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Chapter 2

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Problem of Pesticide Dumps in Poland in the Beginning of XXI Century

Pesticides are toxic chemicals for fighting against various diseases and pests. Many of them are carcinogenic, teratogenic, embryotoxic, and mutagenic. Expired or not used, they become very dangerous wastes, that when improperly stored, penetrate in uncontrolled way to the natural environment making the threat for all living forms. Therefore, the Sophia Declaration was created to underline the negative influences of durable organic pollutants, useless plant protection means, and other substances unsafe for human, environment, animals, and natural resources conditions such as ground waters or soil, and to emphasize the economic results related. The Declaration stresses the accelerating activities to remove above mentioned pollutants and appeals to governments and local organizations that removal of useless dangerous substances was a priority. It also turns to European Union and other sponsors to support domestic initiatives that introduce strategies of removal the durable organic pollutants, useless plant protection means, and other dangerous substances.

The past years remained dozens of thousands of tons of pesticide wastes that have been stored since 1950's. Such large amounts of reserves were collected mainly in 70's when, due to ecological and toxicological reasons, many of them were withdrew from markets and banned in agriculture. Improper management of plant protection means, their wrong distribution, and uncontrolled export also contributed to such situation. Part of means remained at stores, while another was placed in dumps, the building of which started around 70's in a form of wells of 3-4 m depth and constructed from concrete circles of 1-3 m diameter or as brick constructions that, after filling, were buried with 0.5 m ground layer. According to assessment made by Ministry of Environment Protection, with the beginning of XXIst century the total weight of pesticide wastes in Poland could reach even up to 60 thousand tons. It has been documented that ten thousand tons of hazard substances, including highly toxic DDT, has been collected in about 340 dumps. An exact amount and composition of stored pollutants has not been recognized yet.

Institute of Plant Protection in Poznań in cooperation with regional Inspectorates of Environment Protection and Plant Protection began with the end of the XXth

century to catalogue the existing dumps revealing 133 ones localized in 19 among 49 former voivodeships. The largest quantities of wastes were found in former Szczecin, Koszalin, Bydgoszcz, and Toruń regions. Up-to-date control of technical status of dumps indicated the worst situation in eastern Poland. There were 10 dumps and 13 pesticide storehouses within former Białystok region, whereas only 2 such places were revealed in reports of Regional Inspector of Environment Protection by 1998. In total, 42 tons of wastes, including 6 tons of empty packages, were stored there. The dramatic situation can be also observed in former Szczecin voivodeship, where most of waste dumps were localized within flood-threatened areas. Reservoirs near Wejherowo have threated the ecological disaster in former Gdańsk region.

When designing the dumps in the past, no long-term effects of their exploitation have not been taken into considerations. Hydro-geological conditions, characteristics of adjacent area, nor environmental factors have not been taken into account, and no geological survey was performed, which made they settled on geological structures of great permeability, and sometimes just on water-carrying layers. Polish National Sanitary Inspection control revealed that 1/3 of dumps did not meet the localization conditions, because they were built less than 300 m from water intake points, water reservoirs, and agricultural areas. At least 75 dumps were situated near lakes and rivers, 100 ones were just besides drinking water intake points, and about 140 near living areas. A dump was even discovered in Chorzowski Entertainment Park. Nevertheless, storehouses within former PGR's were the greatest threat. They usually form ground holes with no protection, control, and supervision. Their technical condition were and still are dramatic. Toxins and poisons were emitted into the natural environment: soil, water, and air. Ground and surface waters around dumps, mainly underground water reservoirs, have been contaminated. Therefore, chemicals penetrate the water-carrying layers, often making serious threat for human and animal health, e.g. in former Kalisz region (Jaraczewo and Młynów).

Types of dumps

Wrong plant protection means management in 70's of the 20th century along with their excessive production caused the accumulation of expired agents. Expired pesticides were most often deposited in concrete underground reservoirs. Their size and localization greatly varies. Most of them were not adapted for storing dangerous wastes. Sealing that had to protect dumps against toxic leakages, was not sufficient enough or even lacking. Dumps were sealed with tar or cement . Considering their construction, dumps can be divided into 3 main types:

1. Ground dumps (Fig. 1) – that are extremely dangerous; they are usually small in size, although there are also large objects, e.g. in Tworzymirki-Gaj or Lisie Kąty. Ground dumps as the stores of expired pesticides can be met mainly in southern Poland.
2. Well circles (Fig. 2) – they are of 3 ÷ 5 m depth and 1 ÷ 5 m diameter; concrete reservoirs are also counted to that type.
3. Military bunkers (Fig 3) – also former military objects or other installations (fodder silos) are used as dumps.

Figure 1. Ground dumps in Folwarki Tylwickie © K. Ignatowicz

Figure 2. Well circles © K. Ignatowicz

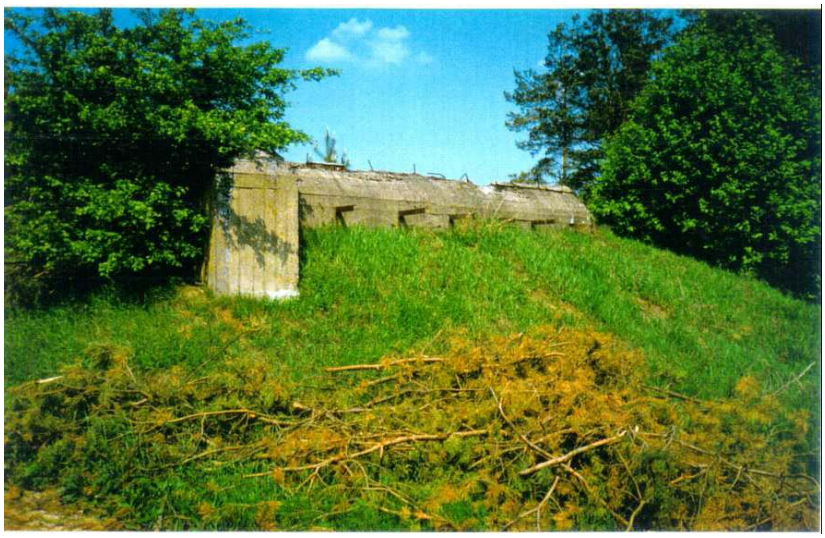

Figure 3. Military bunkers in Słochy Annopolskie © K. Ignatowicz

Technical status of dumps is dramatic. Those, that are wrongly built, do not play their roles as safe waste storehouses. Hence, they are often referred to as “pesticide bombs” or “strike-forth bombs”. The name also derived due to constructional errors and applying improper materials vulnerable to corrosion and erosion. Areas where burial dumps are localized, are not appropriately protected. Fences made along with them have been damaged. Only small number of warning boards or more often pesticide odor in sunny days prove the dump localization.

Figure 4. The dump in Folwarki Tylwickie © K. Ignatowicz

Depending on the structure and localization of dumps, five toxicity categories can be distinguished:

I – dumps of the 1st type, i.e. ground storehouses that do not equipped in any water insulation,

II– dumps the localization of which during de-sealing threats to water intake points and surface waters; dumps situated on wetlands or flood-threatened areas can be also counted to them,

III – those dumps that are not counted within categories I and II. They are characterized by soil and underground waters contamination due to expired plant protection means stored in their vicinity,

IV – dumps of the 3rd type, i.e. in a form of military bunkers,

V – other dumps.

Plant protection means that were removed when expired as well as packages are the most often substances found in dumps. Wrong storing management and central economics in 70's and 80's of the 20th century led to the accumulation of enormous amounts of expired, unused, and removed pesticides that were subsequently deposited in dumps. The situation improved when pesticide production was not subsided, which reduced excessive purchase, and high prices made the pesticide management more economical and efficient.

Considering the pesticide waste management, Poland is exceptional in Europe. Despite of the fact that less than 1 kg of biologically active substances is applied per 1 hectare of crops in Poland, reserves of substances withdrew from markets are almost the largest in entire Europe. Problem of useless and expired pesticides results from many years of wrong management and improper distribution system. A central distribution system along with low prices for pesticides in 1950-1970 led to the accumulation of expired agents that at present are a group of dangerous wastes that are stored in dumps and storehouses. Quantity of pesticide wastes in Poland is estimated for about 60 000 tons, including 10 000 tons deposited in about 350 underground reservoirs within whole state, while in Lithuania, there are about 2 200 tons of pesticide wastes in 954 stores, Moldova about 874 tons, and whole Africa about 20 000 ton.

Among pesticide deposited in Poland, chloroorganic and phosphoorganic insecticides, carbamates, dinitrophenols, phenoxy acids, S-triazines, and mercury-organic compounds are most frequently found (Fig. 5). The percentage of particular groups in the total volume of stored pesticides varies. However, it can be as follows: about 30% – chloroorganic plant protection means, 15% - phenoxy acids, and 14% - inorganic substances. Probably, DDT makes up 50% of the total quantity of chloroorganic compounds, whereas chlorinated camphenes – about 11% and diene derivatives - 5% (Fig. 6). Total weight of biologically active substances, in the case of chloroorganic pesticides, was estimated for 130 ton. Analysis of the forms of stored chloroorganic agents revealed that 20% of them are liquids, 75% powders, and 5% other forms.

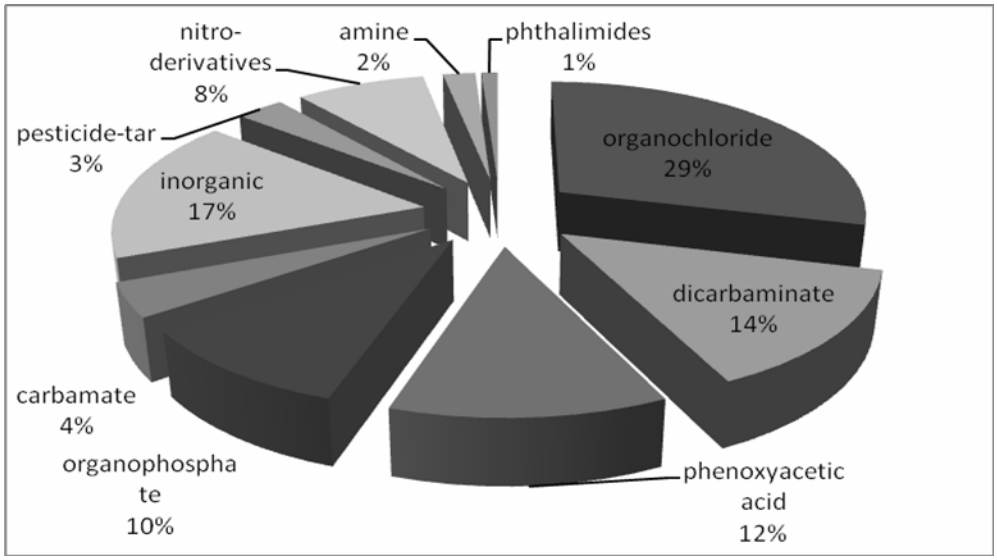

Figure 5. Pesticide waste composition in dumps

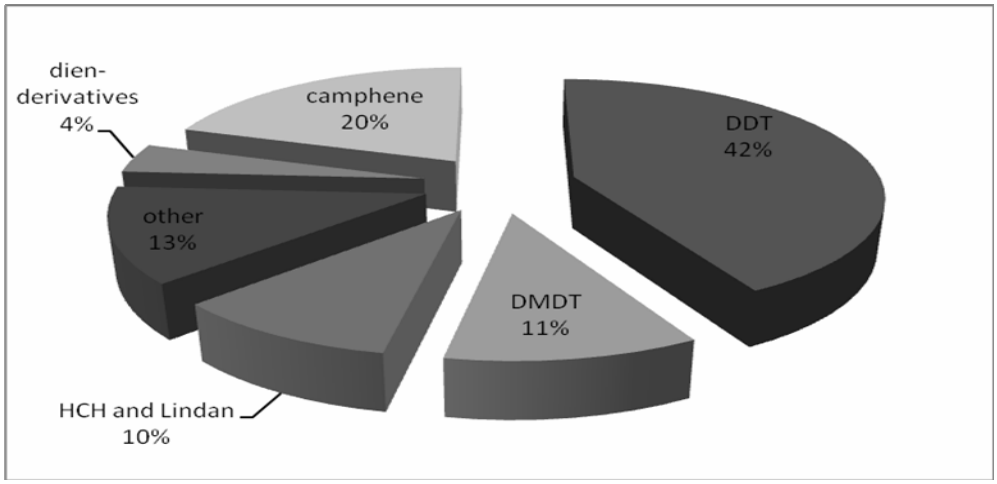

Figure 6. Chloroorganic waste composition in dumps

Dumps cataloguing

The interests in dumps as objects dangerous for natural environment arose in 90's of the 20th century. It suddenly appeared that part of those objects are forgotten, and administration transformations in 70's caused the technical documents and documents on liquidation of expired plant protection means were lost. As an effect, undertaking the works upon cataloguing of dumps and assessing their influences on soils and waters became necessary.

Table 1

Dumps in Poland in 2005

L.p.	Region	Dumps in 2004		Dumps in 2005		Dumps liquidated in 2005	Inspection in 2005
		Ground dumps	Well circles and bunkers	Ground dumps	Well circles and bunkers		
1	dolnośląskie	0	7	0	7	1	4
2	kujawsko-pomorskie	0	17	0	15	2	4
3	lubelskie	0	0	0	0	0	0
4	lubuskie	0	0	0	0	0	0
5	łódzkie	5	17	5	16	1	4
6	małopolskie	20	1	20	1	0	0
7	mazowieckie	2	10	2	10	0	2
8	opolskie	0	2	0	2	0	2
9	podkarpackie	0	1	0	1	0	1
10	podlaskie	0	5	0	3	2	2
11	pomorskie	0	4	0	4	0	2
12	śląskie	1	5	1	5	0	1
13	świętokrzyskie	0	0	0	0	0	0
14	warmińsko-mazurskie	0	17	0	7	10	0
15	wielkopolsie	2	12	2	12	0	0
16	zachodniopomorskie	0	27	0	27	0	2
	Total	30	125	30	110	16	24

First cataloguing works were made by National Inspection for Plant Protection in 1993. In 1994, cataloguing of dumps and storehouses containing expired plant protection means along with the filed inspections and detailed studies upon selected and most dangerous objects, began. In 1998-1999, 108 controls of particular dumps were performed by the Inspection, and they were summarized in a form of reports and directives that referred to: cleaning up the dump surroundings (cutting the grass, fixing the fences, and marking the area), making the technical analysis related to their tightness and performing the surveys of soils and waters using piezometers.

According to National Plan for Wastes Management, since 1965, there have been 340 dumps in Poland with deposited expired plant protection means. Although that number is not complete. The largest dumps were localized in that part of Poland where National Agricultural Farms (PGR) dominated, and for which plant protection means were sold at very low prices. It has been estimated that total amount of poisonous substances deposited in those dumps reached even up to about 10 000 tons. That value is not precise because of the lack of full documentations of dumps. Furthermore it has been estimated that almost 800 "unofficial dumps" accumulated at least 12 000 tons of dangerous substances. No attempts to detailed analysis of the quantity and composition of all dumps have been made yet. Information in Table 1 upon dumps in Poland presented for particular regions would allow for more detailed data on dumps containing dangerous substances. Some voivodeships solved the problem of dumps (lubuskie, lubelskie), although large number of such objects still remains unremoved.

Dumps in Podlasie region

Useless plant protection means and their packages are very important problem also in Podlasie region that covers 20 480 km^2. According latest data, there are 10 dump in the region (including 5 during liquidation process and 13 identified storehouses) where 27 tons of useless plant protection means are accumulated (plus empty packages). Dumps in Słochy Annopolskie and Wąsocz were liquidated in 2001, in Anusin – in 2003, and in Zbójna-Dębniki – in 2004. The wastes were transported to waste combustion plant Lobbe in Dąbrowa Górnicza. In total, about 139 tons of wastes were neutralized. Dump in Nowy Dwór was liquidated in November 2005. Plant protection means along with their packages (1.60 Mg) were transported and neutralized by Przedsiębiorstwo Projektowo-Wdrożeniowe "AWAT" Ltd., Warsaw. After waste removal, the place was cleaned up and the entrance was bricked up. Total quantity of 182 Mg of toxic wastes were stored in dump in three military bunkers connected with tunnels. That dump was liquidated at three steps. The last step was realized in 2001 by transporting 21.621 Mg of wastes to waste combustion plant (AGR) in Germany.

Table 2

Clean-up of dumps in Podlasie

L.p.	Dumps liquidated	Liquidated waste gross (Mg)	Liquidated waste net (Mg)	Year
1	Grajewo (Wąsosz)	182	151	2001
2	Słochy Annopolskie	44	40	2001
3	Anusin	57	51	2003
4	Dębniki (Zbójna)	139	-	2004
5	Nowy Dwór (Bielany)	1,60	-	2005

Only 5 dumps remained within Podlasie region (Tab. 3). According to estimations, about 13.9 Mg of dangerous wastes are stored there. Due to the lack of credible data on the quantities to be removed, it can be accepted that the amount of wastes deposited in these objects can be even by 50% higher, which is associated with not recognized constructions of dumps.

Table 3

Dumps in Podlasie

Lp.	Dump	Waste (Mg)
1	Baciuty	7,0
2	Folwarki Tylwickie	5,0
3	Ryboły	0,3
4	Łapy	1,3
5	Majdan	0,3

A total amount of expired pesticides in Poland is estimated for about 60 000 tons. The stuff of the Environment Protection Ministry claims that building modern storehouses, where contents of existing dump could be transferred to, would be the best solution. At present, dumps are in practice "ownerless", despite of the fact that they are under legal management of three ministries: agriculture, environment, and health. In future, works aiming at not only liquidating the old dumps, but also at protecting the area in such a way not to allow pesticides present within soil, concrete, and other elements for migrating into the environment, should be undertaken. Therefore, there is a need to search for methods to reduce pesticide migration to the environment and incorporate new concepts. Thus it is purposeful to perform studies upon the application of sorption process on selected natural and waste materials as the shield for penetration of pesticides and metals (as pesticide constituents) into the environment, and to reduce their migration from other pesticide burial sites and stores. Phytoremediation on energetic plants was additional element that should limit the contaminants migration. The success of phytoremediation depends mainly on the properly selected plant species. Desirable features making possible to apply a given plant are: fast growth, producing large amounts of biomass in short time, developed root system, higher tolerance to pollution, great ability to accumulate toxins in above ground parts, resistance to diseases, pests, and weather conditions. All above requirements are met by energetic plants, the representative of which if Virginia mallow (*Sida Hermaphrodita* Rusby). This species does not require special soil conditions, thus its cultivation may be performed on chemically contaminated areas where production of consumption plants is not necessary. Virginia mallow is utilized for energetic purposes as the fuel, for chipboards and compost production.

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