

# Million reasons to know about hazardous substances

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MINISTRY OF THE ENVIRONMENT



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## Is your living environment free from hazardous substances?

Imagine you are sitting on the sofa in your living room. Take a moment and think – what you see around you?

A nice looking comfortable living room with furniture, carpets and curtains, television set and your notebook on the coffee table, your child's toys laying on the floor. Now take another moment to think about what you DO NOT see around you. What stands behind those qualities you like the most – colourful elastic toys, water and dirt repelling carpet and furniture, fire resistant curtains and firm television sets or notebook case etc.?

You do not see them, but they are there – hazardous substances in our everyday living environment.

Every day millions of people despite their age or gender are exposed to different cocktails of chemicals and hazardous substances through products which we use and which contain these substances. Is it not enough to start thinking how this affects our health and environment?



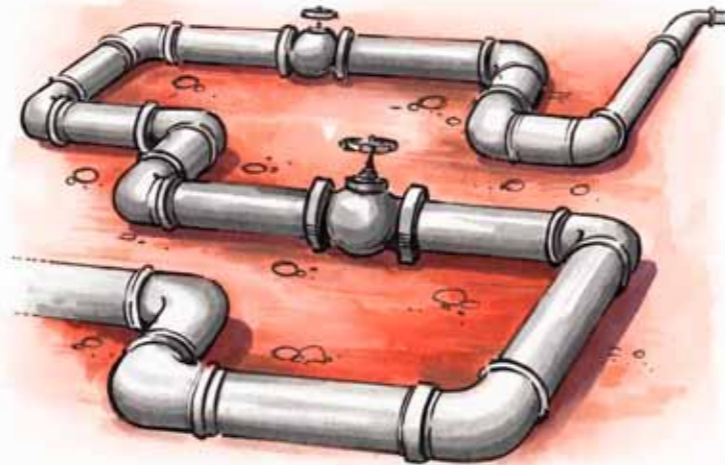
## What are these substances like?

Hazardous substances once released into environment stay there for a very long time. A lot of them do not break down into less harmful chemicals and can travel long distances e.g. with discharged wastewaters into rivers and carried by the rivers the pollution may end up in the Baltic Sea, reach our tables, and finally via food enter our bodies.

Hazardous substances contribute to a variety of health problems. Some of these substances accumulate in our bodies, in fat tissue and are found in human blood or mother's milk. They may disrupt the activities of hormones, by blocking their normal functions (e.g. blocking testosterone function may lead to decline in male fertility).

## Where do hazardous substances come from?

Under hazardous substances we mean here in this brochure man-made synthetic substances, which are created to be added into products to ensure certain properties and qualities of the article. They do not occur naturally in the environment and therefore when emitted into the environment they become pollutants. They can be released into air or water during their synthesis or use in production of products, they can leak from products when we use them or after they have been disposed in landfills.



## Why are hazardous substances not prohibited, if they are so dangerous?

They are cheap and provide the unique qualities for articles ensuring our comfortable lifestyle. Are we ready to refuse that voluntarily? The most evident hazardous substances are banned or restricted in the European Union, but we also use dozens of products produced outside the EU every day, where hazardous substances are less regulated. Testing imported products for hazardous substances is very expensive and it is impossible to test them all.

## These substances are used in very small amounts – is it really worth worrying?

The properties of these substances in most cases are so strong, that even very small amounts may have adverse effects. E.g. female molluscs are masculinised by a hazardous substance tributyltin at levels adequate to one hundredth of the drop of this substance in an Olympic size swimming pool. Apart from this fact we also use many products, containing the same substances or substances with similar properties, therefore those small amounts add up. And no one has understood or proved yet how such a “chemical cocktail” can affect our health or the environment.



## There are many different hazardous substances, so how to avoid them?

Although hazardous substances are widely used, they seldom occur on the product labels, either due to commercial reasons (e.g. in cosmetics), due to very small amounts (as impurities), or simply due to the reason that such labelling is not required for most of the products. However, we could avoid or be less exposed to these substances if we:

- buy and use the products, which are really necessary;
- use eco-labelled products;
- read instructions provided and use the products accordingly;
- use simple proven substances as soda, vinegar, salt, citric acid to clean and decalcify;
- favour non-predatory fish such as carp or smelt preferably caught from lakes and rivers undisturbed by human activities;
- get to know more about the potential hazards in products and ask retailers for the products with less hazardous substances.

There are tens of other ways to reduce the exposure to hazardous substances – discover them, try them out and share with your friends!

# Phthalates

Phthalates are among the most ubiquitous man-made contaminants nowadays. They are used predominantly as softener to make PVC (polyvinylchloride) plastics more flexible. In flexible plastics it typically accounts up to ~ 30%. It's impossible to go through a day without coming into contact with plastic. Take a second to think about everything plastic you touch each day. It could be your toothbrush, remote control, food containers, toys, pens, debit card, cell phone and laptop. Phthalates are not tightly bound into plastics and can easily migrate into the environment during the product life-cycle. Other well-known uses of phthalates include oily substances in perfumes, additives to hairsprays, lubricants, wood finishers, etc.

**Phthalates are also among the most abundant contaminant in rivers and wastewater.**

## Problems with phthalates:

- based on studies with rodents, phthalates contribute to decline in fertility, increased incidence of testicular cancer and falling sperm counts in men;
- women with higher exposure to phthalates are more likely to contribute to adverse effects on genital development in male children, altered sex hormone levels;
- possibly contribute to premature birth, impaired neurological development and premature development of children and puberty;
- phthalates can exacerbate dermatitis.
- might mimic certain hormones.

## Tips how to avoid phthalates:

- avoid PVC products use in house building or reconstruction;
- use plastics with the recycling codes (2), (4), or (5), as phthalates are often used in PVC plastics with recycling code (3). These codes are usually found on the bottom of plastic containers;
- favour wooden and cloth toys to plastic ones;
- limit the use of personal care products, cosmetics and fragrances and reduce uptake of phthalates via the skin;
- regularly vacuum home with the HEPA filter or use a damp cloth instead to minimize phthalates exposure through dust. HEPA is a type of filter that can trap a large amount of very small particles that other vacuum cleaners would simply recirculate back into the air in your home.
- read the labels, phthalates can be identified by such chemical names or abbreviations: DBP (di-n-butylphthalate, dibutyl phthalate), DEP (diethyl phthalate), DMP (dimethyl phthalate), DEHP (di(2-ethylhexyl) phthalate), BBP (butyl benzyl phthalate);
- be aware of the term "fragrance", such products can include phthalates.

**§ Phthalates are already restricted in plastic toys for children under 3 years of age. They will be banned in the European Union from 2015 in majority of products. After this date favour buying products manufactured in EU.**

Phthalates in consumer goods are mostly used in plastic and plasticized products,

e.g. PVC flooring, PVC windows, PVC doors, PVC roofing, toys, shower curtains, luggage or shoe soles, sports mats, maps and folders, artificial leather for bags, book covers and bindings; as softeners in cosmetics (creams, deodorants, perfume); in car production, some medical devices, as insect repellent.



**Phthalates might prevail in many items of our homes and become a source of this substance in our bodies**

Children may take in higher than average amounts because many chew toys are made of highly phthalate-softened vinyl (for example, teethingers).

**Many tests on toys have revealed to contain exceeding amounts of the hazardous substance – phthalate.**

# Perfluorinated compounds (PFCs)

PFCs are fully fluorinated man-made chemicals. The carbon-fluorine chemical bond is the strongest covalent bond in organic chemistry, this makes PFCs tolerate very high temperatures, resistant to degradation and environmental breakdown, and also repellent to water, dirt and grease.

These unique properties are used to make materials stain and stick resistant. PFCs are exploited in numerous different applications, including non-stick cookware (Teflon®), textiles (Gore-Tex®), wire and cables coating, electronics, semiconductors, etc.

Even though they have been in use for only around 60 years, many studies have reported worldwide distribution of PFCs even in remote areas like the Arctic. So even if worldwide production were to end today, levels of PFCs would continue to increase in the environment for many years to come.

## Problems with PFC:

- the predominant toxic effect of PFCs include developmental toxicity, hormonal effects and carcinogenic potential;
- associations have been found between PFCs levels in the general population and reduced female fertility and sperm quality, reduced birth weight;
- occupational exposure to workers may cause increased risk of prostate and bladder cancer.

## Tips how to avoid PFC:

- watch the food packaging, avoid greasy or oily packaged and fast foods, the packages often contain grease-repellent coatings;
- avoid the use of stain/waterproofed products to treat furniture, carpets, shoes and clothing;
- check your personal-care products made with Teflon or contain ingredients that include words “fluoro” or “perfluoro”. PFCs can be found in dental floss and cosmetics, e.g. nail polish, facial moisturisers, eye make-up;

- vacuum regularly using the HEPA filter;
- avoid Teflon® or non-stick cookware. Prefer cast iron, ceramic coated or non coated pans.

## How might you be exposed to PFCs?

- directly by being in touch with consumer products, e.g. grease resistant food packaging and paper products such as microwave popcorn bags and pizza boxes;
- inhaling household dust (and mouthing for children), in upholstered furniture, carpets;
- via food, mostly sea food;
- even Gore-Tex clothing, beloved for its ability to shed water;
- via use of non-stick cookware.
- using some cleaning and personal care products (e.g. dental floss, shampoo, denature cleansers).

## What stands behind a non-stick (Teflon) pan?

- Teflon pans are cheap and have a non-stick feature, therefore are very popular;
- they are made of a synthetic material – polytetrafluoroethylene (PTFE), which later was called Teflon®;
- a non-stick pan left to preheat can easily reach 371°C within a few minutes, at 360°C Teflon® pans begin releasing tiny particles of PFOA.

**§ PFCs have been restricted to be used in high concentrations in articles within EU, however, small concentrations can also accumulate in the human body.**

Perfluorinated chemicals in consumer goods are mostly used to make products water, dirt and fat resistant: carpets, upholstered furniture, non-stick pans, tents, waxes, window cleaning agents, fire-fighting foams, rain clothes, shoes, floor polish, floor paints, car care products, fat-repellent packed food containers.



**PFCs are called as household miracles of modern chemistry but not so innocent, scientific evidence proves them to have toxic effects on human health and the environment.**

- Fumes from Teflon® in very high heat are fatal to some birds due to intake of toxins which are excluded by human lungs..
- Rare cases have been that for humans excessive inhalation of Teflon fumes (300°C and 450°C) may cause polymer fume fever or “Teflon flu” for which the symptoms are flu-like (chills, headaches, fever). Most common forms of PFCs are PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoate or perfluorooctanoic acid).

# Polybrominated diphenylethers (PBDEs)

PBDEs are members of a broader class of brominated chemicals used as flame retardants; these are called brominated flame retardants, or BFRs. About 80 different types of BFRs are used commercially. They come in different forms depending on the number and location of bromine atoms.

PBDEs can be found in almost anything that carries an electrical current or is highly flammable, e.g. furniture foam (pentaBDE), plastics for TV cabinets, consumer electronics (decaBDE), and plastics for personal computers and small appliances (octaBDE).

The benefit of these chemicals is their ability to slow ignition. When heated PBDEs suppress the spread of fire by releasing bromine atoms (Br), creating a very thin layer of bromine gas on the surface of the TV or mattress that keeps oxygen away.

Although use of flame retardants saves lives and property, there are unintended consequences. PBDEs persist in the environment and accumulate in living organisms. They have been detected in wildlife including fish, birds (particularly marine species and in their eggs), and marine mammals such as seals, dolphins and killer whales. PBDE levels have been shown to be increasing exponentially in wildlife in areas such as the Arctic.

## Problems with PBDEs:

- Animal tests with mice have shown that decaBDE can cause cancer and developmental problems in motor skills and learning;
- The level of PBDEs in human organisms have doubled approximately every 3 to 5 years over the past three decades and continue to rise;
- Potentially the greatest threat from BDEs is to developing fetus and children;
- Burning PBDEs can create potentially toxic and cancer-causing chemicals.

## Tips how to avoid exposure to PBDEs:

- vacuum your home regularly, using the HEPA filter;
- cover tears in upholstery that expose polyurethane foam, particularly if foam is crumbling;
- PBDEs accumulate in fat, eat less animal fat;
- remember: electronic and electric equipment (such as PCs, TVs, mobile phones) produced within EU shall not contain decaBDEs since 2008. But in some cases older items can contain decaBDEs);
- get acquainted with companies' policy – many brands have refused PBDEs in their products, e.g. NOKIA and SONY ERICSSON mobile phones, SAMSUNG MP3 players, APPLE laptops, etc.

**§ Penta and octa-BDEs are restricted in articles, due to safety concerns. Deca-BDE is allowed for use in EU in all applications except in electronic and electric equipment since July 2008, but the exception does not apply in Japan, US, Taiwan or China, where many of the electronic equipment goods are being produced. In EU, nowadays deca-BDE is being used mainly in plastics and textiles.**

Polybrominated diphenylethers in consumer goods are mostly used to make flame retardant textiles (e.g. mattress, upholstered chairs, upholstered sofas, curtains, carpet padding, polyurethane foam); electric equipment (e.g. computers, dishwashers, hairdryers, microwaves, refrigerators, remote controls, electrical outlets, washing machines, coffee makers, fans, wires and cables, toasters, lamp sockets); also control panels in cars and pipes in households.



PBDEs are not permanently bound to the products in which they are used. Some PBDEs are semi-volatile and may be released from PBDE containing products (e.g. in your vehicles). Other PBDEs are released from furniture, electronics and other products as they physically degrade.

For most people, the level of PBDE contamination is low – around 30 to 70 parts per billion (ppb). But in some cases people are exposed to concentrations approaching 10,000 ppb. That brings them dangerously close to exposure levels that can harm animals in experiments. 1 part per billion is roughly a teaspoon of PBDE per Olympic size pool.

# Organotin substances

Organotins are man-made chemicals, based on a hydrocarbon structure combined with tin. Organotin compounds are widely used as stabilizers for PVC, as antifouling biocides, as agricultural biocides and as catalysts for the production of polyurethanes and silicones.

While the inorganic forms of tin are generally considered nontoxic, its organic derivatives exhibit a complex pattern of toxicity. The biological effects of the organotin species are mostly depending on the number and kind of organic moieties bound to the tin atom.

The most well known organotin is tributyltin (TBT) which is also the most toxic, known for its biocidal properties, which for many years in the past was used widely in marine antifouling paints to prevent the growth of organisms such as barnacles on the hull of ships and to avoid increased fuel consumption. Extensive use in antifouling paints on watercraft led to the widespread distribution of TBT (and its breakdown products mono- and dibutyltins) globally in marine and freshwater environment – in water, sediment and wildlife species.

Mono- and diorganotin compounds, which have one and two tin-carbon bonds, are used as stabilizers, catalysts, and in glass coating applications.

## Today organotins are used:

- to avoid PVC degradation;
- to speed up chemical reactions, for example, when making polyurethane foams (for furniture, etc.);
- to prevent micro fractures on glass containers;
- in carpets and textiles to preserve it from fungi's;
- as pesticides for protection crop on potatoes, sugar beets, and pecans, citrus, top fruit, vines, vegetables and hops in countries outside EU.

## Problems with organotins:

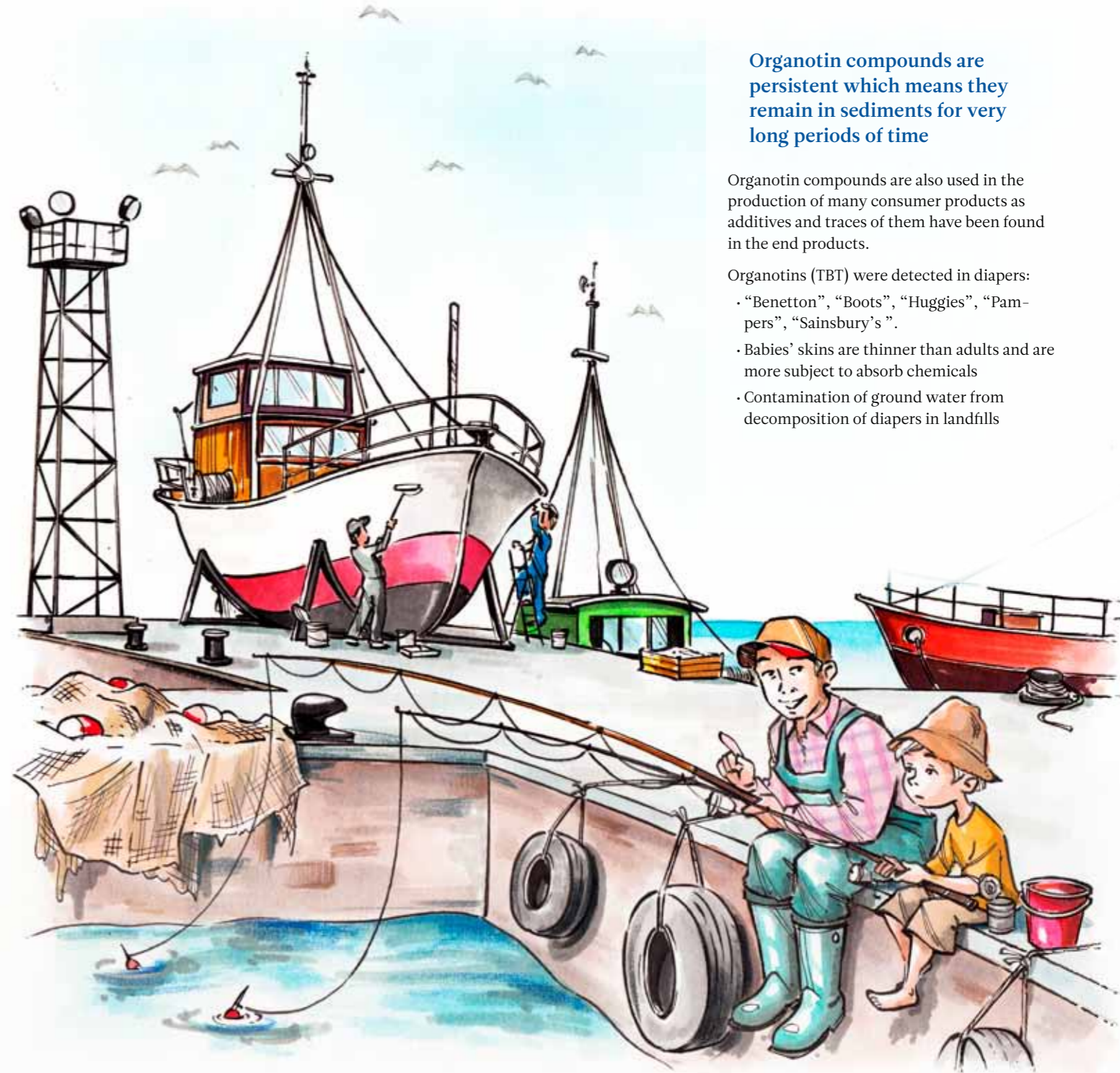
- sperm lack flagella or have impaired motility (in fish, rat);
- sex reversal in fish, resulting in more males than females and unbalancing the population fertility;
- toxicity to liver, nerve cells and those, responsible for immune system.

## Tips how to avoid exposure to organotins:

- avoid PVC at home, it should help to minimize the amount of organotins in household air and dust;
- avoid “antifungal” treated clothing and footwear;
- prefer eco-labelled diapers (e.g. Nordic Swan eco label, German Öko Test) and other female hygiene products, but get to know more of the producers and their environmental and health policy before.

**§ In EU tributyltin and triphenyltin compounds can not be used after 1 July 2010 in articles where the concentration in the article or part of, is greater than the equivalent of 0.1% by weight of tin. Articles not complying with the ban cannot be placed on the market after this date, except for articles already in use in the EU before the deadline. Similar bans will be introduced for dibutyltin compounds in mixtures and articles, and doctyltin compounds in certain articles, from 1 January 2012.**

Organotin substances in consumer goods are mostly used to improve the antibacterial properties of products (e.g. non-allergenic pillows, diapers, athletes foot spray); make flexible plastic and rubber products (e.g. PVC flooring, shoe insoles, rain clothing, vinyl wallpaper) and PVC prints on clothing (e.g. T-shirts, bags, beach balls, cycling shorts, shower curtains, earplugs).



**Organotin compounds are persistent which means they remain in sediments for very long periods of time**

Organotin compounds are also used in the production of many consumer products as additives and traces of them have been found in the end products.

Organotins (TBT) were detected in diapers:

- “Benetton”, “Boots”, “Huggies”, “Pampers”, “Sainsbury’s”.
- Babies’ skins are thinner than adults and are more subject to absorb chemicals
- Contamination of ground water from decomposition of diapers in landfills

# Alkylphenols (AP) Alkylphenoethoxylates (APE)

Alkylphenols (APs) are man-made chemicals, used primarily to manufacture alkylphenol ethoxylates (APEs). They have been used for over 50 years and are important to a number of industrial processes, including pulp and paper, textiles, coatings, agricultural pesticides, metals and plastics.

The most commercially important APEs are nonylphenol ethoxylates (NPEs) and less widely used - octylphenol ethoxylates (OPEs). NPEs main function is to act as surfactants to make stable emulsions in different products. They are especially famous for their cleaning ability in detergents and cleaning agents. Therefore more than half of NPEs used go “down the drain” and are commonly found in wastewater discharges and effluents from sewage treatment plants and also reach our rivers, and later, via fish and other eatable organisms, can appear on our tables.

Degradation of APEs in wastewater treatment plants generates more persistent and toxic APs such as NPs (nonylphenols) and OPs (octylphenols). Prior to imposed restrictions on their use, NPEs were widely used in industrial and domestic cleaning products, textile and leather processing, in paints, spermicidal lubricants, pesticide formulations, hair dyes, cosmetics and personal care products, especially hair products. Nowadays they can be still found in the same goods, imported to EU.

APs are moderately persistent, bind to fatty tissue and can bioconcentrate in aquatic biota. APs and APEs have been detected in fish and invertebrates inhabiting polluted waters.

## Problems with APs:

- breakdown products of NPEs and OPEs are endocrine disruptors. Exposure to endocrine disrupting chemicals are suspected to play a role in certain types of cancer (breast, testicular, prostate), obesity, diabetes, precocious puberty, fertility problems and impacts on neurological development;

- adverse effect on fish - decrease in size of testes; reduced fertilized eggs, reduced embryo survival, abnormal embryos; and mammals - reduced male fertility, testicular size, sperm quality, NP and OP induced growth of human breast cancer cells.

## Tips how to avoid exposure to APs:

- avoid cosmetics, produced in non-EU countries, it can contain APEs;
- avoid textile, produced in non-EU countries, it can contain APEs, but keep in mind that even EU companies have their production sites outside Europe.
- choose textile with eco-labels such as EU Flower or Öko-TEX 1000 (they have forbidden the use of APEs)

**§ Any mixture that contains 0.1% or more of NP or NPE cannot be placed on the market or used for cosmetic products within EU and some other countries (e.g. in European Union OPEs restricted in, NPs banned in plant protection products).**

In consumer goods Alkylphenoethoxylates are mainly used e.g. in car wash and car care products, cleaners and degreasers, cosmetics, laundry detergents, paint & varnishes, pesticides, pharmaceuticals, spot removers, textiles.

About 20 000 tones of OPs per year are being produced within EU and used for making tyre rubbers, electrical insulation coating and painting ink

Exposure to APs can occur directly in the workplace, through use of consumer products or via contaminated food or drinking water.

- NPEs help stabilize emulsions that constitute such widely used products like cosmetics, medicine, body lotions and creams, mayonnaise and other food items. Emulsion is a product of two mixed liquids. Without stabilizing agents (like NPEs) the mixture tends to return to unmixed state. The NPEs insure that the emulsion remains stable.
- NPs in some samples of human blood has accounted for 8 times higher concentration than the allowed concentration of this substance in EU rivers.

