lead and Chromium are two of 451 known and suspected carcinogens listed by Oxford University, England].

Contamination from industrial wastewater appears to exist almost everywhere. “According to the Department of Science, Technology, and Environment of the province of Tay Ninh, untreated wastewater from about 20 cassava-flour production facilities and two major sugar houses has significantly contaminated Tay Ninh Creek” (46). “Precinct No. 1 of Phuoc Long B Ward in District No. 9 of Ho Chi Minh City has been contaminated for years. Untreated wastewater from several industrial facilities has been released into canals and rice paddies and has affected the life of hundreds families... Untreated wastewater containing oil from industrial plants in Hiep Phu Ward (Hai Au Concrete) and Phuoc Long Textile has released directly into shallow rice paddies. The untreated wastewater flow from Hai Au Concrete was approximately 200 m3/day. The untreated wastewater flow from Phuoc Long Textile, approximately 1,500 m3/day, contained COD 60 times higher than the allowable level (6,000/100)” (47). Approximately 7-8 years ago (1993-1994), water in Binh Tho Creek at Truong Tho Ward in the district of Thu Duc was clean and clear, but “... the water has turned black and contained numerous wastes from industrial facilities. Furthermore, Binh Tho Creek also receives untreated wastewater from Thong Nhat and Truong Tho Dairies, Viet Thang Textile No. 2, and Tan Mai Paper Mill” (47). “Now, Tham Luong Canal is highly contaminated by untreated wastewater from 57 manufacturing facilities such as textile, dyeing, food processing, paper, rubber, and mechanics in the Twelfth, Tan Binh, and Go Vap districts. Inspections at 20 of those facilities from May 29 to June 6 indicated that most of the 20 facilities have not installed wastewater treatment systems and that highly contaminated wastewater was released directly into Tham Luong Canal” (48).

INSECTICIDE AND PESTICIDE CONTAMINATION AND HEALTH EFFECTS

It is difficult to know the actual level and extent of contamination from insecticides, pesticides, and

untreated wastewater from industrial facilities in Vietnam. Up to date, only limited analytical results for several chemical substances have been reported in a few published documents or publications. Nevertheless, it is more than enough to frighten a person with an average knowledge about pollution. That person would be terrified if he or she knows that these toxic chemicals have been persisted in breast milk of some Vietnamese mothers for more than 10 years.

As we are aware, in 1989, Dr. Schecter discovered p,p'-DDT with concentration ranging from 4,220 ppb to 7,300 ppb in twelve breast milk samples collected in Southern Vietnam (43). These concentrations are 211,000 to 365,000 times the State of California's drinking water standards of 0.02 ppb for p,p'-DDT. It is terrible!!!

During an investigation conducted by Hatfield Consultants Ltd in 1999, other insecticides were found in breast milk samples collected in A Luoi Valley in the province of Quang Tri. The concentrations of these insecticides (15), shown in ppb, are as follows:

Concerned Chemical	California Standards	A So	Hong Lam	Hong Thuong	Hong Van
Hexachloro-benzene	0.5 (1)	1.4 (2.8)	2.2 (4.4)	1.7 (3.4)	2.1 (4.2)
p,p'-DDE	0.01 (1)	8,900 (890,000)	1,900 (190,000)	3,200 (320,000)	5,900 (590,000)
p,p'-DDD	0.02 (1)	25 (1,250)	16 (800)	20 (1,000)	30 (1,500)
p,p'-DDT	0.02 (1)	1,600 (80,000)	410 (20,500)	530 (26,500)	1,500 (75,000)
Mirex	NA	0,53	0,35	1,30	2,20
Dieldrin	0.02 (1)	0.63 (31.5)	0.30 (15)	0.32 (16)	0.31 (15.5)
Total PCBs	0.5 (1)	16 (32)	50 (100)	54 (108)	51 (102)

As shown in parentheses, the concentrations of the concerned chemicals may reach 890,000 times the State of California's drinking water standards. In comparison to these chemicals, the level of the Dioxin contamination in Vietnam is really humble, if not insignificant! In fact, the average concentration of Dioxin in breast milk samples collected in A Luoi Valley during the same period was 14.6 ppt for A So, 7.3 ppt for Hong Lam, 9.6 ppt for Hong Thuong, and 3.0 ppt for Hong Van. That varied from 0.6 to 2.9 times the State of California's drinking water standards of 5 ppt for Dioxin.

More seriously, Hexachlorobenzene, DDT, Mirex, Dieldrin, and PCBs are among 12 persistent organic pollutants (POPs) the Stockholm Convention treaty signed in the Swedish capital in May 2001 sought for elimination worldwide (49). These POPs include Aldrin, Chlordane, Dieldrin, DDT, Endrin, Heptachlor, Mirex, Toxaphene, PCBs, Hexachloro-benzene, Dioxins, and Furans. Among the POPs found in the breast milk in A Luoi Valley, Mirex is worth for further discussion. It is a manufactured insecticide that does not occur naturally in the environment. It was used to control fire ants, and as a flame retardant in plastics, rubber, paint, paper, and electrical goods. Its manufacturing and usage in the United States have been stopped since 1978. "Animal studies have shown that ingesting high levels of Mirex can harm the stomach, intestine, liver, kidneys, eyes, thyroid, and nervous and reproduction systems" (50). According to EPA, ingesting an amount of Mirex equal to 200 picograms ($\text{pg} = 10^{-12} \text{ g}$) per kilogram (kg) of the body weight per day is not likely to cause significant harmful health effects (50). Based on this allowable intake, a 3-kg infant should not ingest more than 600 pg of Mirex per day. If he or she is fed daily with 500 ml of his or her mother's milk, he or she would ingest 175,000 pg if he or she lives in Hong Lam, 265,000 pg if he or she lives in A So, 600,000 pg if he or she lives in Hong Thuong, and 1,100,000 pg if he or she lives in Hong Van. In summary, infants in A Luoi Valley have ingested from 290 to 1,830 times the daily allowable intake for Mirex.

Needless to say, we have already known potential impacts of the pesticides, insecticides, and toxic chemicals in untreated wastewater released from industrial plants. These potential impacts are very similar to those associated with Dioxin. We wonder if how many people have died, how many people have been affected, and how many Vietnamese children have been suffered from birth defects or diseases caused by toxic chemicals other than Dioxin. Let's look at undeniable evidence.

"My sister-in-law, a teacher at the middle school in the village of Hop Thanh (Yen Thanh, Nghe An), frequently talked about two disabled and miserable pupils in her class. Their father died because of exposure to insecticides. They are brothers An Dinh Pham and Ninh Dinh Pham. Both have identical birth defects: big head, a few blond hair, thick lips, bad

vision, and bad memory. Especially, they do not have any teeth...

I went to the village of Hop Thanh to visit Mrs. Hoa Thi Nguyen, the mother of the disabled pupils... I asked: 'Have you taken the children to a hospital?' Mrs. Hoa replied 'Yes, the central hospital. Doctors said they are poisoned through his father, and blood transfusion is the only chance. But blood transfusion... in this situation...' Suddenly, Mrs. Hoa paused, looked down, and quickly wiped out her tears. I looked to the altar. There was the picture of her husband, Mr. Doan Dinh Pham. He died at 30 years old in 1992. I asked: 'Do you remember how many years he carried the sprayer?' Without hesitation, she said: 'Doan was born in 1963 and graduated from high school in 1983. He joined the Youth and served from 1984 until his death. During that period, he worked for the technical team of the village's agricultural cooperative. He was very healthy, gentle, and hard working. He was one of the best members of the technical team. There were no breaks during periods of emergency spraying, and meals were served at the rice paddies. He always had the most working hours and sprayed the largest area. Early 1992, six month after the second child, Ninh, was born, he got very sick. He was hospitalized and the doctor said he was highly poisoned with insecticides... He died exactly one month later.'

In order to have a better understanding of the diseases An and Ninh have inherited from their father, Doan Dinh Pham, I talked to Mr. Hoi Duc Pham of the village of Dinh Phung. He was the supervisor of the technical team from 1966 to 1994. He said the function of the technical team was to inspect the rice fields, detect pests and insects, and spray insecticides or pesticides to control them. The service area covered by the technical team was 500 hectares. There were 'campaigns' in which insecticides such as Batsa, Vofatox, Metin, and Falion were sprayed continuously for months... These insecticides are extremely toxic, but their toxicity was not known at that time. Everyone thought the insecticides do not have impacts on human and the environment. And that led to the death of Mr. Luu Van Pham, a cooperative member. He died immediately when using his bare hands to transfer Metin. Another member of the technical team, Ms. Huan Thi Pham, used her bare hand to mix the insecticides in a large container. Luckily, she survived after blood transfusion. Doan was the assistant

secretary of the village's Youth and was the healthiest member of the technical team. Because of his physical strength and hard work, he always had the most annual working hours. During the period between 1986 and 1989, insects were widespread. In order to control the insects more effectively, the cooperative purchased a number of portable power sprayers, which are high volume and heavy. Doan Dinh Pham was the only member that can sustain the new sprayers. While other members could not handle for a long time, Doan had carried the sprayers for eight consecutive years until his illness. An and Ninh have birth defects because their father was consistently and highly exposed to insecticides. The village is processing paper work for benefits under Rule 202. I sadly told Mr. Hoi: 'In the past, Mr. Doan suffered for the entire village. How about the present?' Mr. Hoi replied immediately: 'After the policy to lease land to farmers was implemented, the function of the technical team has been limited to identifying and warning of insects. Most farmers have purchased their own sprayers.' As a result, the health effects of the insecticides may now spread to every family in the village. That is because the insecticides are being sprayed over the rice paddies. Every day, numerous 'careless' young men and women spray insecticides 'to protect the crops' without wearing protective gear such as masks, clothes, gloves to protect themselves.

Vietnam imports approximately 34,000 tons of insecticides annually, of which 1,000 tons (approximately 2.97%) are highly toxic and of restricted uses. This amount does not include banned insecticides that are smuggled into the market. These banned insecticides are preferred because they are cheaper and because farmers do not know their health effects; therefore, many farmer families are under insecticide threats. Three years ago, a team of Japanese experts in agriculture visited a farm in the village of Dien Xuan (Dien Chau, Nghe An). After observing insecticides sprayed on growing vegetables, a professor accompanying the team suggested that eating worms may be better (!?)” (51).

But how many more undeniable evidences have not been disclosed? These undeniable evidences may be “unknown illnesses” in Hamlet No. 5 of the village of Long Phuoc (Long Thanh, Dong Nai). An article on the Lao Dong newspaper reports: “A mysterious and deadly illness still remains after nearly 30 years. Many

healthy young men with similar symptoms died during sleep.” According to the article, the illness, which has been observed since 1997, caused five deaths and disabled several other persons. One person, however, completely recovered from the illness (2).

These undeniable evidences may also be patients at the Internal Department of the Tumor Center, which is specialized for treatment of cancers in children in Ho Chi Minh City. Since the opening on May 15, 2000, the Department has received 1,005 children during the second half of 2000 and 1,232 children during the first half of 2001. According to the Department director, Dr. Khuong Chanh Tran, “... leukemia is the most common (approximately 50%) followed by brain tumors, retinoblastomas, lymphomas, nervous tumors, soft-tissue sarcomas, and kidney tumors... Dr. Khuong said: ‘Cancers in children are caused by several factors. The primary factor is the gene disturbance. Genes can be disturbed by virus infection in the womb or by mother’s exposure to radiation or chemicals during pregnancy. Chemicals have significant impacts on the gene disturbance’... I searched for the answers from the scientists and doctors who are studying this subject. It became clear that the environmental pollution is the primary cause of the gene disturbance and has generated cancers in children. The ratios of patients from various local areas indicate the actual conditions of environmental pollution in those areas... At the conference on ‘Planning for Construction along Ho Chi Minh Route,’ which was held in August in Hanoi, I was really scared when statistical numbers relating to the consequences from the use of toxic chemicals during the Vietnam War were ‘updated’... That does not include other factors of similar significance such as the extensive use of chemicals in foods, pesticides, and insecticides without considering their effects on human health” (52).

RELIABILITY AND CONVINCING ABILITY OF DIOXIN STUDIES IN VIETNAM

According to the current Vietnamese officials, scientists in North Vietnam have begun their studies on potential impacts of Dioxin on human health since 1970 (21). Results from the studies, however, were presented lately in the “International Symposium on Herbicides and Defoliant in War: The Long-term Effects on Man and Nature” from January 14 to 19, 1983 in Ho Chi Minh City. The symposium “... was convened... in

order to examine the aftermath of this chemical assault on South Vietnam..." (53). A booklet was published to present the final summary report of the symposium, seven final summary reports of the working groups, and an article compiled by Dr. Vien Khac Nguyen from the papers presented by the Vietnamese scientists at the symposium. The booklet indicates that "Scientists attending the symposium highly valued the contribution made by Vietnamese scientists who, despite the limited facilities and other difficulties during and after the war, were able to overcome these problems and made valuable research contributions. The reports and suggestions made by Vietnamese scientists at the symposium provided a crucial basis for discussions in the working groups and at the plenary sessions. Large-scale field studies done by Vietnamese scientists in localities in southern Vietnam as well as northern Vietnam have provided many materials of scientific value not previously demonstrated in other countries [!]" (53).

But only two numbers were provided in the booklet to demonstrate the existence of Dioxin in Vietnam. "In 1981 analyses were made of 7 soil samples taken in a rural area of Ho Chi Minh City, at different depth levels. On a sample taken at a depth of 1 metre there was a trace of dioxin, with a concentration below 5 p.p.t. of soil. On a wet sample on the soil surface the concentration was 14 p.p.t. of soil" (53). Such inadequate data cannot convince international scientific communities that the Dioxin contamination in Vietnam is the world's largest! In fact, "According to John Constable, a retired Boston plastic surgeon who began studying herbicide effects in Vietnam in 1969, 'There were lots of suggestive papers produced by the Vietnamese. They did hard work with not much money, and yet it's very difficult to show any papers that clearly meet Western standards of proof for an association between dioxin and anything but soft-tissue sarcoma.' Statistician and dioxin expert Christopher Portier of the NIEHS goes further, saying dioxin studies in Vietnam have yielded very limited information 'because they generally do not fully explain the methodology used in their analysis of study results.' Finally, although Vietnamese studies seem uniformly positive for an association between dioxin and disease, some experts question these findings due to the fact that the contaminant was spread so unevenly through the environment (and therefore, exposures should vary), and the studies generally used memory rather

than lab tests to measure exposure. Since memory is not a good guide to exposure, both the 'exposed' and the 'unexposed' groups were probably erroneously categorized, thus nullifying the results of some studies" (41).

Ten years later, the second international symposium entitled "Herbicides in War – The Long-term Effects on Man and Nature" was held in Hanoi on November 15-18, 1993. Similar to the first symposium, the Vietnamese scientists continued to present suggestive papers, which were summarized in an official 4-page report. Unlike the 1983 booklet, the 1993 report admits that "...in order to gain the actual status of malformed children potentially caused by Agent Orange exposure investigation on genetics should be carried out systematically and carefully on the basis of standard techniques..." and that "... much attention should be paid to adverse effects of chemicals used in peace time as well as Agent Orange used in war. This is the origin of pollution caused by chemicals works, paper pulp bleaching, misuse of agricultural pesticides, incinerators,..." (4). Like the 1983 booklet, the 1993 report concluded, without any supporting data, that "... Vietnam provides a unique opportunity to study the effects of herbicides and dioxins because Agent Orange was used during wartime with large amount. This use, for defoliation at that time, is believed to be the world's largest dioxin contamination" (4). This is the primary reason making the studies by the Vietnamese scientists inconvincible. Results of the Vietnamese studies have become more skeptical after scientists from the NIEHS had to surrender samples and data to the government officials before leaving Vietnam in June 1995. Similarly, experts from Hatfield Consultants, a Vancouver firm testing for dioxin around paper mills, were prevented from bringing back from Vietnam 200 samples of soil, plants, and foodstuffs in 1996, even though this company was working for the Vietnam's 10-80 Committee (41). It's understandable because those paper mills may possibly be other sources of Dioxin contamination in Vietnam!

Studies on the potential impacts of Dioxin in Vietnam have been improved significantly through coordination with Hatfield Consultants Ltd. Two reports released in 1998 and 2000 (14,15) contain a lot of valuable data and demonstrate that those studies were systematically conducted. However, the Hatfield reports also have the same shortcoming as the 1983 booklet and the 1993

report, i.e. reliability and convincing ability. For example, the 2000 report (Conclusion C.4) concluded that “TCDD levels in blood of A So residents are higher than most residents of industrial countries who have been exposed to TCDD (e.g., herbicide plant workers, metal plant workers, chemists, etc.” (15). This conclusion contradicts with data presented in Table 2.9 of the report. The report also concludes (Conclusion F.4) that “Pesticide use is low in the valley; pesticide levels are low in soils and breast milk; it is unlikely they are a confounding factor in this dioxin investigation” (15). As mentioned above, several insecticides or pesticides have been found at very high concentrations in breast milk of mothers in the A Luoi Valley area. This is a clear evidence of serious contamination of pesticides in that area; therefore, the contamination of pesticides should be investigated carefully and thoroughly. Conclusion G.7 of the report states: “Vietnam provides the best natural laboratory in the world to refine our understanding of the environmental and human health impacts of dioxins” (15). Would you please comment on this conclusion, Dr. Paolo Mocarelli?

INITIAL STEPS FOR SOLVING CHEMICAL POLLUTION PROBLEMS IN VIETNAM

Based on the above discussion, we can see that chemicals used for malaria control, agricultural production, and industrial manufacture are being the major sources of pollution in Vietnam. Of course, we cannot ignore Agent Orange because of its potential impacts on the environment and human health in Vietnam. With limited resources, objectives for addressing the chemical pollution in Vietnam should be prioritized to optimize their effectiveness.

The first and relatively easy step is to effectively control the imported pesticides, insecticides, and chemicals for agricultural and industrial uses. More importantly, illegally imported and smuggled pesticides, insecticides, herbicides, and chemicals should be stopped, especially banned substances.

The next step is to prepare and implement appropriate measures to encourage the safe and effective use of chemicals, pesticides, and insecticides in agricultural and industrial production. These measures may include, but are not limited to, providing appropriate directions and instructions for chemical usage and

application, promoting the use of alternatives, implementing environmental education in public schools, improving public awareness through public media, and rewarding the reduction in chemical usage.

The third step is to ratify the Stockholm treaty for the elimination of 12 persistent organic pollutants and to seek international assistance, through the United Nations Environmental Programme, in preparing and implementing a national implementation plan to replace DDT in controlling malaria (54).

The fourth step is to seek humanitarian aids (not reparation) from international communities, especially from the United States, and to provide a favorable working environment in determining if dioxins, or other chemicals, have caused cancers and birth defects currently observed in Vietnam. The most important needs are technology and laboratory equipment so that Dioxin and other suspected chemicals in environmental and human samples can be detected at acceptable levels.

The fifth step is to prepare and implement a special health program to investigate and monitor existing and future cases of cancers and birth defects at the existing hospitals such as the Tumor Center and the Tu Du Hospital in Saigon. In this program, a medical file should be created and stored into the program database. Patients and their parents should be examined and tested carefully and thoroughly to determine the cause(s). The program should also include a data collection program to collect data and information relating to diseases. This data and information are necessary for statistical and/or epidemiological investigations in the future. If acceptable standards and procedures are followed, this database would be adequate to support the investigation results conducted by the Vietnamese scientists in the future.

The sixth step is to prepare and implement appropriate measures to effectively control the disposal of wastes (solid, liquid, and gas) from industrial areas, especially from those with high potentials. These measures should be simple yet practical. They should avoid an “enforcement and penalty” approach and facilitate low-income facilities (small or family-run businesses) to prevent inappropriate disposal of wastes.

CONCLUSIONS

The chemical pollution has become one of the most serious environmental problems in Vietnam. It is a consequence of the on-going development yet an important factor affecting the national development and the welfare of the Vietnamese people in the future. When discussing the chemical pollution in Vietnam, many people refer to 19 million gallons or 73 million liters of "Poisonous Agent Orange" used by the United States during the Vietnam War from 1961 to 1971 to "poison the South Vietnamese people." That volume of Agent Orange contains approximately 170 to 180 kilograms of Dioxin, which was considered as the most toxic chemical on earth. Others believe millions of Vietnamese have been affected by Dioxin that causes parentally transmitted diseases; reproductive disorders including birth defects, spontaneous abortion, and trophoblastic diseases; cancers; and disturbances of the central and peripheral nervous systems since 1960's. Approximately 500,000 of those victims are children with malformations. Any contaminated areas in Vietnam are being considered by the Vietnamese officials as Dioxin contamination, and Dioxin is being blamed for any birth defects or unknown diseases in Vietnam. With the help from a few so-called international consulting firms and experts, the Dioxin contamination in Vietnam has become the most Dioxin contamination problem in the world, and the concentration of Dioxin in the blood of the Vietnamese people has become the highest in the world!

It is surprised to know that a few people have recognized, but ignored, the presence of other toxic chemicals such as insecticides, pesticides, and other chemicals in untreated wastewater from industrial manufactures. These chemicals are capable of killing people throughout Vietnam from the North to the South gradually and silently. At least five toxic chemicals have been found in breast milk in A Luoi Valley in Central Vietnam during studies conducted since the late 1980's. These chemicals, whose concentrations exceeded the California drinking water standards up to 890,000 times, belong to the 'dirty dozen' persistent organic pollutants the Stockholm Convention in Sweden sought to eliminate in May 2001. Based on available data obtained from the previous studies, the level of the Dioxin contamination in Vietnam is insignificant, if not negligible, in comparison to these five chemicals. And fortunately, the available data also shows that the

Dioxin contamination in Vietnam and the Dioxin concentration in the blood of the Vietnamese people are not the highest in the world!

Based on the above scientific data and information, revolutionary romance, political tricks, emotional humanity, caring for compatriot, and past propaganda should be set aside to scientifically and wisely select the most economically effective measures that are necessary to solve the chemical pollution problems in Vietnam as soon as possible. Those measures should focus primarily on insecticides, pesticides, and other toxic chemicals used for industrial and agricultural production. Of course, potential impacts of the Agent Orange on the human health and the environment cannot be neglected. With technical and financial assistance from international communities, the actual causes of birth defects, cancers, and other unknown diseases will certainly be detected if the Vietnamese government has determination and makes efforts to facilitate studies and activities conducted by conscientious international organizations and experts. Overcoming the consequences of "the toxic chemicals used for military purposes" is just a myth if the actual causes of the diseases cannot be specified scientifically and accurately. Sciences, not politics, must be taken into consideration first!

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