
Ministry of the Environment
Estonian Environmental Research Centre



PERSISTANT
POLLUTANTS
POLLUTANTS

IN OUR ENVIRONMENT

Tallinn 2006



Pursuant to § 53 of the Constitution of the Estonian Republic every person is obliged to preserve the environment and compensate for the damage, caused to the environment.

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PERSISTANT ORGANIC POLLUTANTS IN OUR ENVIRONMENT

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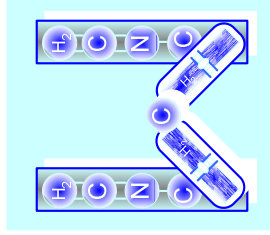




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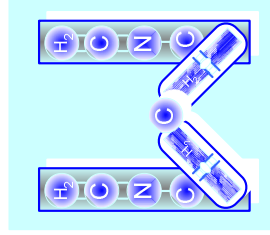
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1. Introduction



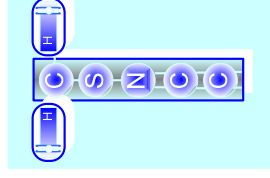
When the book “Silent Spring” was published at the beginning of the sixties, people were not capable of comprehending that chemicals could present a serious hazard to our surrounding nature. The aforementioned title launched an upheaval of „interest“ with regard to the impact of persistent organic pollutants (POP) among chemicals, on the nature that is surrounding us.

The amount of chemicals on the market is enormous and even at this moment it is extremely difficult to get an overview of their actual quantity. It is assumed that as many as ten million chemicals are known to researchers, whereby several hundred thousand of them are in everyday use. By reason of the afore-said, we can get an impression of how complicated it really is to have a control over such a multitude of chemicals. At the same time it is evident that we are not able to manage without using chemicals in the modern society of today.



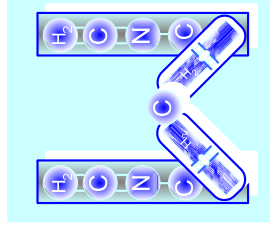
What is meant when speaking about hazardous chemicals? The broader concept of hazardous chemicals has been specified by the Estonian Chemicals Act. According to the Chemicals Act, a chemical is hazardous when, on account of its intrinsic qualities it may cause damage to health, the environment or

property. A narrower definition, which gives a better characterization of the hazard, represented by chemicals, is provided in the Water Act. A hazardous substance is an element or a compound, which through its toxicity, stability or bioaccumulation, poses or may pose a threat to human health and impairs or may impair other living organisms or ecosystems. A mission of the World in the immediate future is to reduce the emission quantities of hazardous contaminants (including POP-s) that are discarded into the surrounding environment as well as their concentration in the air, water, ground and food alike and at the same time bring down the content of toxicants in our surrounding environment to the level harmless to human health.



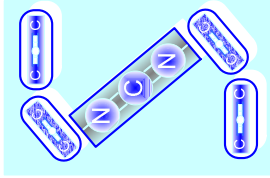
The aim of this booklet is to prepare an overview of POP-s in our environment. We also give a short survey on how and where POP-s are formed, what are the most perilous POP-s at the present moment as well as whether and how it is possible for a commoner to avert their origination.

2. What are POP-s?



We are considering as persistent organic pollutants synthetic or artificial compounds, which have in agriculture and industry alike. They may also be formed sort of unintentionally in manufacturing, households and transport resulting from fractional

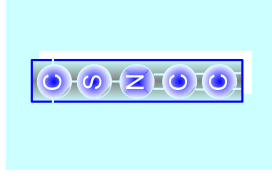
combustion of certain chemicals, their waste and the fuel. Persistent organic pollutants are mainly compounds including chlorine, which are posing a threat to human health and impairing living organisms and ecosystems, due to their toxicity, persistency and bioaccumulation.



sixteen out of the one hundred and seven persistent toxic organic compounds have been selected out to be included in the so-called „black list“ of compounds that are most harmful to human health and which use therefore has been either prohibited or restricted. The production and use of those compounds is governed by a series of international conventions, among them the Stockholm Convention and the Persistent Organic Pollutants Protocol of the Convention on Long-range Transboundary Air Pollution. Eleven of those compounds are plant protection products of which two are commercially produced and the remaining three are formed as hazardous-harmful by-products in the process of commercial production. The sixteen POP-s in their turn are distributed into three groups:

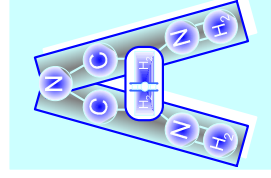
1. Substances, which are intended to be removed (Aldrin, clordan, chlorodecon, DDT, dieldrin, endrin, heptachlor, hexabromobifenyl, hexachlorobenzene (HCB), mirex, polychlorinated biphenyls (PCB) and toxaphene).
2. Substances, which use is to be constrained (DDT, hexachlorocyclohexane (HCH) and PCB).
3. Substances of which reduction of emissions compared to the reference year is required (1990 or

some other year within the period of 1985-1995) polycyclic aromatic hydrocarbons (PAH) polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) and hexachlorobenzene (HCB);



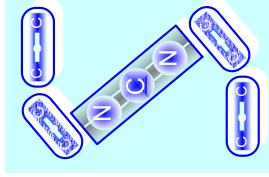
In Estonia application of plant protection products on a broader scale started at the end of the fifties. For example, in 1957 they were used in the total amount of 226 tons, primarily DDT and hexachloran as well as pelletizing preparations to a small degree.

Starting from 1968, the import of organochlorine plant protection products into Estonia has been prohibited, still for instance DDT in a small quantity was factually used in Estonia as late as in 1977. Problems may arise in relation to the use of old supplies. For that matter every human being can contribute to the prevention of pollution by discarding the use of the remainders of old plant protection products for which there is no information and notifying corresponding authorities of the finding.

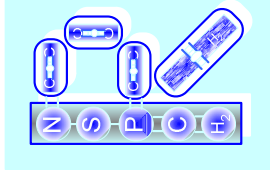


At the present moment the special attention in Estonia is given to the control of five POP-s: Polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF); Hexachlorobenzene (HCB); Polycyclic aromatic hydrocarbons (PAH); Polychlorinated biphenyls (PCB) and hexachlorocyclohexane (HCH).

Several POP-s, like dioxins and furans, have never been used as chemicals and for that reason it is no wonder that they have been „discovered relatively late“ in the nature. Only a few people are aware of the fact that the group of dioxins for one comprises 75 “different chemicals” (isomers) and the number of known furans amounts to 135. 17 of the compounds are toxic and one compound is yielding to the genesis of cancer. The number of the isomers of polychlorinated biphenyls is by one item less than that of the dioxins/furans, notably 209, of which 12 are dioxin-like toxic isomers. In the nature PCB was for the first time found in the Baltic Sea in the middle of the sixties, although the production of those compounds was started already in 1929.



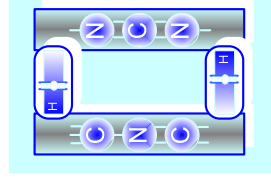
relations between health and environment are often enough rather complicated. We are inclined to pay attention to hazardous chemicals only on the occasion of major accidents. Yet we have to acknowledge that each new thing is a forgotten old one. Expressly similar intoxication cases were registered for the first time in Japan as early as at the end of the sixties and on Taiwan at the end of the seventies (disease – Yusho), when a considerable amount of leaking transformer oil, containing persistent organo-chlorine contaminants got into human food, namely the rice, by accident.



Pigment spots appeared on the faces of people, who were affected by intoxication, their nails turned blue, etc. However, those occasions may be considered as extreme cases, wherein the content of POP-s in food exceeded the maximum allowable amount by several thousand of times. Still we may say that the harmful effect of POP-s to the human organism could be established on ground of those instances.

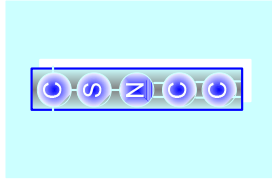
3. Why are POP-s hazardous?

In the strength of their persistence and other characteristics POP-s may drift far away from the actual source of pollution by means of air, water and food as well. POP-s are especially hazardous to organisms, belonging to „the top of the food chain“ (a human being among them), who may have contracted those compounds in a quantum, which is several hundred of times higher than in the surrounding environment.

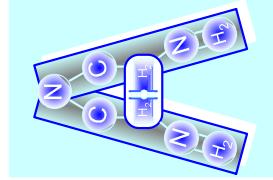


Environmental pollution with POP-s will bring along a series of human health disorders, including allergy and infertility, wild carcinogenic effect and may appear as the cause of untimely death. At the same time POP-s may inflict impairments of the central and the peripheral nervous system, the internal organs and the immune system of human beings. At the present moment primary attention is dedicated to a couple of particularly sensitive age groups, namely the children and the elderly. Exposure

to POP-s before coming of the age of two years may produce brain hypoplasia of a child.

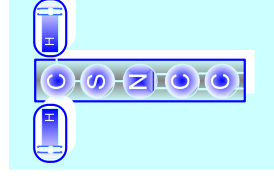


It is extremely difficult to estimate the impact on human health of POP-s that are received in small quantities and during an extended period. For instance, it is presumed that a higher breast cancer risk factor that has been detected pertaining to the women around the Baltic Sea as well as the drop in the children's weight at birth (distinctly evident regarding the boys), have been produced by the high content of POP-s et cetera in the Baltic Sea fishes. It is also thought that POP-s affect „our genetic material“ (the number and activity of male gametes) among other things. The assessment of the harmfulness of chemicals is further complicated by the fact that the results of animal experimentations can not always be applied to human beings.



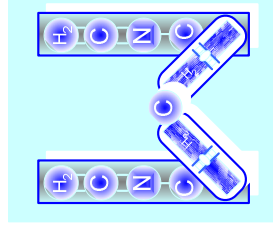
more specified overview of the toxicity and hazardousness related to each and every dangerous chemical is provided in the Minister for Social Affairs Regulations „List of Dangerous Substances“ and „Procedure for Identification, Classification, Packaging and Labelling of Dangerous Chemicals“. We highly recommend everybody to examine the list. It's better to exercise caution now than repent later.

4. POP-s as global contaminants



The Geneva Convention on Long-range Transboundary Air Pollution was signed in 1979 by the member states of the United Nations Economic Commission for Europe in Geneva. It is the first agreement at the international level, which aim is to protect human beings and the environment from global air pollution. State parties to the Geneva Convention assumed an obligation to restrain their air pollution, to exercise permanent supervision thereon and at the same time reduce the flow of pollutants into neighbouring countries.

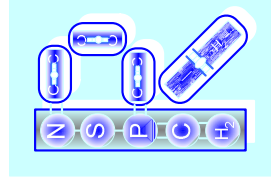
The aim of the Persistent Organic Pollutants Protocol of the Convention on Long-range Transboundary Air Pollution is the reduction or keeping under control of the emissions and leakages of persistent organic pollutants (POP) or their elimination.



Whilst the Baltic Sea is governed by the South-Western and Southern winds, the regions of the highest risk factor in relation to long-range air pollution are the West-Estonian islands and South-Estonia. For example, the closest local source of POP-s to Estonia is located in Latvia near Salaspils. We are receiving certain amounts of POP-s through long-range transport

primarily from Western and Central Europe. At the same time, we have to reckon with the fact that Estonia is appearing as a transmitter of air pollution to its neighbouring countries as well. Regarding PAH-s for instance, roughly a half of Estonia's own air pollution is deposited on the territory of Estonia and the other half is transmitted to its neighbouring countries or the Baltic Sea. In the same way, about a half of the PAH-s, deposited on the territory of Estonia through long-range transfer, derives from Europe. The situation may be different in relation to various POP-s. The long-range transport of POP-s into Estonia is considerably affected by the direction and strength of the prevailing winds and the amount of precipitation.

5. The primary places of origin for POP-s



apid economic development has brought about alongside with numerous benefits also distinct pollution problems in relation to the air, ground, water bodies and organisms surrounding us. Pollutants emerge into our surrounding environment from industry, agriculture and transport. The places of origin for POP-s are differentiated into two types: stationary sources and distributed sources (Chart 1).



The sources of POP-s are everywhere around us.

Chart 1. The main stationary and distributed sources of.

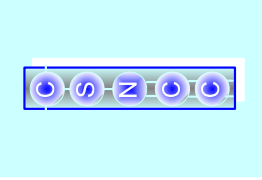
Stationary sources

Incineration of waste: Dangerous waste; Waste of hospitals; Waste water (sludge) sediment; Solid waste, etc.
Energy production: Fossil fuelled industries; Combustion of wood, etc.
Metallurgy: Thermal metallurgical processes; Production of steel, aluminum, iron, etc.
Distributed sources
Transport: Motor vehicles and other means of transport
Household heating: Coal, oil, gas, wood; Combustion processes in consumer industry.
Accidents: PCB-based oil fires; Landfill fires; Forest fires; Building fires; Volcanic eruptions; Motor vehicle fires;

The dangerous compound emissions of stationary sources can be subjected to steady control.

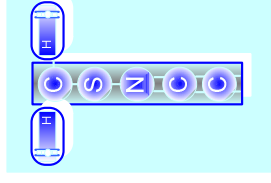
It is very complicated to control the distributed sources. There's the obligation of every individual to give his/her best for the reduction of pollution. For instance, a study of the sources for the formation of POP-s in Estonia, conducted by Danish researchers, indicated that the greatest part of the total annual emission of dioxins and furans had been released to the air as a consequence of uncurbed combustion processes (landfill fires; combustion processes in consumer industry; forest fires, etc.).

6. POP-s in our food

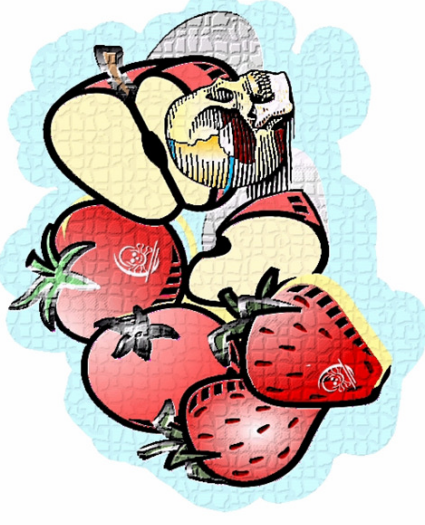


In a time, when we are seemingly provided with abundant resources of everything, there is however one area that is dominated by ever-growing shortage – we are speaking of the deficit of SAFE FOOD. Several experts disagree with the argument, yet public opinion polls give definite evidence of the fact that people are feeling continually more desorientated in reference of nutrition matters as they have ceased to trust the information on the labels of food products. The problem is further aggravated by the issue that even experts frequently fail to agree upon the specification of safe food, although the content of most of the chemical substances in food has been fixed by the regulations, i.e. maximum permitted levels have been

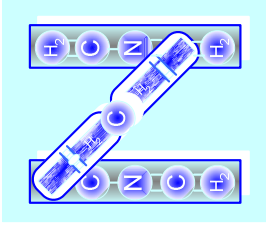
established for their content (<http://www.safefoodnet.net>), in order to guarantee the safety of food.



The estimated sources of persistent organic pollutants regarding the dietary intake of the European population are as follows: 41.6% from fish, 27.7% by dairy products, 11.3% by fats, 10.4% by meat, 6.8% by fruit and vegetables, etc. An additional monitoring of POP-s in foodstuffs has been prescribed for member states of the European Union, whereby each state has been assigned a fixed minimal number of samples to be analysed annually, the single list of analysed pollutants and the list of analysed foodstuffs. Estonia acceded to this monitoring in 2005.

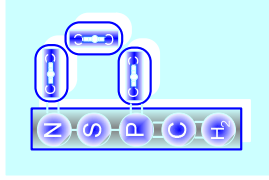


Even fruit and berries might not be safe.



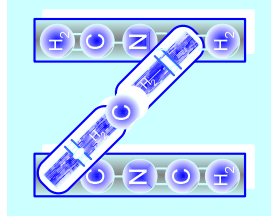
owadays it is practically impossible for any country, specializing in a large-scale production of fruit and vegetables, to do without plant protection products.

Monitoring of pesticide residues has been conducted in Estonia since 1998. The average number of varying fruit and vegetables, which are analysed in the process of observation, remains in the scope of 350 to 400 items, whereof one third is formed of local and two thirds of imported products. The maximum permitted level of pesticide residue content was exceeded in 73 samples out of the total of 1857 fruit and vegetable samples, analysed by Plant Material Control Centre in the course of the pesticide monitoring programme during 1998-2002. It was ascertained that the fruit and vegetables of Estonian origin are less contaminated by pesticide residues than the imported products. Better control should be imposed upon the fruit and vegetables sold on the markets.



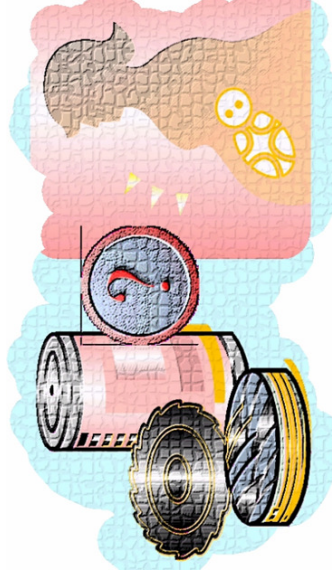
ersistent organic pollutants are accumulated in fats, therefore primary attention has to be paid to high-fat food, first and foremost the fishes (the Baltic herring, the Baltic sprat and the salmon) and the River lamprey. Thanks to the assistance of the Ministry of Agriculture and the Ministry of the Environment it has been possible for the moment to study persistent organic pollutants in the fish of the Baltic Sea and to a smaller degree in the fish of Lake Peipus as well. We must not be oblivious of the dairy

products and meat, as animal (bird) feed may contain POP-s. The dioxin content in fish has been fairly exhaustively studied in Estonia. Since 2006 the dioxin content of dairy products (milk and butter), meat, fish oil, etc. has also been examined.



ational monitoring of persistent organic pollutants was started in 1994. The monitoring of polychlorinated dibenzo-p-dioxins and dibenzofurans in fish has been carried out since 2002. (<http://www.agri.ee/index.php/14298>).

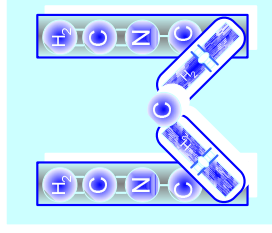
How much and what may we eat without being exposed to risk? It is a common knowledge that fish is advantageous for human health, but it would be advisable to follow the principle of risk-spreading. To that end, we should observe



Does pregnancy have a decisive role in menu selection?

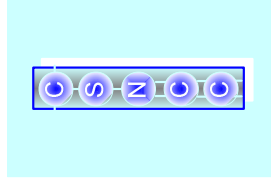
that not all the fish we consume were high-fat. In Estonia POP-s have so far been examined in the fish of the Baltic Sea and Lake Peipus. No risk is incurred by the perch, the pike-perch and the flounder. The Atlantic salmon, the sea trout and the eel caught in the Baltic Sea have not been adequately examined so far due to the reason that those fish species are caught (eaten) in Estonia to a relatively small extent and their proportion in human consumption is inconsiderable. People should be also moderate in the consumption of the River lamprey, but evidently two servings of fish in a week can not be harmful to people's health, but rather just the opposite. As for the Baltic herring, the consumption of the "large Baltic herring" with the length of more than 17 cm (and the age of more than five years), should be avoided or constrained (especially by pregnant women). At the present time the age of the Baltic herring in the coastal waters of Estonia is mostly 2-4 years. The annual studies of the Estonian Marine Institute have indicated that fish of an age over five years are rather rare in catches - only 7-8%. For that reason there is no risk to the health of the people, who are used to eating the Baltic herring of a smaller or medium size that is ordinarily traded with at the stores and on the markets. Only marketing without further examination of the so-called "unchecked fish", whereon there is no information as for its fishing area and country, should be avoided. However, a research on the content of toxic compounds (especially dioxins) in the foodstuffs, exported to the countries of the European Union and Estonia among them by non-contracting parties, should be definitely conducted in the immediate future. Although the highly toxic compounds like aldrin, dieldrin, endrin and isodrin have

never been used in Estonia, these compounds should be checked over in the foodstuffs and animal (bird) feed that are imported into Estonia.



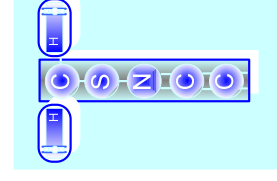
e would recommend to increase the share of the perch, the pike-perch and the flounder as well as the fish deriving from inspected fish farms and imported from the states of the European Union in the daily food intake. The salmon from Norway for one is safe for consumption, since the content of dioxins is examined in fish feed as well. A survey of 3000 adults in Finland at the end of the nineties revealed that the total amount of consumed fish and fish products of 29 g per day comprised on the average: 3 g of the Baltic herring; 6.5 g of the steelhead trout and 19 g of other fish products. Consequently we may say that people are paying attention to recommendations. Only few corresponding positive examples can be brought out in Estonia, namely the restaurant "Gloria" pointed out in its commercial of using in food preparation the smaller Baltic herring in order to avoid dioxin exposure. According to the information provided in the publication of the Estonian Institute of Economic Research "Kala ja kalatoodete turg Eestis" (The market of fish and fish products in Estonia), 2003, the average annual per capita consumption of fish and fish products in Estonia during 2000-2002 was 16.6 kg, wherefrom in 2002 chilled or frozen fresh fish and seafood constituted 9.9 kg. By way of comparison we may bring the corresponding amount in Estonia in the years 1937/38 -

28.5 kg. For instance in Finland and Sweden the annual per capita consumption of fish products is twice as much, namely 30-34 kg. Taking for the basis of calculation the fact that the dioxin content of most of the Baltic herring in Estonia is not extending over half of the EU standard, the dioxin content of the perch, the pike-perch and the flounder is not extending over one fifth of the standard and the maximum weekly per capita amount of fish consumption is 200 g at the most (half of which would be constituted of the Baltic herring), we may confirm that the dioxin quantity acquired from fish in a week would under no circumstances exceed the dioxin standard per human body weight for a week, established by the Scientific Committee for Food.

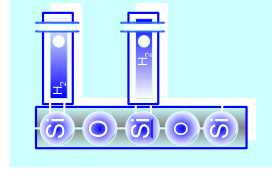


In brief, it is often difficult even for people, who are living in modern societies, to find clear and reliable answers to questions regarding the safety of food. For that reason one of our most urgent tasks at present is to find out what kind of information is available in relation to safe food, how and on what level is information accumulated, what is its reliability, who is responsible for the accumulation and preservation of information as well as by whom and in which way should this information be disseminated to the public.

7. How to avoid the formation of POP-s in households?



The first thing to be done in households is to establish control over furnaces and heating materials. It is possible to reduce the formation of POP-s in households to a considerable extent by choosing an appropriate furnace, operating mode of the furnace (depends immediately upon the user) and heating material. The most expedient heating material in Estonia, where the total area of forests forms more than 40% of the territory, is wood. Forests are renewable natural resources. We should also reckon with the fact that preference is to be given to dry wood, which water content is roughly 20%. The water content of undried wood is 50% and the weathering of wood in undercover storage outdoors takes at least a couple of months. Be sure to use only such furnace, which has controllable combustion process. When choosing a furnace, consult its manufacturer-salesperson, establish the qualities and an appropriate heating mode. Risk lies in fractional combustion, which is indicated by the emission of dark fumes from the chimney.



First and foremost, we have to remember and reckon with the fact that “anything that burns, is not suitable for burning”:

- Do not burn waste like PVC- plastic material, the so-called “waste oil”, deriving from old condensers and transformers (produced prior to 1990), which oils contain polychlorinated biphenyls and highly hazardous polychlorinated dibenzo-p-

dioxins and dibenzofurans may form in the combustion process. The burning of impregnated and painted timber, rubber, synthetic rugs, etc. is not. Neither is it recommended in the same way.

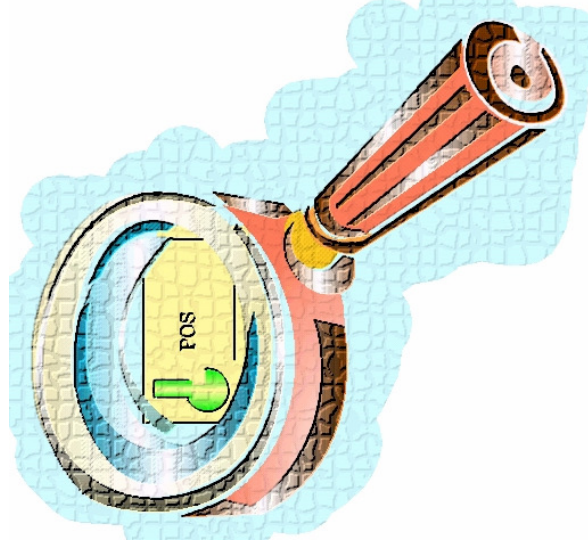
- Do not burn yard waste. It is recommended to compost the yard waste.



We must not forget that a substance, which has once entered the environment is going along with all the natural cycles.

Secondly, the handling and use of chemicals should be closely observed to the same degree at home, in the garden and in the field. The maintenance and destruction of hazardous chemical waste must be executed pursuant to local legislation. We must bear in mind that a wrongful behaviour is going to affect not only our own household, but the neighbours as

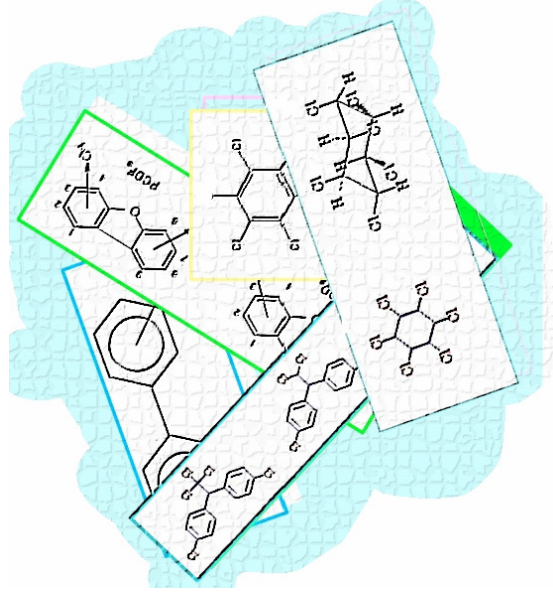
well. As POP-s may spread both by air and by water and really far away from the source of pollution in case of favourable winds, we are also endangering the health of our neighbours. POP-s that have precipitated on the ground are also contaminating the soil, in consequence organic farming has to be given up in that particular area.



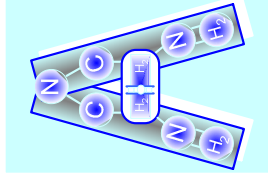
We should check the hazardousness of those chemicals, which are noted on the packaging.

Claims for a large-scale compensation of damage may be submitted against a polluter by close neighbours. Restrictions concerning the handling of chemicals, which are harmful to the population and nature, are provided in Estonian legislation pursuant to the Minister for Social Affairs Regulation No 36 of February 28, 2005. When

buying and using chemicals, special attention should be paid to the hazardousness of those chemicals, which are noted on the packaging. The use of chemicals, which do not provide information about their hazardousness, should be avoided and it applies particularly to remainders of old chemicals. Although the major part of old dangerous chemical remainders have been accumulated at the Vaivara hazardous waste landfill site, there still might appear to be remainders of hazardous substances in some region of Estonia.

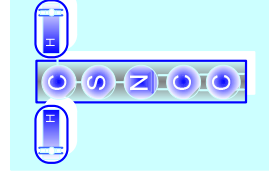


Chemicals are seemingly just a sequence of links between chemical elements



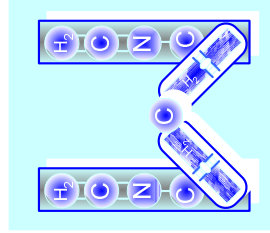
our shores are open for anybody at the present time and the number of boats-launches has grown to a considerable extent, the principle of avoiding the pollution of the surrounding natural environment and the surface water has to be followed, when executing their painting.

As an example, pursuant to the Minister for Social Affairs Regulation 36, in order to avoid contamination to be inflicted by micro-organisms, plants or animals, it is prohibited to use certain chemicals and their compounds for processing of water craft structures, the cages, floats, nets and other equipment and devices used in fish, crustacean and shellfish farming as well as the equipment and devices to be used wholly or partially underwater.

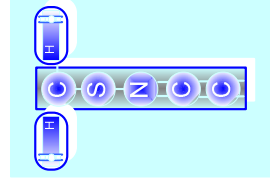


hirdly, the means of transport at our homes have to be thoroughly inspected, first and foremost in reference of exhaust emissions. Everybody should strive to keep our motor vehicle (tractor, etc.) in good order and have the content of vehicle exhaust emissions regularly checked. Additionally to the point that if a motor is working in an incorrect operating mode, hazardous POP-s will be transferred into our surrounding environment, several studies of the recent time have examined the emissions of persistent organic pollutants (PAH, PCDD, PCDF, etc.), formed in the process of vehicle combustion. No corresponding study has been

conducted in Estonia, but the number of vehicle fires in Sweden has increased by during the period from 1996 to 2001. Although the number of fires due to technical failures of the concerned means of transport within that period has decreased, on the other hand the amount of deliberately started fires has gained by nearly 150%.

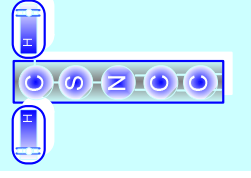


When buying and using the so-called “good (less hazardous) chemicals” (with provided information on the hazardousness to human health on the package) instead of the so-called “hazardous chemicals” we shall manage to exclude the latter from Estonian market, therefore in the end anyone is able to bear implicit impact on the business of chemicals.



The monitoring of persistent organic pollutants in the environment is a highly time-consuming and expensive process, which calls for special equipment. Frequently enough the cost of a single analysis is reaching over the margin of ten thousand Estonian kroons. But on top of the analyses, a polluter shall have to compensate for the decontamination expenses, which require the expenditure of sums in the range of millions of kroons.

8. Legislation



The control of chemicals in Estonia is based on six acts: Chemicals, Waste, Plant Protection, Water, Food Act and Integrated Pollution Prevention and Control Act. The production, sale and use are governed by a great number of Estonian as well as the European Union regulations. This booklet has provided a few of them that would be essential for the Estonian people to get themselves acquainted with. Most of the legislation of this field is available on the Internet (<http://www.legaltext.ee>).

