

PRODUCTION OF CHLORINE AND CHLOROORGANIC COMPOUNDS IN THE GDR: ECOTOXICOLOGICAL CONSEQUENCES

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Abstract

The preliminary results of a case study "Halogenated organic compounds in the GDR" presented here, is the first publication of production and emission data of these group of substances in the GDR.

Introduction

Halogenated organic compounds are - as no other chemical class of substances - suitable for a demonstration of the anthropogenic load in the ecosphere. They are produced in large quantities and tend to accumulate to great extent. Furthermore they have a variety of toxicological properties. Therefore there are for certain compounds limits, for instant for food and feed and drinking water. These media thus have to be controlled regularly and the results of these investigations reflect the degree of the application of these substances in the territory considered. Less well known are the consequences of accidents, spills and the situation in highly contaminated sites.

Owing to politically motivated secret orders the input of halogenated hydrocarbons into local and regional ecosystems has never been measured systematically. We try to reconstruct this input by using contamination data. In doing so we summarize the halogenated hydrocarbon content of soil, pedological and geological underground, surface- and groundwater, fish, plankton, vegetable and animal food, birds of prey and human lipids. Most of the data were obtained by communal authorities of hygiene and veterinary medicine. Here we present the first results about the production of organochlorine compounds in the GDR.

Results and Discussion

During the eighties 400 000 to 600 000 t of chlorine have been produced in the GDR. The atmospheric emissions amounted to more than 1 % of the amount produces. Most of the chlorine was used for the production of light volatile halogenated hydrocarbons, mainly vinyl chloride and di-, tri-, and tetrachloromethane, chlorobromomethane and chlorinated ethanes and ethenes and

fluorochlorohydrocarbons. Additionally up to 1980 it was used for the low volatile chlorinated hydrocarbons like DDT, HCH (BHC) and PCB.

In the GDR the production of light volatile halogenated hydrocarbons concentrates mainly in the large chlorine producing chemical plants Chemiekombinat Bitterfeld (CKB), the Chemische Werke Buna (production of vinyl chloride and solvents) and Nünchritz (fluorochlorohydrocarbons) as well as VEB Berlin-Chemie (chlorobromomethane). The main amounts in CKB come from the chlorination of methane, 34858 t of a mixture of chlorinated methanes were produced in 1989 (mainly dichloromethane). The same enterprise in 1989 produced or processed 10486 t of tetrachloroethane 8500 t of monochloroethanes and 1480 t of tetrachloromethane. Hereby 830 t of solid wastes were produced consisting of a mixture of hexa-, penta- and tetrachloroethanes and which were disposed of at a landfill in the immediate vicinity of two communities. In 1989 about 200 000 m³ per day of wastewater with 3.9 to 31.9 mg L⁻¹ "volatile and chlorinated hydrocarbons" were discharged via a channel into the river Mulde, 13400 m³ with 0.29 to 0.89 mg L⁻¹ "volatile and chlorinated hydrocarbons" into the river Leine. During the production of these compounds high amounts of gaseous waste products are formed which are emitted to the atmosphere. Hereby the emission of the final products is remarkably high, e.g. 10 % for tetrachloroethane, more than 1/3 for tetrachloromethane. In the Chemische Werke Buna 2200 t of 1,1-dichloroethene, 39460 t of trichloroethene, 8250 t of tetrachloroethene, 306015 t of 1,2-dichloroethane were produced in 1988, additionally 8000 t 1,2-dichloropropane were formed as a by-product which has been stored since, so far, no practicable way of a disposal in sight.

Among the ecotoxicologically most important classes of substances are the low volatile halogenated hydrocarbons. The main representatives of these group are the insecticide DDT and its persistent metabolites, the isomers of 1,2,3,4,5,6-hexachlorocyclohexane, especially the gamma isomer lindane, furthermore hexachlorobenzene, originally known as a fungicidal seed dressing (but the main amount of the hexachlorobenzene input comes from the by- and wasteproducts of various processes of the chemical chemistry). HCB was never intentionally produced in the GDR, the amounts needed (7 t annually) were imported from Poland. Furthermore the polychlorinated biphenyls play an important role within these groups of substances. DDT, HCH and PCB were produced in the GDR - the latter in amounts of 120 t per year up to 1965 in Weterregeln (Buna). The amounts produced were comparatively low, all three compounds were imported after the production stop, lindane has been imported up to now. Large amounts of DDT and lindane were applied for plant protection in the sixties. DDT was produced in the CKB up to 1970 (2500 t) and in Chemnitz (1741 t in 1967; 198 t in 1972). For DDT the amount applied in the GDR was about 600 t per year in 1970. The Decision of the Council of Ministers form 15.1.1970 concerning the stepwise reduction of DDT production came into force, led to a decline of the amounts applied to 60 t per year in 1986. Additionally 40 to 50 t were processed annually to the acaricide dicofol. Since the production of DDT was cancelled in the Chemiekombinat Bitterfeld in 1973 the demand had to be met by annual imports of 100 to 150 tons.

HCH and lindane, respectively was produced in the GDR in the following enterprises: Berlin-Chemie (158 t per year HCH up to 1972 and processing to lindane 12 t per year), CKB (5058 t HCH in 1970 to 2110 t per year in 1982 processing to lindane 361 t in 1970 and 151 t per year in

1982), Fettchemie Chemnitz (only production of HCH 3395 t per year in 1970), Fahlberg List Magdeburg (processing the HCH produced at Fettchemie or from imports to lindane 410 t per year in 1970 and 188 t per year in 1981).

A main problem of this production is the disposal of the non-insecticidal isomers on landfills ("Regina" at Bad Freienwalde, 50000 t, mine "Antonie" at Bitterfeld more than 100000 t and stone-pits at Emden district of Haldensleben 100000 t). Lindane was produced in the GDR up to 1982 and is applied until today. Until the end of the eighties DDT-lindane combination preparations were used in forest protection; 1500 t of the wood protection medium "Hylotox" with 3.5 % DDT technical grade, and 0.5 % lindane was produced annually until December 1988. Nowadays there are considerable stocks in circulation. At present 600 t per year Hylotox I with 0.5 % lindane are produced and delivered, furthermore 25 t per year Hylotox S with 35 % Pentachlorophenol-Na. There is a declining tendency in the application of pentachlorophenol in wood protection in the GDR, too.

Other low volatile halogenated hydrocarbons produced in the GDR were Dicolol (Delizia Delitzsch), Camphechlor (Fahlberg-List) and Methoxychlor (BC).

The main ecotoxicological problem of low volatile halogenated hydrocarbons are of historical nature: disposal of production residues (isomers of HCH and PCB) mainly on indiscriminate dumpings leads to highly contaminated sites.