

## SOIL CONTAMINATION BY ORGANOCHLORINE PESTICIDES IN THE REPUBLIC OF ARMENIA

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At present in Armenia there function 39 objects/facilities for storage and sales of pesticides, which do not correspond to the sanitary-hygienic requirements.

The pesticide burial is located in Artashat region, where in 1980s great stocks of DDT were buried. In the vicinity of the burial summer houses and mansions were built. The burial itself is not shut in; the ring-shaped concerted trench for removal of rain waters is partially destroyed. As a result, rain-waters can freely penetrate into the deep layers of the burial and contact pesticides.

With the aim to fulfill environmental monitoring soil samples were taken.

The analyses were performed by means of gas chromatography. Mean samples were taken from the areas adjoining pesticides store-houses, burial and agricultural lands from Ararat, Armavir, Aragatsotn, Tawush regions.

The results of the study signify that soil samples taken from the territory of pesticides store-houses were more contaminated. The residue level of organochlorine pesticides made: DDT – 0-20 mcg/kg, DDE – 0-5.08 mcg/kg, DDD – 0-2.1 mcg/kg, heptachlor – 0-3.7 mcg/kg, HCH – 0-12.6 mcg/kg, lindane – 0-3.0 mcg/kg.

Despite the fact that no DDT was imported to Armenia, our analyses demonstrate that DDT is used and the revealed residues signify to the fresh soil contamination.

Before 1990, the import and application of pesticides were centralized in Armenia. Annually, on the average, 30-40 names of pesticides were brought into the country, including 5-6 organochlorine pesticides.

Despite the prohibition to use DDT and hexachlorocyclohexane (HCH) since 1971 and 1980, appropriately, the importation thereof continued. DDT was brought until 1980, while HCH was imported till 1985. The amounts obtained were supposed for use in case of special indications.

In Armenia, pesticides were used for stockbreeding, poultry-keeping, plant protection in public health, in household chemistry, and in production of insecticides.

Since 1990, import and application of pesticides in Armenia became non-centralized; only the amounts of pesticides, previously cumulated at the special storehouses, were used. Therefore, during our study that was performed at the former storehouses no pesticide residues were found. At the same time, non-specialized (illegal) import and application cannot be excluded.

The preliminary assessment of environmental pollution/contamination due to organochlorine pesticides was performed in order to analyze the previous and current situation on import and application of pesticides in Armenia, as well as contamination of foodstuffs and environmental objects by pesticides.

Basing on the results of preliminary evaluation, in order to reveal the situation in concern of soil contamination by organochlorine pesticides in Armenia, we performed the sampling and study of soils in marzes (regions) and communities of Armenia.

Residues of DDT, DDD, DDE, Hexachlorbenzene, lindane, aldrin, dieldrin, and heptachlor were determined in the samples tested.

The analyses were performed in certified laboratories by means of gas chromatography. The areas subject to study were identified basing on the results of preliminary assessment of contamination.

Conditionally, the areas under study were divided into:

- More contaminated areas of Armavir, Ararat, Kotaik regions;
- Contaminated areas of Vaiotsdzor, Siunik, Aragatsotn regions;
- Clean (non-contaminated) area of Gegarkunik region.

The region of Gegharkunik tentatively can be considered a non-contaminated area, as at the agricultural farms of this region pesticide application was limited, whereas the use of organochlorine pesticides was prohibited in concern of Sevan Lake protection and conservation.

Sites for soil sampling were conventionally divided as follows:

- evidently (visually) contaminated lands;
- territory of former store-houses of agrochemicals, functioning shops, where the pesticides are sold;
- implicit contamination of territory (gardens, fields, and sown areas)

Samples from the visually contaminated sites were taken from the depth of 10-15 cm from the surface layer. From the territories of implicit contamination sampling was performed at the depth of 10-25 cm. Soil sampling at the arable lands was done mainly from the ploughed fields, at which due to the natural climatic conditions the depth of the topsoil was pre-defined and made, as a general, 20-25 cm. On the territory of gardens and fields, the depth of 15-20 cm was chosen for sampling. Samples were taken at the test fields and sites chosen by us.

From the test territories, 10-20 initial (one-time) samples were taken. Then, by means of “quartering” procedure, the mean/ average sample was formed and, further on, analyzed at the amount of 0.5-1.0 kg.

From some territories of the regions of Armenia, 170 average soil samples were taken. In the samples taken from the evidently/visually contaminated territories, from the territory of former storehouses of agrochemicals and pesticide shops the following residues were revealed:

DDT	in the range of 0.467 – 40.310 mcg/kg
DDD	- 1.067 -0.973 mcg/kg
DDE	- 0.314 – 10.039 mcg/kg

HCH	-	0.296 -12.682 mcg/kg
Lindane	-	0.249- 7.086 mcg/kg
Hexachlorbenzene-		0.061-13.992 mcg/kg
Heptachlor	-	1.611 – 3.677 mcg/kg

According to data obtained, it is possible to suppose that, despite the prohibition to use DDT and HCH, the amounts of these pesticides stocked at the storehouses were continually used.

Amounts of DDT (0.694-5.496 mcg/kg) detected in tested samples taken from the territory of pesticide shops signify to the probability of DDT illegal import and use.

In the tested soil samples taken from the implicit contaminated territories (gardens, sown areas) aldrin was revealed in one sample from Kotaik region.

Heptachlor detection percent ranged from 42 to 78; the amounts revealed made 0.269-1.444 mcg/kg. The highest level was determined in Aragatsotn region.

Highest levels of DDT were revealed in samples from the towns Armavir (40.310 mcg/kg) and Echmiadzin (8.320 mcg/kg). The content of DDE in tested samples made 0.067 – 10.039 mcg/kg. DDE was revealed at 0.002 – 1.039 mcg/kg, HCH at 0.002 – 12.682 mcg/kg, Lindane at 0.076 – 7.086 mcg/kg, Hexachlorobenzene at 0.063 – 13.992mcg/kg.

In the samples from marzes (regions) of Vayots Dzor and Siunik polychlorinated biphenils were found at the level of 42.072 – 72.351 mcg/kg.

In samples of soil from the territory of pesticide shops, the following residues were revealed: Heptachlor was found in the range of 1.611 – 2.758 mcg/kg; DDT at 0.694 – 5.496 mcg/kg, DDE at 0.328 mcg/kg, DDD at 1.067 mcg/kg, Hexachlorocyclohexane at 0.006 – 3.502 mcg/kg, Lindane at 0.64 – 1.512 mcg/kg, Hexachlorobenzene at 0.460 – 1.842 mcg/kg. The soil from the territory of pesticide shops was less contaminated as compared to the territory of storehouses.

DDT detection percent was 42-89; the revealed amounts made 0.244-5.557 mcg/kg, while the highest levels were found in Armavir region.

DDD detection percent in the tested samples reached 46-78 %, while the revealed quantities summed up to 0.672-2.965 mcg/kg. The highest levels were detected in Aragatsotn region.

DDE detection percent in the tested samples was the lowest and made 11-30 %. The revealed residual amounts ranged from 0.062 to 1.037 mcg/kg.

Low detection percent and the residual amounts revealed in the samples signify to the fact that previously used quantities of DDT, after degradation, turned into the end product, i.e. into DDD.

Thus, a conclusion is drawn that the illegal use of DDT continues in Armenia.