8. *The environment and health*

The quality of the surrounding environment plays a crucial role in our well-being. The environment that has deteriorated due to air pollution, chemicals, noise or low quality food or water may cause illnesses (cancer, asthma, allergies, etc.) as well as reduce life expectancy and worsen the quality of life. The European Union has set itself the objective of reducing pollution to levels that minimise harmful effects on human health and the environment.

While the levels of pollutants in ambient air have decreased significantly in both the EU and Estonia, fine particles continue to be a problem. Transport is a major source of fine particles as well as air and noise pollution. Although the quality of food and water for human consumption is rather good in Estonia, the adverse effect of pesticides and chemicals on human health has recently received considerable attention throughout the world. However, the outdoor environment is not the only thing that is important. Another major risk factor for human health is radon contained in indoor air.

8.1 Drinking water

The majority of Estonian consumers (65.8%) get their drinking water from groundwater; surface water is only used in Narva and Tallinn.

In 2012, the Estonian Health Board exercised supervision over 1,105 public water supply systems that supply 1,153,076 consumers, or 89.6% of the population of Estonia, with drinking water. The number of public water supply systems has decreased (from 1,235 in 2007 to 1,105 in 2012). As quality requirements are becoming more stringent, many smaller systems are merged with larger ones in order to ensure the supply of high quality drinking water to consumers.

The quality of drinking water must conform to the requirements set forth in Regulation No 82 of the Minister for Social Affairs of 31 July 2001 “Quality and control requirements and analysis methods for drinking water”. The quality of drinking water is assessed by microbiological, chemical and indicator parameters.

The quality of drinking water has significantly improved in recent years in terms of both microbiological and chemical as well as indicator parameters (Table 8.1).

While 17 cases of microbiological parameters exceeding the limit for a short time were discovered in 2012, all public water supply systems conformed to the microbiological requirements by the end of the year. Microbiologically impure water facilitates the spread of diseases.

0.64% of consumers received drinking water from public water supply systems that did not conform to the requirements in terms of chemical parameters. The chemical parameters of water from 36 public water supply systems did not conform to the requirements. The most problematic of all indicators is fluoride content in ambient air, which exceeded the limit in western Estonia. Excessive fluoride can damage tooth enamel, especially in children’s growing teeth.

However, the problems identified in relation to public water supply systems are most often related to indicator parameters that exceed the limits established by legislation. Indicator parameters affect the organoleptic qualities of water. If the limits for indicator parameters are exceeded, it affects the conditions of consuming water and the quality of life of consumers without posing an immediate risk to their health. 11.78% of people who got their water from public water supply systems were forced to consume water the indicator parameters of which did not comply to the requirements. The parameter that was most frequently exceeded was iron content in water, which may damage consumer electronics.

In northern Estonia elevated levels of naturally occurring radionuclides were measured in the water from bore wells that extract water from the Cambrian-Vendian aquifer. According to risk assessments of effective doses in drinking water from the largest bore wells, carried out by the radiology division of the Environmental Board, the occurrence of damage to human health is unlikely.

In conclusion, the majority of the population of Estonia consume good quality and safe drinking water; the quality of water continues to improve as new water treatment plants are built and pipes are repaired and reconstructed.

Table 8.1. Share of consumers using drinking water from public water supplies that does not conform with the quality requirements (%)

Year	Non-compliance with microbiological parameters (%)	Non-compliance with chemical parameters (%)	Non-compliance with indicator parameters (%)
2007	0,01	8,9	26,0
2008	0,1	8,6	21,6
2009	0,05	6,25	20,3
2010	0,08	3,6	12,5
2011	0,01	0,99	14,0
2012	0	0,64	11,78

8.2 Bathing water

The quality of bathing water was monitored throughout the summer in all 50 public swimming places.

The quality of water in a swimming place must comply with the requirements set forth in Regulation No 74 of the Government of the Republic of 3 April 2008 "Requirements for bathing water and beaches". The samples were analysed for two indicator bacteria: Escherichia coli and Enterococci Besides microbiological analysis, the surface of bathing water and beaches were also assessed visually for any residual oil and glass, plastic, rubber and other waste. The occurrence of potentially toxic blue-green algae bloom was also assessed.

A total of 435 samples were taken during the season, of which 295 samples were from public swimming places. 16 samples did not comply with the requirements. The two indicators were analysed in 870 cases and 19 samples (2.18%) did not comply with the requirements.

The number of non-compliant samples has increased by a couple of percent compared to previous years (before 2008) – mainly because the monitoring process of bathing water changed upon the enforcement of a new regulation on bathing water in 2008. The quality of bathing water is not assessed based on new, more stringent standards.

The quality of bathing water is assessed and swimming places are classified after the end of each swimming season. The first assessment was carried out in 2011 because by then we had the four year data required for the classification of bathing water. Each swimming place is assigned to a quality class – "very good", "good", "adequate" and "poor" – according to the percentiles calculated on the basis of the dataset.

In 2012, 35 swimming places were rated as "very good", eight as "good" and five as "adequate". None of the assessed swimming places were rated as "poor". Two swimming places (the Liivalauka and Aafrika beaches) were not assigned to a quality class because there were no data for four consecutive years on the quality of water.

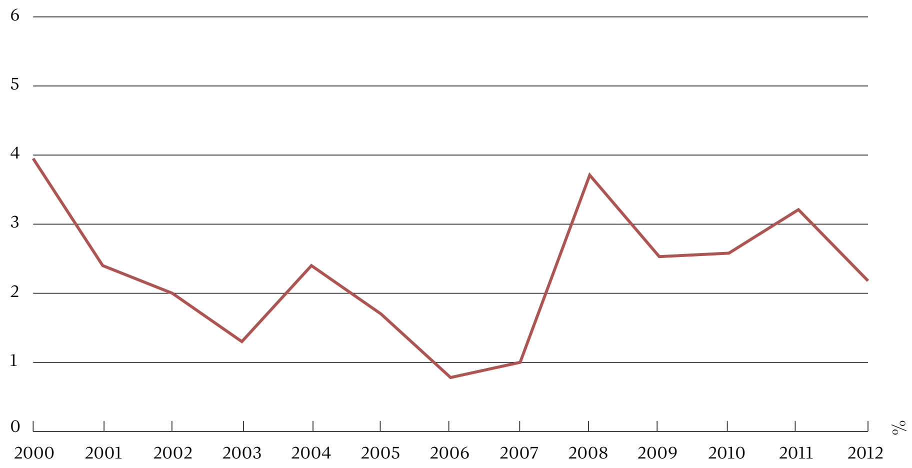

Figure 8.1. Proportion of micro-biological samples not complying with the requirements for bathing water.

Further reading:

- Health Board website. Suplusvesi (Bathing water). *[www] http://www.terviseamet.ee/keskkonnatervis/vesi/suplusvesi.html*

8.3 Environmental noise

Environmental noise is defined in the Ambient Air Protection Act as "unwanted or harmful outdoor sound created by human activities and unwanted or harmful sound created by stationary or mobile sources of pollution". The Act prohibits the unjustified creation of noise.

In real life, however, noise is created by any activity — cars, trains and planes rumble; various equipment emit noise; wind turbines and ventilators hum; construction works create noise, etc.

In physical terms, noise refers to sound waves of various frequency and intensity. There is no fixed particular decibel limit to decide when sound becomes noise because it depends on both the sound emitted and the listener. Noise is ascribed negative qualities — too loud, unpleasant, irritating; sounds are described with positive adjectives — beautiful, gentle, melodic.

The damaging effect of noise depends on the intensity or loudness, measured in decibels (dB), frequency (Hz) and duration of a sound. Humans can perceive sounds between 20 and 20,000 Hz, but non-uniformly, i.e., there is an acoustical window where the human ear is most susceptible: 500–8,000 Hz. Noise levels can be measured, calculated and modelled based on calculations.

Noise can have an adverse effect on human health and well-being. It may interrupt work, rest, sleep, information exchange and studying or make it more difficult. Noise can cause permanent damage to the inner ear, which may result in hearing loss of various grades. In addition, noise can have other physical and psychological effects. Noise can cause stress or various functional disorders. How people react to noise depends, aside from the physical qualities, on how they perceive noise. People react to the same levels of noise differently.

According to a survey conducted by the World Health Organisation (WHO), one in five Europeans is regularly exposed to sound levels at night that could significantly damage health. The European Union has calculated that the estimated costs of noise pollution to society vary between 0.2% and 2% of GDP.

Noise is often equated to traffic noise. Traffic noise is caused by tyre-road interaction and the engines of vehicles. The intensity of noise mainly depends on the intensity of traffic and on the number of heavy vehicles. Noise levels also depend on the nature of the landscape. The effect of traffic noise on a building depends on the distance of the source of noise and the position of the building relative to the road.

Traffic noise is efficiently dampened by noise barrier walls and mounds. Regrettably, we can see those structures more often in other countries than in Estonia. However, the protection of roadside houses against noise is also given increasing consideration in road maintenance projects in Estonia.

Table 8.2. Some typical sound pressure levels

source	**sound pressure level (dB)**
jet engine	155
attending a rock concert at a stadium	150
high-speed train, 120 km/h	126
lorry, 100 km/h	113
circular saw	113
passenger ferry	110
big compressor	110
excavator, lifting equipment	109
lorry, 50 km/h	108
passenger car, 100 km/h	107
big pump	106
big transformer	103
shouting	90
speech	60

8.3.1 Legislation on noise

Estonia has about 100 legislative acts on noise; the most important of these are the Ambient Air Protection Act and the Public Health Act as well as various regulations, adopted on the basis of these Acts, concerning environmental and indoor noise and laying down permissible noise levels. Noise is also addressed by the Planning Act, the Environmental Impact Assessment and Environmental Management System Act and the Integrated Pollution Prevention and Control Act, which regulate the issues related to noise and the possibilities to dampen noise when planning an activity or designing premises. Another issue is the level of noise in the working environment, which is regulated by the Occupational Health and Safety Act as well as various regulations adopted under that Act.

Noise level requirements for different equipment are set forth in the Product Conformity Act, the Machinery Safety Act and other legislation.

The issues of noise supervision and competency are regulated by the Penal Code and the Law Enforcement Act (not yet entered into force).

8.3.2 Wind turbines and wind farms

The construction of wind farms and the erection of wind turbines have raised concerns among residents about increased noise levels. The best solution of this problem is, as in the case of other new sources of noise, meticulous and skilful planning to ensure the protection of noise-sensitive objects. A noise assessment report should be prepared and measures foreseen from the planning stage. Noise levels to which residential buildings, schools, hospitals, etc. are exposed may not exceed certain limits. Local authorities may establish even more stringent limits of noise from wind turbines and wind farms.

8.3.3 Noise map of Tallinn and Tartu in 2012

In 2012, a noise map of Tallinn was prepared the second time and of Tartu for the first time. These are the most extensive surveys of noise levels, although not the only ones.

The residents of Tallinn are mainly exposed to traffic noise. The number of people exposed to noise from other sources does not exceed 15,000 (both in the daytime and at night). According to calculations, the total surface area of traffic noise zones with noise levels over 55 dB is 68 km^2, which constitutes ~ 43% of the total area of Tallinn. The total number of people in these zones is 270,900, or ~ 67% of the total population of the capital city.

In Tartu, traffic noise zones with noise levels over 55 dB constitute 33% of the town's territory, or around 12.9 km^2, and the estimated share of people affected by traffic noise is 42% of the total population, or around 41,200 people, while rail traffic noise zones constitute 8%, or 3 km^2, and the number of people affected by rail traffic noise is about 3,200, or 3% of the total population. Industrial noise levels are much lower and do not pose a problem.

The estimated numbers of people exposed to traffic noise should be accepted with a certain reservation because it is clear that the numbers are overstated due to some weaknesses in the EU recommended assessment method and the resulting generalisation.

The following measures should be implemented in order to reduce noise levels:

- decrease the number of motor vehicles in densely populated areas and divert intensive traffic flows from residential and recreational areas;
- ensure better conditions for pedestrians and cyclists by creating cycle and pedestrian tracks; cycle and pedestrian tracks should be located further away from roads to decrease exposure to pollutants and noise;
- city planning should take into account environmental health aspects; the total surface area of buffer and green spaces should be increased;
- change the behaviour and habits of people.

Further reading:

- Ministry of the Environment website. *[www] http://www.envir.ee/422956*
- Health Board website. *[www] http://www.terviseamet.ee/keskkonnatervis/fuusikalised-tegurid/mura.html*

8.4 Ionizing radiation

Radiation can be classified according to the effects it produces on matter, into **ionising** (cosmic rays, x-rays and radiation emitted by radioactive materials) and **non-ionising** (UV-radiation, infrared radiation, radio waves and microwaves, visible light) radiation. This environmental performance review deals with ionising radiation emitted by radioactive substances, which creates ion-pairs in the tissues of organisms, i.e. a part of molecules is separated into electrically charged particles. Such radiation may cause cancer. Ionising radiation cannot be seen or felt and the level of radiation can only be measured by using special equipment.

Ionising radiation is ubiquitous in the environment and humans are exposed to it. Ionising radiation comes from both natural sources (cosmic rays, gamma radiation in the ground, radon decay products in the air and various radionuclides occurring naturally in food and drinks) and artificial or man-made sources (medical use of x-rays, radioactive pollution from atmospheric nuclear testing and radioactive emissions produced by the nuclear industry, etc.).

In Estonia, information about the radiation levels in the environment is collected in the course of the national monitoring programme. More than 250 samples taken from the environment are analysed each year. The primary interest of the monitoring are radionuclides – 137Cs, 90Sr and 3H – emitted to the environment as a result of human activity. The main pollution indicator is 137Cs, which originated from atmospheric nuclear testing and the Chernobyl nuclear power plant disaster. There are no nuclear power plants in Estonia and therefore, the main source of danger is transboundary pollution from other countries. 10 monitoring stations across Estonia monitor the level of natural gamma radiation in the atmosphere and three filter stations measure the radioactivity of airborne particles. In recent years, the annual average values of background natural gamma dose rates have remained at around 60 nSv/h. The concentrations of 137Cs in the atmosphere are low and have been stable over the years (1.5 mikroBq/m^3 on average). Single higher values have only been measured only after extensive bog and forest fires that have temporarily raised the radioactive pollution found on the ground into the atmosphere. Higher than average levels of 137Cs were also recorded in 2011, after the Fukushima nuclear disaster (the highest level measured was 0.4 mBq/m^3).

However, the increase in the level of radiation was marginal and did not pose any danger to people. As regards other man-made radionuclides, these have either not been detected in the atmosphere or their levels are so low that they cannot be detected. Only after the Fukushima disaster, 134Cs (the highest value was 0.35 mBq/m^3) and 131I (the highest value was 1.2 mBq/m^3) were detected in the atmosphere. The levels of radioactivity in other samples, taken from soil, surface and drinking water, the marine environment, raw milk and food produced in Estonia, daily food rations, forest mushrooms and berries, have also been low.

People get their main dose of radiation from natural sources. About half of the radiation dose comes from radioactive **radon** gas that seeps from the ground. Radon occurs naturally as an indirect decay product of uranium. Uranium is found everywhere in the Earth's crust in varying concentrations. This means that radon is also found everywhere. High radon levels in soil are related to the dicthyonema shale formation in the klint zone in northern Estonia and in the areas of granite intrusion in southern Estonia. Radon that has seeped from the ground dissipates quickly in the atmosphere and its levels in ambient air do not exceed 10–30 Bq/m^3. Indoor levels of radon may be much higher, reaching up to several thousand Bq/m^3. Radon seeps into buildings due to poor construction quality and through cracks formed as the building ages. When inhaled, radon can lead to lung cancer. Indoor radon levels were measured in more than 2,500 buildings in the course of national monitoring. In recent years, the monitoring has focussed on child care institutions and various working places (spas, mines, pumping station). In the course of the most recent monitoring that was completed in 2012, radon levels were measured in 100 kindergartens in Tallinn. The overall situation is good. Only single rooms in single kindergartens did not conform to the requirements for the indoor climate in pre-school child care institutions established by a regulation of the Government of the Republic in 2011. Data from the survey are used in the planning of renovation works in child care institutions. Reports on radon surveys and radiation monitoring are published on the website of the Environmental Board.

The content of natural radionuclides (isotopes of radium) is significantly high in the drinking water from the Cambrian-Vendian aquifer, exceeding the indicator parameters laid down by legislation by as much as nine times.

Further reading:

- The Environmental Board's website. Kiirgus (Radiation). *[www] http://www.keskkonnaamet.ee/keskkonnakaitse/kiirgus-3/*
- Ministry of the Environment website. Mis on kiirgus? (What is radiation?) *[www] http://www.envir.ee/1171545*

8.5 Availability of solar energy and UV radiation

The availability of solar energy is an environmental factor that determines the primary production and affects the health of humans and other life forms. What is important are the amount and spectral composition of solar radiation. The intensity of solar energy depends on the geographical latitude and also on the changing of the atmospheric conditions (the amount of clouds as well as the aerosol and water vapour contents). In Estonia, the amount of energy from total integral solar radiation[1] varies within 10% in a year. The main source of energy for primary production is photosynthetically active radiation at wavelengths ranging between 400 and 700 nm. Ultraviolet (UV) radiation that reaches the Earth's surface damages cell structure at shorter wavelengths (between 290 and 400 nm) but exposure to small amounts of UV radiation can have beneficial effects. UV-B radiation is most effective at wavelengths below 315 nm. Over time, various mechanisms have formed in the atmosphere that stabilise the chemical composition and remove pollutants. Pollutants are created in the atmosphere with the help of UV radiation. The progress made in phasing out the production and consumption of chemicals with Ozone Depleting Potential under the Montreal Protocol and its more stringent annexes has been surprisingly good and the threat to the ozone layer has been dramatically reduced (see Chapter 3.2.3). However, some loss of ozone will persist for several decades due to the increasing GHG content in the atmosphere. By the second half of this century, the ozone layer above Estonia may be as much as 10% thicker than before the damaging of the ozone layer started. In Estonia, integral and UV radiation levels are mainly measured in Tõravere in cooperation between the Tartu Observatory and the National Weather Service. The results of measuring the integral solar radiation and other indirect data have been used to reconstruct retrospectively the erythemally weighted daily UV doses for the period starting from 1953. The direct measurement of these doses started in 1998. The results indicate that an average of 80% of the integral radiation and 90% of the erythemal radiation are received during the summer half-year. The biggest contributors are the four summer months (May to August) (Figure 8.2). This information can be used to assess the effects of UV radiation and its changes over time. The amplitude of change in UV-B radiation doses is bigger than in the case of integral, erythemal and UV-A radiations.

According to the long-term data collected at the Tartu-Tõravere meteorological station, nearly 90% of the effective erythemal dose (the amount of sun exposure which causes skin sunburn redness) reaches the Earth's surface in the period between the spring and autumn equinoxes[2]. The variation of this value has remained within 8% year on year, apart from two exceptional years (1963 and 2002) when the average dose value was 11%. Relatively sunny and relatively cloudy summers occur with a cycle of 35–40 years, similarly to the cyclical alternation of dry and wet years. This means that we can expect a string of above average rainy summers in the forthcoming decade. UV light kills or inactivates bacteria and viruses, which is beneficial to health. The direct impact of UV radiation on people depends on the behaviour of individuals. The ratio between the radiation densities of the UV-B (290–315 nm) and UV-A (315–400 nm) spectral areas is important for the normal functioning of biological tissues. A thin ozone layer and clear sky increase the UV-B irradiation, while a thicker ozone layer and cloudy weather shift the ratio in favour of the UV-A irradiation. When a well-established balance is upset, the cells are damaged.

It has been know for more than 70 years that there is a positive statistical correlation between ultraviolet (UV) radiation and the number of deaths from skin cancer. Skin cancer is more common in people with light skin colour; their skin is more susceptible to sunburn, especially when they are in a hotter region, away from their usual place of residence. There is a correlation between nonmelanoma skin cancer and cumulative exposure to UV radiation. It wasn't until around 30 years ago that we started paying attention to the role of UV radiation in the production of vitamin D and its anti-cancer effect as well as other health-beneficial properties. Although vitamin D deficiency is more common in northern latitudes, it may also occur in sunny regions. The spectral composition of the UV lamps used in sunbeds differs somewhat from that of natural sunlight and may increase the risk of skin cancer. Many local authorities in the Scandinavian countries have banned the use of sunbeds. No studies assessing the skin cancer risk associated with sunbathing have been conducted in Estonia.

The spectral composition of UV radiation (the ratio of UVA to UVB in sunlight) also affects the quality of fruit used for food. On a clear sunny day the share of UVB is bigger. The UVB/UVA ratio affects the content of antioxidants and other additives in fruits. For example, the antioxidant content in strawberries that have ripened in sunlight is higher than in those that have ripened on rainy days.

1 Integral radiation refers to solar radiation that reaches the Earth at wavelengths between 300 and 3,000 nm.

2 Erythemal radiation is the range of UV wavelengths that causes skin sunburn redness.

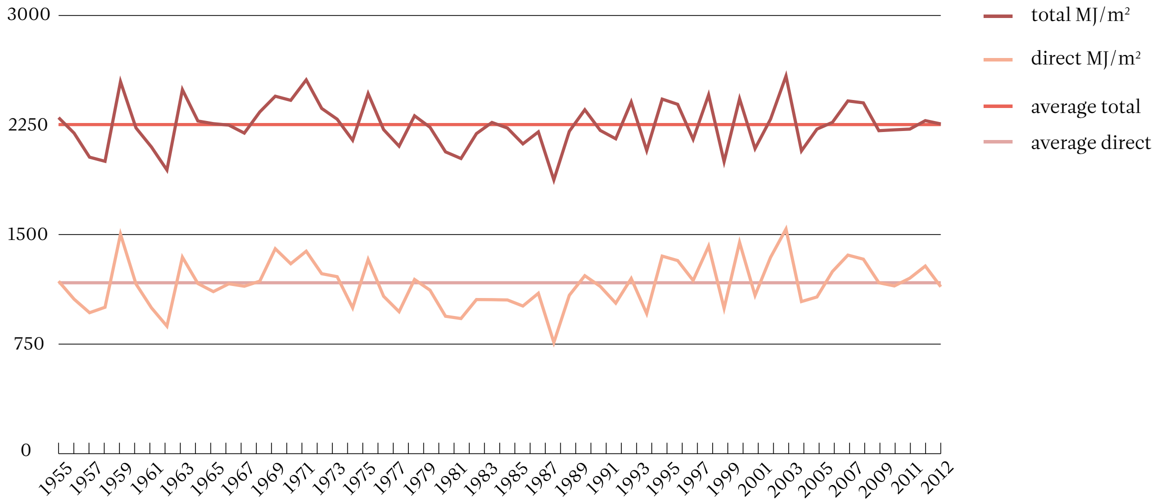

Figure 8.2. Change in the amount of energy from total radiation (direct and diffuse radiations) and direct radiation from May to August in 1955–2012. Note: UV-B and UV-A (315–400 nm) radiations are measured separately from 2002; UV radiation spectra at wavelengths between 290 and 400 nm are registered regularly from 2004.

Further reading:

- V. Russak, A. Kallis (editors), H. Tooming (ed.). (2003). Eesti Kiirguskliima teatmik. EMHI, Tallinn, 384 p.
- U. Veismann, K. Eerme. (2011). Päikese ultraviolettkiirgus ja atmosfääriosoon, Ilmamaa, Tartu, 215 p.

8.6 The impact of ambient air pollution on human health

The harmful effect of air pollution on health depends on the type and amount of pollutant, source of pollution, the medical history and age of the individual exposed to the pollution as well as on many other factors. Exposure to pollutants is a risk factor for triggering both acute (from short-time exposure to high concentrations of pollutants) and chronic health effects (from long-term exposure to moderately high concentrations of air pollution). However, diseases are often caused by a combination of factors, air pollution being just one of them. People who are more susceptible to pollution can experience negative symptoms even when others don't. The primary health problems arising as a result of air pollution are lung diseases and diseases of the heart and circulatory system.

An analysis of the monitoring data from recent years indicates that the greatest problem related to ambient air quality is the amount of **fine particles**, especially in spring. However, air quality may also deteriorate during the winter heating season. Fine dust, or more precisely particulate matter, is a mixture of very small particles consisting of nitrogen and sulphur oxides, acids (nitrates and sulphates), organic substances (polyaromatic hydrocarbons – PAHs), metals and soil and dust particles. The primary sources of particles are vehicle emissions, wood-burning stoves and fireplaces, boiler plants and industrial enterprises. An assessment of the health impact of particulate matter carried out in Estonia showed that particles can reduce the average life expectancy by 0.41 years[3]. On the basis of this assessment, the average life expectancy decreased by 0.7 years in Tallinn, 0.6 years in Tartu, 0.5 years in Narva and Pärnu and 0.4 years in Kohtla-Järve. This means approximately 600 incidents of premature death per year, more than 8,000 lost years of life, and hundreds of hospital days. While the effect is below the European average, it is still significant.

Epidemiological studies of the participants in the research "The respiratory tract and health" in Tartu indicate that people who live in areas where the amounts of fine particles from traffic are bigger are 1.18 times more likely to develop cardiovascular diseases[4] and those who live in areas with higher pollution from wood burning stoves and fireplaces are 1.20 times more likely to develop cough and 1.30 times more likely to develop asthma[5] (the ratio of probability was calculated for changes corresponding to the changes in the median quartile of PM exposure). Also, people who lived near (< 150 m) heavy traffic areas (> 8,000 trips) had an increased risk of developing cardiovascular diseases. An ongoing time series analysis that compares the average daily pollutant contents at the Õismäe monitoring station with the mortality rates in Tallinn suggests that peaks in the content of pollutants in ambient air have an impact on the mortality of the following day.

Besides the health effect of fine particle, the health effects of ozone have also been extensively studied throughout the world and in Europe. While fine particles are considered to be the cause of 3.5 million premature deaths worldwide, ozone is believed to cause 0.7 million incidents of premature death. The number of ozone-related deaths in Europe is 30,000[6]; there are no precise data available for Estonia. Health studies have found that ozone, similarly to fine particles, affects health at concentrations below the limit values. Therefore, Estonia too should assess the health effect of ozone in the near future.

Ambient air also contains other pollutants besides fine particles and ozone, such as polyaromatic hydrocarbons (PAHs), carbon monoxide (CO) and sulphur dioxide (SO_2) but a large part of their effect is tied to the impact of particulate matter. Since 2012, the Estonian Environmental Research Centre's oven lab has measured the emissions of pollutants (such as PAHs, dioxins/furans and HCB) from stoves and fire places that are used for heating private homes. The results of measurements can be used to specify the health effect of pollutants from local heating. The ambient air in the industrial region of north-eastern Estonia, where specific pollutants, including VOCs, are emitted from industrial processes, also needs to be analysed.

3 Välisõhu kvaliteedi mõju inimeste tervisele – peentest osakestest tuleneva mõju hindamine kogu Eesti lõikes. (Impact of ambient air quality on the health of people – assessment of the effect of fine particles across Estonia.) (2011). / H. Orru et al. University of Tartu [www] rahvatervis.ut.ee/bitstream/1/5081/1/Orru2011.pdf

4 Chronic Traffic-Induced PM Exposure and Self-Reported Respiratory and Cardiovascular Health in the RHINE Tartu Cohort. (2009). / H.Orru jt. International Journal of Environmental Research and Public Health 6 (11) : 2740–51.

5 Effects of Chronic PM Exposure From Local Heating on Self-reported Respiratory and Cardiovascular Health in the RHINE Tartu Cohort. (2011). / H. Orru jt. Epidemiology 1, S 225 – S 226.

6 Impact of Climate Change on Ozone-Related Mortality and Morbidity in Europe. (2013). / H. Orru et al. European Respiratory Journal; 41: 285–294.

8.7 Dangerous substances in food

The European Union is paying particular attention to food safety, in order to prevent risks to consumer health. National monitoring programmes are sampling programmes that aim at monitoring food safety and quality and identifying food that is dangerous to human health. Monitoring programmes are prepared in accordance with the requirements of Estonian and EU legislation.

Commission Regulation (EU) No 1259/2011 on maximum levels for dioxins, dioxin-like PCBs and non dioxin-like PCBs in foodstuffs[7] is applicable. Compliance with limit values is ensured by Commission Regulation (EU) No 915/2010 concerning a coordinated multiannual control programme of the EU for 2011, 2012 and 2013 to ensure compliance with maximum levels of and to assess the consumer exposure to pesticide residues in and on food of plant and animal origin[8]. The regulation that sets maximum levels for certain contaminants in foodstuffs[9] is also applicable.

Usually, people only start paying attention to chemicals when a disaster happens, a non-compliance with food safety requirements is discovered or a public figure suffers from food poisoning. Toxic substances or groups of substances that persist in the environment and are transported, through air, water, waste, food (including forage) or migratory species, across state borders and bioaccumulate in aquatic and terrestrial ecosystems far from the original source are especially dangerous to human health. Organisms at the top of the food chain (including humans) are most susceptible to effects from hazardous compounds because the toxicants can accumulate in their tissues at levels hundreds of times higher than in the surrounding environment. Estonians can also be exposed to hazardous substances when they are travelling abroad.

Commission Regulation (EC) No 1881/2006[10] sets the maximum levels for certain contaminants in foodstuffs, such as polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofurans (PCDF), dioxin-like PCBs (DL-PCB), cadmium, mercury and lead. The Scientific Committee on Food (SCF) in Europe has established tolerable weekly intakes (TWI) for hazardous substances, while the World Health Organisation (WHO) has defined acceptable daily intakes (ADI) of substances. The above limits are expressed in terms of the content of a dangerous substance in food consumed per kg of body weight. For example, the tolerable weekly intakes for PCDD/Fs and DL- PCBs, a group of compounds that are considered to among the most dangerous, is 14 pg/kg body weight, which corresponds to the WHO's acceptable daily intake value (1–4 pg/kg body weight).

Infants, the elderly, and pregnant or breastfeeding women are more susceptible to the effects of hazardous substances. In the Baltic Sea region fishermen and their family members are also at a higher risk. It is believed that the increased risk of breast cancer in women and low birth weight in infants (boys in particular) in the Baltic Sea region is caused by high dioxin content of fish from the Baltic Sea. Exposure to dioxin in children aged up to 2 years may affect the development of their brain. High dioxin levels have been found in fatty fish (salmon, Baltic herring, etc.) from the Baltic Sea. It is recommended to prefer low fat food, including fish from the Baltic Sea, in order to spread risks. However, recent studies into food safety conducted in Estonia and Finland suggest that the content of PCDD/Fs and DL-PCBs in Baltic herring has decreased in the period between 2002 and 2009. According to the primary information, the total contents of dioxins and dioxin-like PCBs in eight years old and 22 cm long Baltic herring and in other fish over 22 cm long (in the case of PCDD/Fs in 8.11 years; in the case of dioxins and dioxin-like bifenyls 7.7 years) caught in Estonian coastal waters exceed the limit values. More than eight year old Baltic herring constitutes a couple of per cent of the total catch by Estonian fishermen. The Estonian findings were confirmed by those of a group of Finnish researchers in 2009. In 2011, it was stated in Brussels that the total contents of dioxins and dioxin-like polychlorinated biphenyls in large Baltic herring (over 21 cm long) caught from the Gulf of Finland were below the limit values established in the EU.

The contents of dioxins and dioxin-like PCBs in other foodstuffs – pork, mutton, poultry, beef, butter, rapeseed oil, non-fatty fish (pike, perch pike, perch, bream), tinned fish and fish from Estonian fish farms – were significantly below the limit values; therefore they do not pose a risk to the health of the Estonian population.

In 2009–2011, 61 samples of fresh and chilled fish analysed by the Veterinary and Food Board contained metals, while the cadmium and mercury contents exceeded the limit of analytical determination in only six samples.

From 1 July 2007, supervision over the forage and food handling chain is within the competence of the Veterinary and Food Board.

7 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:320:0018:0023:ET:PDF
8 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:269:0008:0018:ET:PDF
9 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006R1881:ET:NOT
10 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLE-G:2006R1881:20100701:ET:PDF

Further reading:

- Food safety control and surveillance programmes: Monitoring of pollutants in food (including foodstuffs of animal origin); monitoring of pesticide residues; monitoring of dioxides in food (including fish from the Baltic Sea and Lake Peipsi), monitoring of additives; other studies and expert opinions *http://www.agri.ee/uuringud-statistika/ and http://www.vet.agri.ee/?op=body&id=682*

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8.8 Dangerous substances in the aquatic environment

The data collected within the monitoring of hazardous substances is used for the development of monitoring programmes as well as for planning, implementing and amending environmental measures. The data are also used in reports on hazardous substances submitted to the European Commission and HELCOM. The ultimate aim of the actions related to hazardous substances is to achieve the elimination of hazardous substances from surface water and contribute to achieving concentrations in the aquatic environment near background values for naturally occurring substances.

The issue of hazardous substances in the aquatic environment is governed by various directives and regulations. Directive 2000/60/EC of the European Parliament and of the Council establishes a framework for Community action in the field of water policy. Directive 2006/11/EC of the European Parliament and of the Council concerns pollution caused by certain dangerous substances discharged into the aquatic environment of the Community. Directive 2008/105/EC of the European Parliament and of the Council defines environmental quality standards in the field of water policy. Regulation No 33 of the Minister of the Environment establishes lists 1 and 2 of hazardous substances and groups of substances as well as the lists of priority substances, priority hazardous substances and groups of such substances that harm the aquatic environment, while Regulation No 49 (amended by Regulation No 50) of the Minister of the Environment establishes the environmental quality standards applicable to surface water, methods of their application and the environmental quality standards applicable to aquatic biota.

Estonia has established lists 1 and 2 of hazardous substances and groups of substances as well as the lists of priority substances, priority hazardous substances and groups of such substances that harm the environment, including humans. Two types of environmental quality standards apply to these hazardous substances/groups of substances in surface water: annual average limit value and maximum permissible limit value. The limit values have been established for both inland surface water (rivers, lakes and the related artificial water bodies as well as heavily modified water bodies) and other surface water. As regards the hazardous substances that can harm surface water, the concentrations of monophenols and diphenols and heavy metals in our surface water bodies and coastal waters may still cause problems.

Over the past four years, the concentrations of many hazardous substances that had not been analysed previously have been measured. The concentrations of hazardous substances/groups of substances have been analysed recently within studies commissioned by the Ministry of the Environment and in the framework of international projects.

The findings suggest that the status of the majority of our surface water bodies is good. In most cases, the concentrations of hazardous substances measured in surface water (rivers, Lake Peipsi) remained below the limit of analytical determination and did not exceed the environmental quality limit values.

Water samples taken from Tallinn Bay, in the coastal area adjacent to BLRT Grupp AS (a shipbuilding company) contained very high concentrations of organotin compounds; the concentration of tributyltin exceeded the maximum permissible limit value (0.0015 µg/l) by more than 6,000 times. The concentrations of some organotin compounds, such as monobutyltin and dibutyltin, in the water of Keila, Kasari and Narva rivers also exceeded the limit of analytical determination.

The concentration of benzene in the Kunda and Pühajõe rivers exceeded the average annual limit values applicable to inland surface water. However, these concentrations were significantly below the maximum permissible limit value established for the concentration of the compound in inland surface water.

High concentrations of monophenols were identified in water samples taken from the Kohtla, Vasalemma, Narva and Keila rivers, Lake Peipsi and the coastal waters in the region of Sillamäe.

The concentrations of cadmium and mercury in rivers were below the limit of analytical determination. The concentrations of the following substances exceeded the limit of analytical determination but remained below the average annual limit values: lead and its compounds in the water of the Kunda and Pühajõe rivers; nickel in the water of the Kohtla and Pühajõe rivers; zinc in the Vasalemma, Pärnu and Mustjõgi rivers; chromium in the Kasari and Vasalemma rivers.

While the concentrations of some phthalates, such as diisobutyl phthalate, di(2-ethylhexyl)phthalate and dimethyl phthalate, exceeded the limit of analytical determination, they remained below the established limit values.

Our oil shale mining region continues to be problematic in terms of the concentrations of hazardous substances. The concentrations of organotin compounds are high in the areas of ports and shipyards. Also there are hazardous substances, the concentrations of which have not been measured. Additional studies are required to check the occurrence of these substances in the Estonian aquatic environment.

In recent years, we have also examined the potential sources of substances that are harmful to the aquatic environment and measured the concentrations of such substances in wastewater, soil and wastewater sediments.

When monitoring hazardous substances in the aquatic environment, sample matrixes must be selected by taking into account the chemicals used in Estonia and the EU recommendations on which substances should be monitored in water and which in sediments or aquatic biota.

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8.9 Pesticides

A pesticide is any substance used to control pests that can damage plants during their life-cycle and to increase yield. Pesticides are used to control insects and rodents (insecticides and rodenticides), unwanted weeds (herbicides) and to fight fungal infections (fungicides).

Pesticides have been used for decades. The most infamous synthetic pesticide is DDT (p,p-dichloro-diphenyltrichloroethane), which was introduced to the market in 1939 and used widely to kill insects. After that, the production and use of synthetic pesticides grew explosively, persisting for more than 40 years. DDT and other halogenated organic compounds were used widely and in large quantities – it was not known that they were highly toxic not only to insects, but also to the environment as a whole. People are only starting to realise how harmful the accumulation and persistence in soil and water of these compounds is. Pesticides and fertilisers have a direct impact on the environment through soil and water. Residues of pesticides flushed from field may reach both surface and ground water and end up on our table in agricultural products.

Pesticides also have an impact on pollinator insects. Pollinators have a crucial role in ecosystems and society. Many European cultivated crops and wild flowering plants rely on pollinator insects to produce seeds and fruit – around 90% of flowering plants are insect-pollinating and humans get about one third of their nutrition from these plants, either directly or indirectly. The most efficient pollinators are Apoidea, including honey bees and bumblebees. There is clear evidence that the number of honey bees has decreased in different parts of the world, including Europe. A similar tendency is observed in Estonia. The decline in bee populations has been linked to modern intensive farming practices, including the increased use of pesticides. A large part of pesticides used in the world today are neonicotinoids that act as a neurotoxin on insects. Unfortunately, they can affect not only pests, but also useful insects, such as honeybees. Recent studies suggest that even very small quantities of neonicotinoids can significantly change bee behaviour and physiological processes in bees. It has been established that the toxicity of neonicotinoids increases as it is combined with other pesticides. Therefore, many bee researchers have found that neonicotinoids are harmful to bees and their use should be limited or banned altogether.

Based on this insight, the European Commission adopted a regulation that limits the use of three neonicotinoids (clothianidin, thiamethoxam and imidacloprid). The restriction entered into force on 1 December 2003 and is reviewed no later than within two years.

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