

DETERMINATION OF PESTICIDES IN THE AIR OF CHEMICAL WASTE SITE

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Introduction

During the 60ties and 70ties agriculture in Latvia, similarly to other world countries, was known by use of a huge amount of plant protection chemicals containing persistent organic pollutants (POP), such as notorious DDT and toxaphene. POPs are among the most dangerous human made environment pollutants what cause such irreversible consequences as inherited dangerous, cancer, allergies, depressed immune system etc.

At the moment use of POPs in Latvia, as well as the majority of the world's countries, is prohibited but unutilized supplies of pesticides are either being collected and stored in specially established sites for hazardous waste or extinguished. There are two sites for hazardous waste in Latvia – Kņava and Gardene. At the moment more than 1860 tons of hazardous waste are being kept there, including 200 tons of DDT, 5 tons of toxaphene, 170 tons of lindane and more than 200 tons of pesticide mix which contain lindane and DDT. Therefore is necessary to make POPs air monitoring there.

The aim

To evaluate the level of hlorganic pesticides pollution in toxic waste site work environment, what can be excreted in the air from plant protection means that are being held in the sites.

Materials and methods

The air samples were collected in the workers' breathing zone by personal pumps. The air samples are taken stationarily as well, in the sites next to the shelves where chemical substances are being held in locked barrels. Accordingly with state of aggregation of a matter and the conditions of the method of matter determination, the vapor and gasiform matters of agents existent in the air of work environment were caught and concentrated on activated carbon (SKC Charcoal tubes) but aerosol particles – on Millipore filters (polyester with pore size 0.4 µm). Activated carbon pipes were joined to filter cassettes in order to ensure all pesticide sorption. Three parallel air samples were taken in one place so that the results were statistically valid.

The obtained data were extracted in hexane and analyzed with the method of gas chromatography using electron capture detector. The sensitivity of analytical method depends on the aspirated air volume and varies in range 0.1 – 7 pg/m³.



Image 1 SKC Charcoal tubes



Image 2 Millipore filters

The results

Total 45 samples from 13 warehouses have been analyzed. Presence of nine pesticides was obtained: 4,4 – DDT; 2,4 – DDT; 4,4 – DDD; p, p – DDE; dieldrin; heptachlor; α, β and γ-hexachlorocyclohexane. In nine warehouses of thirteen the concentration of pesticides was under determination level of the method. In others sites permitted to identify and quantify α- hexachlorocyclohexane (2 ng/m³ – 480 ng/m³) and γ- hexachlorocyclohexane (1.1 ng/m³ – 70 ng/m³). Also heptachlor (890 ng/m³) and 4.4 DDT (1180 ng/m³) was only once found. Concentration of the others pesticides were under the levels of quantification of the method.

Warehouse No.	Chemical substance	Concentration, ng/m ³
1	α - hexachlorocyclohexane (α-HHCH)	2.0 ± 0.5
	γ - hexachlorocyclohexane (γ-HHCH)	1.1 ± 0.3
2	α - hexachlorocyclohexane (α-HHCH)	3.4 ± 0.8
3	α - hexachlorocyclohexane (α-HHCH)	0.13 ± 0.03
	γ - hexachlorocyclohexane (γ-HHCH)	1.2 ± 0.3
	heptachlor	890 ± 180
4	α - hexachlorocyclohexane (α-HHCH)	0.79 ± 0.16
	4,4-DDT	1180 ± 240
5	α - hexachlorocyclohexane (α-HHCH)	480 ± 90
	γ - hexachlorocyclohexane (γ-HHCH)	70 ± 10

Notes:
Heptachlor occupational exposure limit 0.5 mg/m³, Recommendation of NIOSH;
4,4-DDT occupational exposure limit 0.1 mg/m³, Regulation of the Cabinet of the cabinet of Ministers No. 325/2007 "Work safety requirements when working with chemical substances";
No exposure limit for α-hexachlorocyclohexane and γ-hexachlorocyclohexane.

Image 3 Results



Image 4 Warehouse for hazardous waste

To reduce the potential workers exposure to hazardous chemicals in pesticides sites is necessary to observe the following safety and health measure:

- Acting with hazardous chemicals and containers in which they were packed workers should protect respiratory system to avoid the possible inhalation of the substance by using personal protective equipment.
- Exclude chemical substances direct contact with the skin, as these chemicals is readily absorbed through the intact skin, workers should use appropriate protective gloves.
- Precautions are strictly observed by all personnel (including transport workers), but not the only employees who perform direct manipulation with chemicals.
- Regularly educate employee about work safety and health issues, including measurments results presentation.
- Strictly monitor employee personal hygiene practices in dealing with hazardous chemical waste;
- For more complete assessment of pollution levels should carry out chemical concentration measurements in different seasons.



Conclusions

1. Pollution of pesticides was found just in four chemical waste sites from thirteen. The concentration of pesticides what were found is insignificant and can be measured in micrograms and nanograms on cubic meters of the air.
2. The employees must use personal protective equipment (respirators, gloves, special clothing) because the pesticides found in the sites are very dangerous, they can be absorbed through skin and thus the employees seriously risk their health.