

REVIEW SOME ENVIRONMENTAL IMPACTS OF AGENT ORANGE USED BY US MILITARY IN VIETNAM WAR

Tam TN

Department of Environment, Agency of Science, Technology and Environment, Ministry of Defence, Vietnam

Introduction

As a consequence of applications and handling of Agent Orange at US military installations, two sources of dioxin contamination in Viet Nam have been identified:

- + Areas were heavily sprayed with Agent Orange by aircraft,
- + Former US military installations where herbicides were stored, deployed and spilled such as Bienhoa airbase, Danang airbase and Phucac airbase.

Areas were heavily sprayed with Agent Orange

Although there are some differences of research approach but all results affirmed that dioxin contained herbicides usage by US force in Vietnam war cause long time serious effects to human health, ecological system and environment.

From 1961 to 1971, nearly 80 million liters of dioxin contained herbicides was sprayed by the US force in the large areas of over 25,500 communes and 3 million ha of forest, destroyed the ecological system and brought negative effects to around 16 million Vietnamese in both civilian and veterans.

As consequence of dioxin expose due to Agent Orange spraying, many people have been suffering from dioxin-related illnesses, reducing of labour capacity, shortening their life. For their second and thirth generations it brings to the potential risks of abnormal growth in term of the mind and the body. Remedies with these effects are huge facing not only for scientists but also the communities' responsibility to compensate their lose.

Fortunately, almost 40 years after spraying, levels of dioxin found in soils do not retain high levels of dioxin, given years of tropical rains, erosion, etc. The decades and forces of nature have reduced actual concentrations of dioxin in soils when the herbicide was originally dispensed from aircraft during planned spray missions. The analytical results showed that current concentrations of dioxin in soils in most of southern Viet Nam are below international guidelines and do not generally pose a human health concern, event for some areas it is lower than the ones of developed countries which is existing because of industrial activities. This is good news for residents in areas sprayed during the war and for the economic development of Viet Nam. In the fact, most of agricultural, seafood products of Vietnam have been tested strictly to meet the standards of consume markets such as EU, US, Japan....

Former US military installations

Former US military installations in southern Viet Nam (e.g., Bien Hoa, Da Nang, Nha Trang, and Phu Cat) that are referred to as dioxin 'hot spots' have been attracting attention of scientists and community to this day. These sites, where Agent Orange and other defoliant were stored, spilled, loaded onto aircraft, applied by truck-mounted sprayers, etc., thereby effecting a dioxin loading to soils that was significantly higher than that resulting from aerial applications.

The presence of dioxin in the environment in and around former US military sites in Viet Nam is a direct result of storage and use of herbicides by the US and their allies forces, spillage, and from improper disposal of empty herbicide barrels. In fact, huge amount of dioxin contained herbicides was leached into the environment. To prevent negative impacts for human health and environment, most of dioxin contaminated sites have been remedied only by leveling the ground, simple burying or concrete covering without treatment.

By early of the year 2000, Hatfield company conducted to investigate and assess the impacts of residual dioxin to human health and environment based on forecast of high potential contaminated with dioxin sites. From the list of thousand sites which was related to activities of Agent Orange storages, transportation, spray in 2 campaigns namely Ranch Hand (1961-1971) and Pacer Ivy (1970-1972), Hatfield reported persuasively the potential 28 sites of high dioxin contamination. It consists of 19 airports, 9 storages, harbors, stations not include of the cases of crash sites and load jettison sites of spray planes.

These “hot spots, in general, are the most critical sites that must be removed from the exposure profile of the local Vietnamese population. US troops have been out of the country for decades, with many veterans suffering health problems from suspected exposure to dioxin -contaminated defoliants; Vietnamese continue to be exposed on a daily basis, many suffering similar maladies as US veterans.

Due to the chemical stability of dioxins, contaminated lands have potential to expose the general population to dioxin for many decades, well beyond initial aerial applications and spillages during wartime. The dispersion of dioxin into the environment depends on the site’s topographic characteristics, climate, hydrographic and pedologic conditions, in which the main factors are erosion, sweeping away and stick diffusion of molecules moving toward ground water.

From the above analysis it could be provided some remarks as below:

- It is necessary to continue investigation of other sites related to activities of dioxin contained herbicides in Vietnam war.
- High concentration of dioxin in soil in former US bases and specific run-off areas in their vicinity do remain a serious problem requiring interim measures to prevent dioxin removal into the environment while waiting for a long- term plan clean-up, which needs international financial assistance.
- Environmental monitoring plan conducting at “hotspot” is urgent need in both of scientific and practical aspects in term of environmental rehabilitation, sustainable social-economic development.

In the first phase of overcoming the toxic consequence used by US in the war, Vietnamese authorities have investigated, assessed the impacts of dioxin at some hot spots as well as make progress some measures to prevent temporary dispersion and mitigate the harmful effects of dioxin to human health and environment.

The researched results in some hotspot such as Bien Hoa (Dong Nai province), Da Nang (Da Nang city), Phu Cat (Binh Dinh province) are presented in the Table 1 & 2.

References

- 1.Layne Dwernychuk. Chemosphere 2005; 998-999.
- 2.Layne Dwernychuk. 26th International Symposium on Halogenated Persistent Organic Pollutants-Dioxin 2006.
- 3.Olaf Paepke, Quynh HT, Arnold Schecter. Organohalogen compounds 2004; 3702.
- 4.Orians, G.H. Pfeiffer, E.W. Science 1970; 168:544.
- 5.Schecter, A.2001. J Occup Environ Med 2001; 43: 435–443
- 6.Stellman, J.M. Health Perspects 2003; 111: 321-323.
- 7.Wayne Dwernychuk. Nature 2003; 422:681-687.

Table 1. The characteristics of climate, hydrography, pedology and interim measures to stop dioxin removal at 3 hotspots.

N ^o	Site	Characteristics of climate, hydrography, pedology	Trend of dispersion	Suggested interim remediation
1	Bien Hoa airport (Dong Nai)	<ul style="list-style-type: none"> - Tropical, monsoon, subequatorial climate - Rainy season: May - Nov. - Dry season: Oct. - next April - Annual average temperature: 27^oC - Annual average sunlight hours: 2,387 hours - Annual average rainfall: 1,870 mm - Annual average humidity : 80% - Acid soil, exhausted, sand mix, poor nutrition, low humus (pH: 4-6) - Uneven terrain, random level, unclosed land 	<ul style="list-style-type: none"> - Existing 2 areas of high contamination in storage and South-Western oriented regroupment sites - Dispersion in both of depth and width - Sweep along following the natural watershed in the region - High capacity of dispersion into the resident area by going to sewage system 	<ul style="list-style-type: none"> - Building up the surrounding ditch system, isolate the contaminated area - Burying the highest contaminated areas by hazardous waste treated technologies - Testing measures of biological disintegration and indigenous tree plant to reduce erosion. - Environmental monitoring plan need to conduct at related to dioxin contained herbicides - Building up the filter sewage system, collect and treat the water flows through the isolated area before discharging to city's sewage system.
2	Da Nang airport (Da Nang city)	<ul style="list-style-type: none"> - Tropical, monsoon climate - Rainy season: Sep-Dec. - Dry season: Jan.- Aug. - Annual average temperature: 25.5^oC - Annual average sunlight hours: 2,200 hours - Annual average rainfall: 2,400 mm - Annual average humidity : 80% - Average flood: 4 times/year - Main windy directions: North-Eastern and South-Western - Close land, man-made level, partial uneven terrain without rule - Acid and alluvial sand mix soil (pH: 3-7), poor humus, unfair clay content (5-25%) 	<ul style="list-style-type: none"> - Existing 2 areas of serious contamination in the Northern and Southern airport - The isolated contaminated areas far from the resident - Water from contaminated areas was collected naturally into 3 Northern and 5 Southern lakes - Total of dioxin contamination is around 100 square ha in area - Dioxin is dispersed in both of depth and width and accumulated in the ponds, lakes in the area, flowed over into the sewage system of city 	<ul style="list-style-type: none"> - Building the protected wall to separate contaminated and non-contaminated areas - Concrete covering the serious contaminated area - Building the surface water collected system to prevent flow through contaminated area - Building the stirring velocity reduced system of stream flows into dioxin contaminated lake. - Do not use of animal-vegetable system in the contaminated area as source of supplying the food - Limiting the mixing, stirring activities in the lake.

		<ul style="list-style-type: none"> - Limited capacity of erosion - Abundant floristic composition 		
3	Phu Cat airport (Binh Dinh province)	<ul style="list-style-type: none"> - Tropical, wet climate - Rainy season: Oct.- next Jan. - Dry season: Feb.- Sep - Annual average temperature: 27⁰C - Annual average sunlight hours: 2,223 hours - Annual average rainfall: 1,900 mm - Annual average humidity : 79% - Average windy velocity : 3m/s - Annual average rainy days: 105 days - Basalt soil, laterite, pH 4-5, poor humus and clay, limited capacity of erosion. 30m above sea level 	<ul style="list-style-type: none"> -High contaminated areas is of highest altitude of airbase - easily erosion, - Dioxin is dispersed in both of depth and width and accumulated in the lower land. 	<ul style="list-style-type: none"> - Building the surface water collected system to prevent flow through contaminated area - Building the stirring velocity reduced system of stream flows into dioxin contaminated lake. - Do not use of animal-vegetable system in the contaminated area as source of supplying the food

Table 2: Concentration of dioxin in soil at hotpots

<i>No</i>	<i>Places</i>	<i>Dioxin concentration at different depth (ppt)</i>	<i>Volume of soil need to be cleaned up</i>	<i>Note</i>
1	Danang airbase	34,000 (at depth of 0-30cm) 950 (at depth of 120-150cm)	32,000m ² 47,000m ³ (equal.... to 85,000tons)	Remediation needs to reach to 1,5m depth, exclusive of adjacent ponds
2	Phucat airbase	11,400 (at depth of 0-30cm) 500 (at depth of 90-120cm)	15,000m ² 15,000m ³ (app. 27,000tons)	Remediation needs to reach to 1,0m depth, exclusive of low lying fiels
3	Bienhoa airbase	27,500 (at depth of 0-30cm) 500 (at depth of 90-120cm)	43,000m ² 43,000m ³ (app. 74,000tons)	Remediation needs to reach to 1,0m depth