RESEARCH ON LEVEL DISTRIBUTION OF TOXIC ISOMERS 2,3,7,8 – TCDD OF AGENT ORANGE/ DIOXIN IN WESTERN – SOUTH AREA OF BIEN HOA AIRBASE, DONG NAI, VIETNAM

Phung Khac Huy Chu[1*], Pham Ngoc Canh[1], Dinh Ngoc Tan[1], Pham Van Au[1]

Center for Technology and Environmental Treatment, Ministry of Defence *(*Vietnam*).*

Introduction

During the Vietnam War from August 10, 1961 to October 31, 1971, the U.S. military sprayed a total of 74,139,520 liters of herbicides, in which: 43,332,640 liters of Agent Orange; 2,927,600 liters of Agent Green, Agent Pink and Agent Purple; 21,798,400 liters of Agent White and 6,080,880 liters of Agent Blue [2]. Agent Yellow, Agent Orange, Agent Greeen, Agent Pink and Agent Purple contain dioxin (Tetraclordibenzodioxin-TCDD) - the most toxic substance ever known.

Bien Hoa Airbase is one of the military base preparing for chemical air strikes in South Vietnam battlefield, there are currently four dioxin contaminated areas at the airport. Zone 1, that contains Airport South Area*:* with the highest pollution levels 5.8 million ppt-TEQ, Total area: 4,7 ha, uneven level distribution, loWestern depth sampling calculated from soil surface detected dioxin is 120cm higher than allowed standard, humus content ranging from 1.0 to 2.6%, mechanical component is mainly light soil, Unlinked aboriginal soil and formed during the construction process of airports [5]; Zone 2 - South of Airport: contaminated area of 1,0 ha, contaminated depth of 1,0m, dioxin levels (2,3,7,8 TCDD) of 65.000 ppt (TEQ) [5]. Zone 3: pond - Lake area (airport gate II*):* contaminated area is more than 2 ha, mainly sediment (mud) highest contaminated level of 2.200 ppt (TEQ). Zone 4: North - South airport area is newly discovered.

Dioxin in soil sticks to the soil surface and sand so it will not deeply penetrate into the soil. Dioxin in soil is normaly found in soil layers from 0 - 10cm, but is seldom found in soil layers from 10 to 30 cm [7]. Previous Researches on the move of dioxin at Bien Hoa area, Dong Nai showed that dioxin level discreases with depth [9]. The move of dioxin mainly depends on humus level and soil component of grain of soil, that the spread and penetrated level of dioxin discrease when humus level increases [8].

This Research refers servey results of isomer 2 ,3,7,8-TCDD at the area, that is newly discovered dioxin sprayed by American army during the war in Vietnam at Zone 4: Western - south runway belonging to the military base Bien Hoa, Dong Nai, Vietnam. The Research providing pollution characteristics, pollution rule in the Westernern – South area will help us assess pollution status, pollution process and help the administrators make solutions to minimize the pollutantion spread in the area.

Materials and methods

1. Soil sampling method:

Soil is taken according to the regional terrain and pollution status. Take samples at 10 locations in three rows along the pollution area and analyze 31 samples at the different sampling depths (determined by the GPS 76CSx). At the sampling location, soil was taken out from subsoil profile, stored in polyethylene plastic cases, enclosed by dark plastic bags and put in preservation buckets for the last. In this Research, materials is the soil samples taken at different depths including: +40 cm + 100 cm + 150 cm;-25cm-135cm; - 115cm;-200cm. Soil was analysed for 17 dioxin toxic isomers.

2. Sample Analysis

After taking the soil samples, they were dried in air conditions, crushed and sifted through a 1 mm sieve. Then the sample was extracted by soxhlet method in accordance with EPA-8280B and analysed by Gas Chromatography-Mass Spectroscopy (*GC-MS*).

Results and Discussion

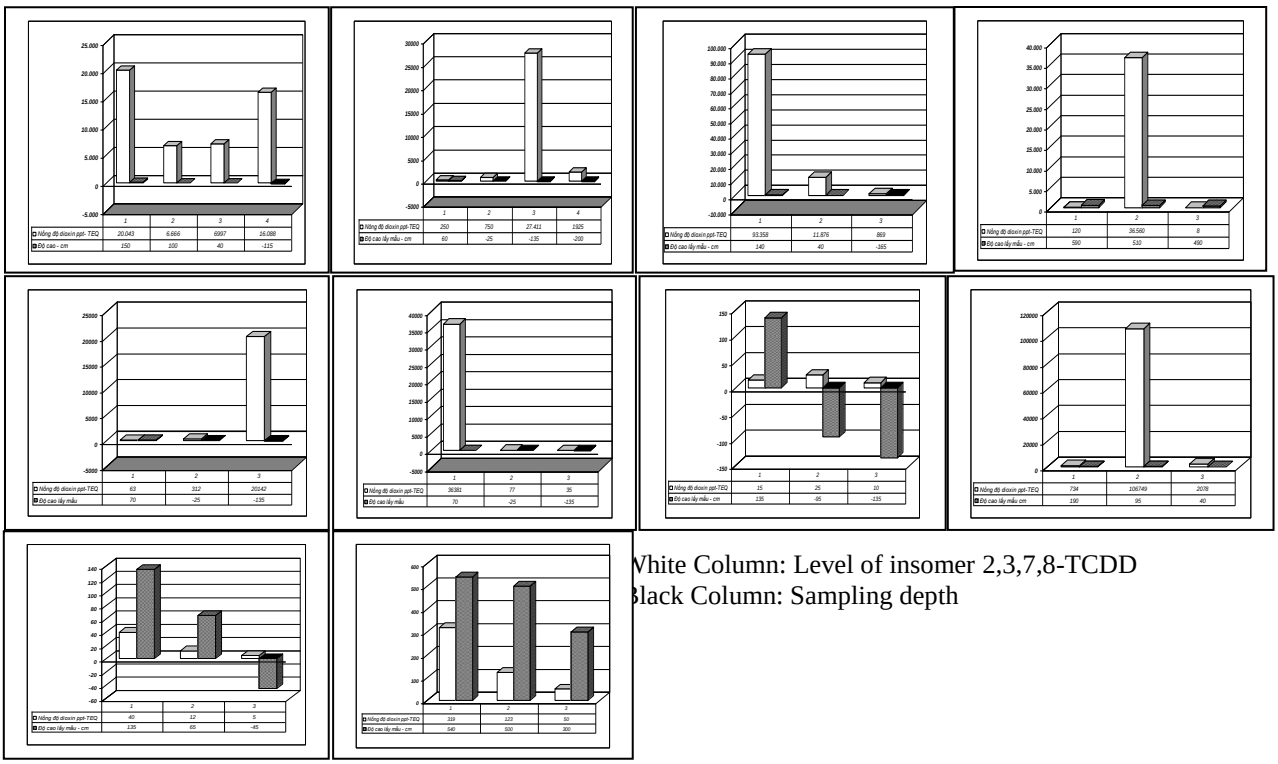
Levels of dioxin in soil at the south-Western of Bien Hoa airbase.

The level of toxic isomer 2,3,7,8-TCDD is given by Table 01

Table 01 : The result table of the indicator analysis at the Research location:

No.	Sampling location	Sampling depth (cm)	Level of 2,3,7,8-TCDD (ppt-TEQ-WHO)	No.	Sampling location	Sampling depth (cm)	Level of 2,3,7,8-TCDD (ppt-TEQ-WHO)
1	**S2**	140	20.043	**6**	**S9**	70	36.381
		100	6.666			-25	77
		40	6997			-135	35
		-115	**16.088**	**7**	**S11**	140	15
2	**S4**	60	250			-95	25
		-25	750			-135	10
		-135	**27.411**	**8**	**S13**	190	734
		-200	1925			**95**	**106.749**
3	**S5**	140	93.358			40	2.078
		40	11.876	**9**	**S14**	540	319
		-165	869			500	123
4	**S6**	590	120			300	50
		510	36.560	**10**	**S15**	135	40
		490	8			65	12
5	**S8**	70	63			-45	5
		-25	312				
		-135	20.142				

Describing diagrams of level fluctuation of isomer 2,3,7,8 -TCDD in depth (From the results Table 01)



White Column: Level of insomer 2,3,7,8-TCDD
Black Column: Sampling depth

The table and diagram above show that the highest level of insomer 2,3,7,8-TCDD at this area (until to Research point) is 106.749 ppt-TEQ (the Research continues in this area) in the sampling depth of 95cm. The loWestern sampling depth detected isomers is 135cm at 27.411 ppt-TEQ. So, dioxin contamination in this area does not comply with the Rule that contaminants move from top to bottom. In this case, contamination level fluctuate between the sampling depths of the subsoil at the sampling points. At the S2: sampling depth : 140 cm, level of insomer: 20.043 ppt-TEQ; sampling depth : -115cm, level of insomer:16.088 ppt-TEQ. In the depth of 40cm and 100cm, the level of insomer is lower, but many times higher than allowed . At the S13 (the distance between S2 and S13 is 30m): sampling depth*:* 95cm, level of nsomer: 106.749 ppt-TEQ, but in the 190 and 40 cm depth, the level of insomer is much lower. This occur similarly at ch many points such as S5, S6, S8, S14 …

When comparing the dioxin levels at the same sampling depths at different points, heterogeneity of the dioxin distribution in the Western – South Bien Hoa airport is showed.

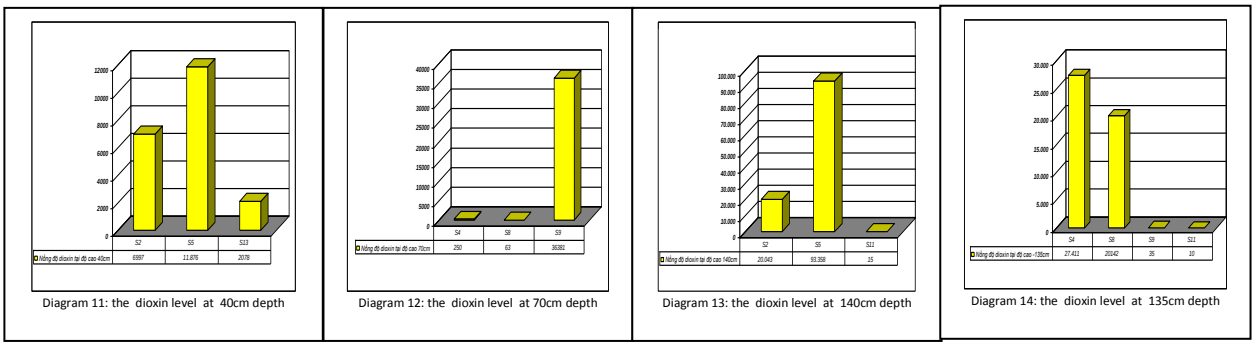


Diagram 11: the dioxin level at 40cm depth

Diagram 12: the dioxin level at 70cm depth

Diagram 13: the dioxin level at 140cm depth

Diagram 14: the dioxin level at 135cm depth

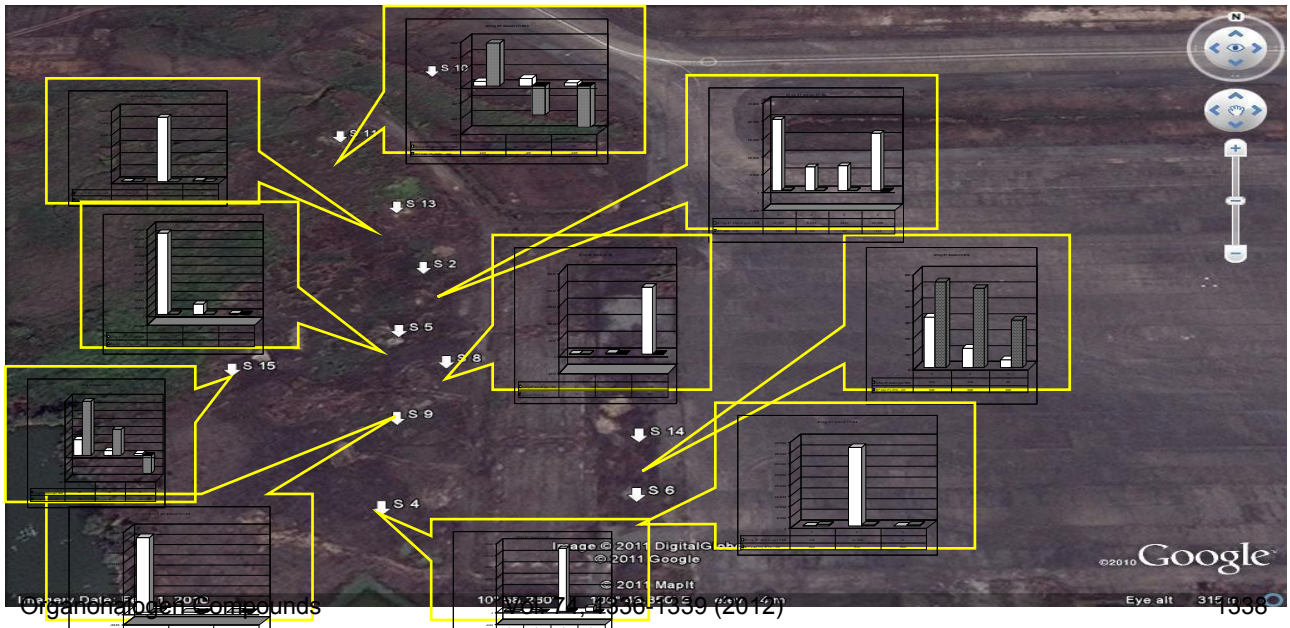
Note: The yellow column: levels of isomers 2,3,7,8-TCDD at the same sampling depth.

The diagrams 11, 12, 13, 14 show that the distribution of insomer 2,3,7,7-TCDD in the same depths at the sampling point is very different.

From the above research results, The conclusion is as follows*:*

1. The contamination level of dioxin in soil at the Western - South Bien Hoa airport is quite high, the level of insomers 2,3,7,8-TCDD analyzed in the study point is 106.749ppt-TEQ that 100 times higher than Vietnamese standard (TCVN-8190).
2. The levels of dioxin in soil have abnormal movement at the different sampling depths as well as at the same sampling depth and between sampling points.

Picture 1: Sampling point and level distribution of insomer 2,3,7,8-TCDD



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