

5. *Ambient air*

Ambient air is an important factor that affects our lives during the daytime and at night because the quality of indoor air depends largely on that of ambient air. Air pollutants in ambient air affect human health and the status of ecosystems even when we may be unaware of any pollution of ambient air.

According to the data from the continuous monitoring of ambient air, the quality of air in Estonia is good; a number of national legislative acts have been adopted in order to ensure that the good quality of ambient air is maintained and improved. We also need to ensure that international requirements are met. However, what is most important is that anyone can contribute by acting reasonably and taking care of their health and the health of others, as well as of the environment.

The main sources of ambient air pollution are oil shale-based energy production and the shale oil industry, closely followed by transport.

This Environmental Performance Review includes national emission totals for the territory of the Republic of Estonia as well as for the economic area, based on monitoring data or calculated results.

5.1 Legal background

The activities that affect the air quality in Estonia are governed by the **Ambient Air Protection Act**, adopted in 2004, and the 30 legal acts adopted on the basis of the Ambient Air Protection Act, all of which aim to maintain the quality of ambient air in regions where it is good, and at improving it in regions where the quality of ambient air does not meet the legal requirements.

Any activities subject to the Ambient Air Protection Act must be carried out so as to ensure the achievement of national objectives, while taking into account the requirements of the legislation of the European Union as well as international ambient air protection conventions.

The most important international requirements are set out in Directive 2008/50/EC on ambient air quality and cleaner air for Europe; Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants; the Convention on Long-range Transboundary Air Pollution; Council decision on the significant negative impacts on human health of fine particulate matter (PM_{2.5}) and Directive 2010/75/EU on industrial emissions. The latter imposes more stringent requirements for large combustion plants, with effect from 1 January 2016. The transition periods for the application of the emission limit values for sulphur dioxide and particulate matter granted previously to large combustion plants firing oil shale in Estonia will remain effective until 31 December 2015.

In the longer term, it is very important to review the EU air quality policy and the relevant legislation. The aim of the revision is to transpose into EU law the emission reduction commitments for main air pollutants to be achieved in 2020, as agreed by amending the Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to the Convention on Long-range Transboundary Air Pollution in 2012. In addition, further common EU targets for ambient air quality will be considered.

A regulation adopted under the Ambient Air Protection Act sets out emission limit values for different types of motor and fuel used by mobile sources of pollution.

All these legislative acts aim to reduce the overall content of pollutants in ambient air in order to improve the quality of air for large sections of the population and to minimise long-range transboundary air pollution. The quality targets for ambient air are specified in the Estonian Environmental Strategy 2030¹.

5.2 Emissions of acidifying pollutants

Sulphur and nitrogen compounds react with moisture in the air to form acids that fall as acid rain and cause damage to the environment, including forests, water ecosystems as well as buildings and other property.

Acidification is caused by sulphur dioxide (SO₂), nitrogen oxides (NO_x) and ammonia (NH₃) emitted into the air due to human activity. The largest sources of sulphur dioxide emissions are the energy sector and industry. Nitrogen oxide emissions primarily originate from transport and the energy sector, while ammonia emissions come mainly from animal husbandry and the use of fertilisers.

According to the Gothenburg Protocol to the Convention on Long-range Transboundary Air Pollution, as revised in 2012, Estonia must limit, by 2020, the emissions of SO₂, NO_x and NH₃ by 32%, 18% and 1%, respectively, as compared to the baseline level of 2005 (Figure 5.1).

These targets will become effective upon the ratification of the amendments to the Gothenburg Protocol by Estonia. Until that time, the following total limit values for emissions of sulphur dioxide, nitrogen oxides and ammonia from stationary and mobile sources of pollution will apply in Estonia:

SO₂ – 100,000 t,
NO_x – 60,000 t and
NH₃ – 29,000 t.

In recent years, Estonia has had no problems with adhering to the emission limit totals. Also, annual emission limit values for sulphur dioxide have been established for large combustion plants firing oil shale (25,000 tonnes in a calendar year; effective from 1 January 2012). In order to adhere to the limit values, Eesti Energia's company Narva Elektriijaamad AS installed desulphurisation equipment in the Eesti Elektriijaam power plant; also, alternative treatment methods are applied, such as adding limestone to oil shale and water injection into furnaces.

¹ <http://www.envir.ee/orb.aw/class-file/action-preview/id=462256/keskkonnastrateegia.pdf>

Sulphur dioxide SO₂

A total of 72,690 tonnes of sulphur dioxide was emitted into Estonia's ambient air in 2011; the bulk of it was generated as a result of burning fuel in the energy sector (92.7%) and in manufacturing industry (6.1%). Most of the emissions originated from oil-shale-fired power plants. This means that the reduction of sulphur dioxide emissions directly depends on measures implemented at power plants as well as on the amounts of gases, such as semi-coke gas and generator gas, generated in the course of oil shale production. A marginal amount of SO₂ emissions originated from the non-industrial fuels combustion and from transport (due to the use of motor fuels containing sulphur).

SO₂ emissions have dropped by approximately 73.4% compared to 1990 (Figure 5.2). The changes came about through the restructuring of the economy in the early 1990s, which significantly reduced the amount of electricity consumed by industry. The extent of the use of other fuels also changed, after natural gas and wood were substituted for heavy oil with a high sulphur content. The use of shale oil and light fuel oil as well as motor fuel with lower sulphur content has also increased.

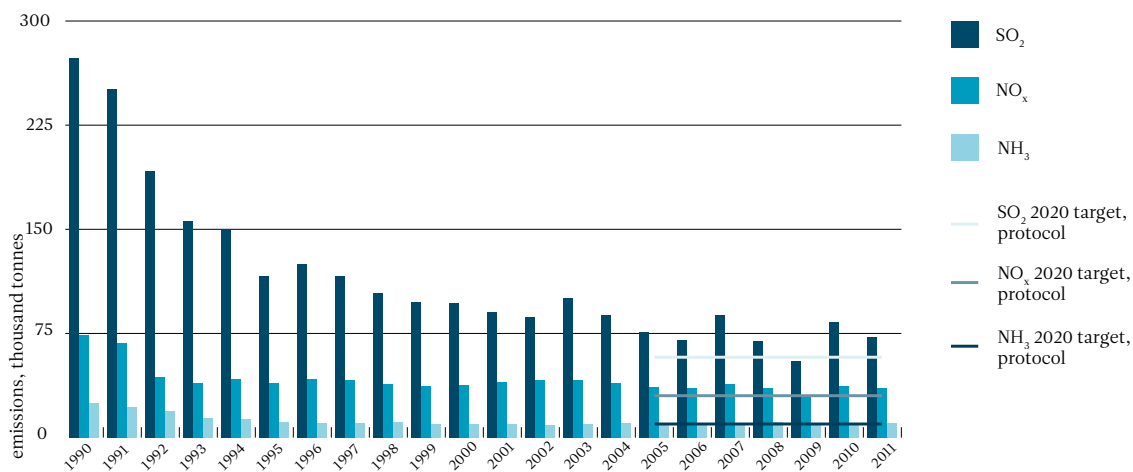


Figure 5.1. Emissions of sulphur dioxide (SO₂), nitrogen oxide (NO_x) and ammonia (NH₃) in 1990–2011 and emissions reduction targets agreed under the Gothenburg protocol. The targets are enforced after the ratification of the protocol and are to be achieved by 2020. Data: ESTEA (the Estonian Environmental Agency).

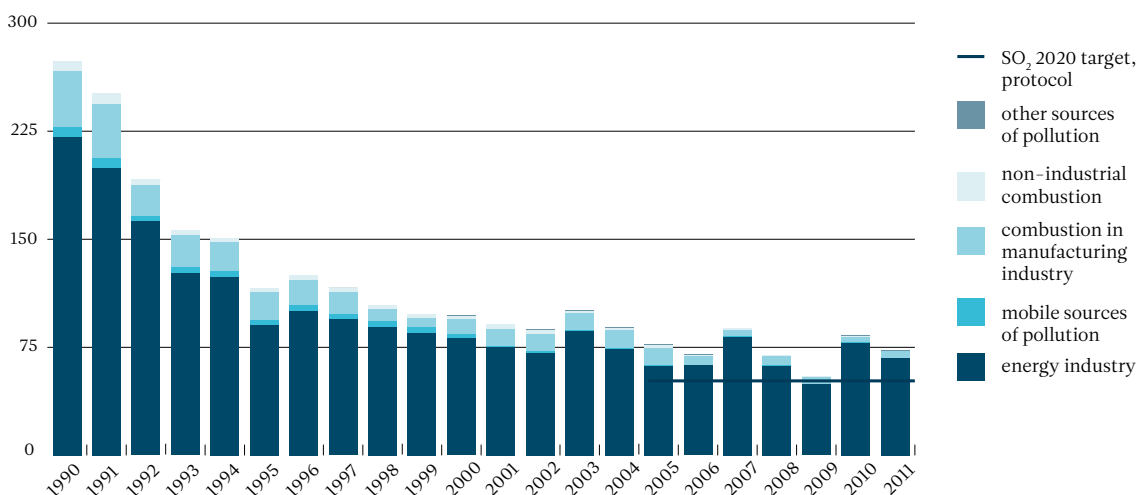


Figure 5.2. SO₂ emissions by fields of activity in 1990–2011 and emissions reduction target agreed under the Gothenburg protocol. The target is enforced after the ratification of the protocol and is to be achieved by 2020. Data: ESTEA.

Nitrogen oxides NO_x

In 2011, around 35,654 tonnes of nitrogen oxides were emitted into ambient air in Estonia, 42% of which originated from mobile sources of pollution. The remainder of the nitrogen oxides emissions were generated as a result of burning fuels in the energy sector (42%) and in the manufacturing industry (6%). The main pollution sources for both sulphur dioxides and nitrogen oxides are power plants firing oil shale.

The emissions of nitrogen oxides have decreased by 51.6% compared to 1990, mainly due to changes in the energy and transport sectors and the increase in the use of diesel fuel and the number of new vehicles equipped with catalytic converters (Figure 5.3).

There were no significant changes in nitrogen oxide emissions in specific economic sectors compared to 1990.

Ammonia NH₃

A total of 10,382 tonnes of ammonia was emitted into Estonia's ambient air in 2011; the bulk of it (93.5%) originated from agriculture. A small portion of ammonia emissions also came from transport and manufacturing processes. In agriculture, ammonia emissions originate primarily from livestock houses, manure storage systems and fields fertilised with manure and mineral fertilisers.

Emissions of ammonia have dropped by approximately 57.8% compared to 1990 (Figure 5.4). The land and ownership reforms reduced the crop area, the amount of fertilisers and the number of farm animals; therefore, emissions also decreased. In the past decade, the volume of emissions was affected mainly by changes in livestock housing systems. Dairy cattle farmers have adopted a free-range system instead of permanent tethering and liquid manure technology has been used in place of solid manure technology. The changes in manure handling technology have increased the emissions of ammonia because liquid manure generates more ammonia than solid manure.

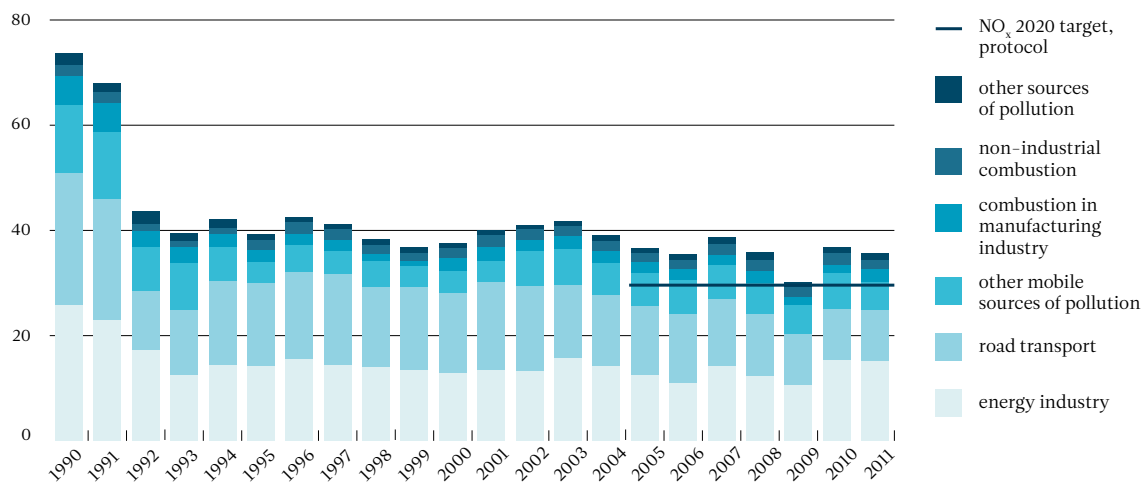


Figure 5.3. NO_x emissions by fields of activity in 1990–2011 and emissions reduction target agreed under the Gothenburg protocol. The target is enforced after the ratification of the protocol and is to be achieved by 2020. Data: ESTEA.

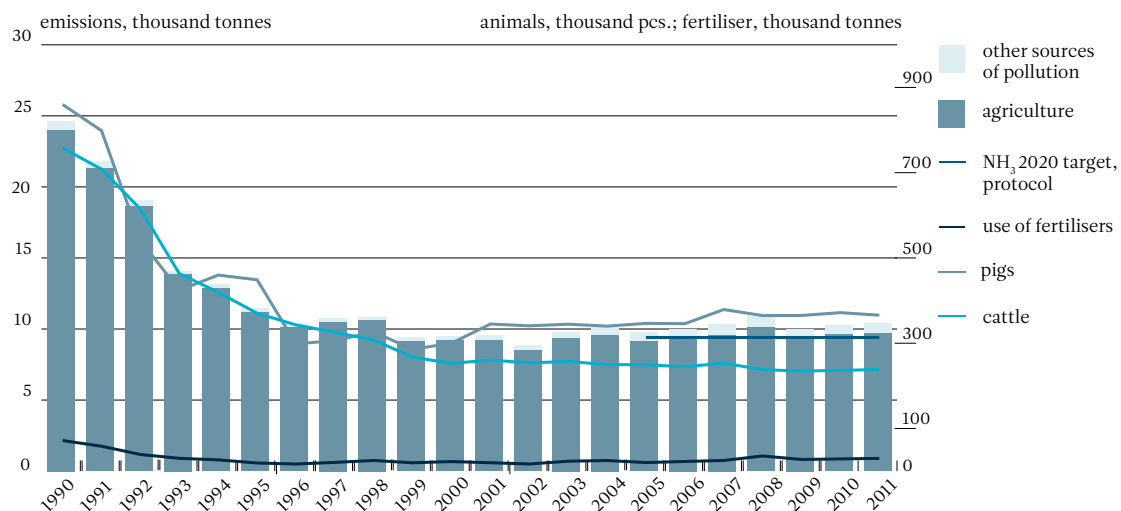


Figure 5.4. NH₃ emissions by fields of activity in 1990–2011 and emissions reduction target agreed under the Gothenburg protocol. The target is enforced after the ratification of the protocol and is to be achieved by 2020. Data: ESTEA; Statistics Estonia.

5.3 Tropospheric ozone and other pollutants

Ground-level ozone is harmful to the biosphere and the surrounding environment as well as to living organisms due to its strong oxidizing effect together with its corrosive and irritating qualities. Ozone (O_3) is a toxic foul-smelling gas that is present in low concentrations throughout the Earth's atmosphere.

Ground-level ozone is not released directly in the course of technological and combustion processes but is generated in photochemical reactions and is a constituent of smog found mainly in large cities. Therefore, ozone is a secondary pollutant that is generated in the troposphere by solar radiation and various compounds called **ozone precursors**, such as carbon monoxide (CO), non-methane volatile organic compounds² (NMVOC), methane (CH_4) and nitrogen oxides (NO_x).

In line with the targets for 2020 agreed under the Gothenburg protocol, Estonia intends to reduce the emissions of NO_x and NMVOCs, which participate in the formation of tropospheric ozone, by 18% and 10%, respectively, compared to the baseline levels of 2005.

Of the pollutants responsible for **ground-level ozone**, the emissions of nitrogen oxides and non-methane volatile organic compounds have decreased the most in 1990–2011. In 2008–2011, no major changes have been observed in the decrease of emissions (Figure 5.6).

147.8 tonnes of **carbon monoxide** was emitted into ambient air in Estonia in 2011. The main sources of carbon monoxide were non-industrial boilers firing solid fuels, including households using wood firing ovens (65.6%), the energy sector (14%) and road transport (12.3%). Emissions have dropped by approximately 35% compared to 1990, mainly due to the decrease in the share of old cars.

The emissions of **non-methane volatile organic compounds** have dropped by 53% in 1990–2011, constituting 33.1 tonnes in 2011. The decrease in emissions occurred due to changes in the manufacturing industry and the energy sector, the decreased use of petrol and in recent years also due to fewer numbers of vehicles running on petrol.

In 2011, the primary source of non-methane volatile organic compounds emitted into ambient air were non-industrial combustion plants (including households), which accounted for 46.5% of NMVOCs (Figure 5.5). Other major sources of pollution include the use of chemicals (19.2%), agriculture (animal husbandry; 11.1%) and road transport (7.3%). Other areas of activity, such as the use of fuels, industry, energy production, industrial boiler plants and waste management, contribute significantly less to the emissions of NMVOCs.

Methane emissions have fallen by 43% compared to 1990. The reason for the decrease is that animal husbandry and distribution quantities of natural gas have declined significantly. However, the emissions of methane have not changed significantly since 1993, fluctuating between 45,000 and 50,000 tonnes per year.

The emissions of nitrogen oxides are detailed in the part concerning the emissions of acidifying pollutants.

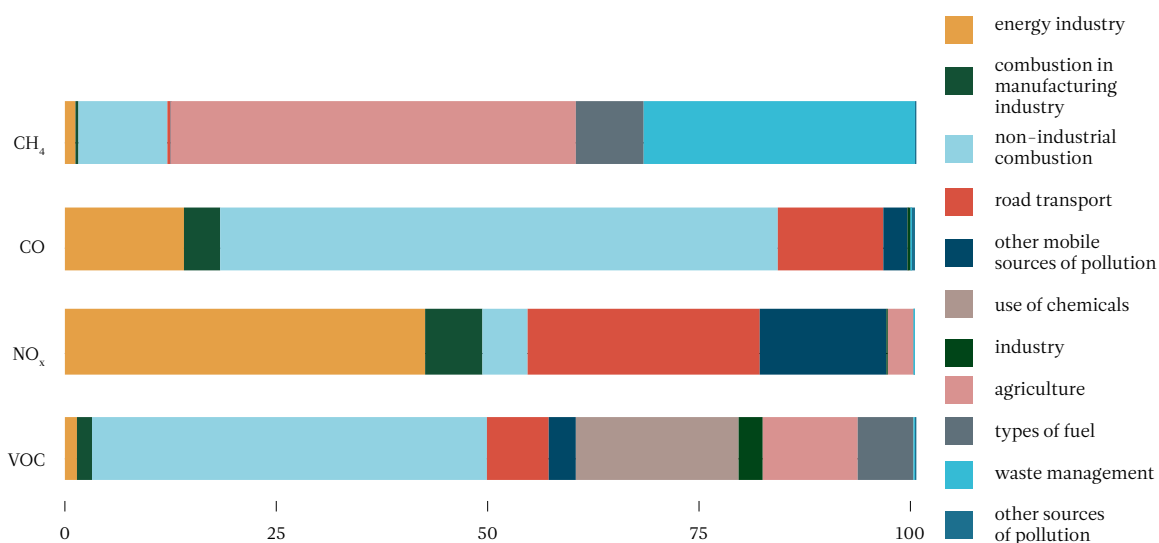


Figure 5.5. Total emissions of tropospheric ozone precursors by fields of activity in 2011. Data: ESTEA.

² Volatile organic compounds (VOC) are chemical compounds that readily evaporate under normal conditions; these compounds participate in smog-formation and some of them are carcinogenic. The most common VOCs are methane, ethanol, benzene, aldehydes, aromatic and aliphatic hydrocarbons. Non-methane volatile organic compounds (NMVOC) are identical to VOCs, but with methane excluded and considered separately from other VOCs.

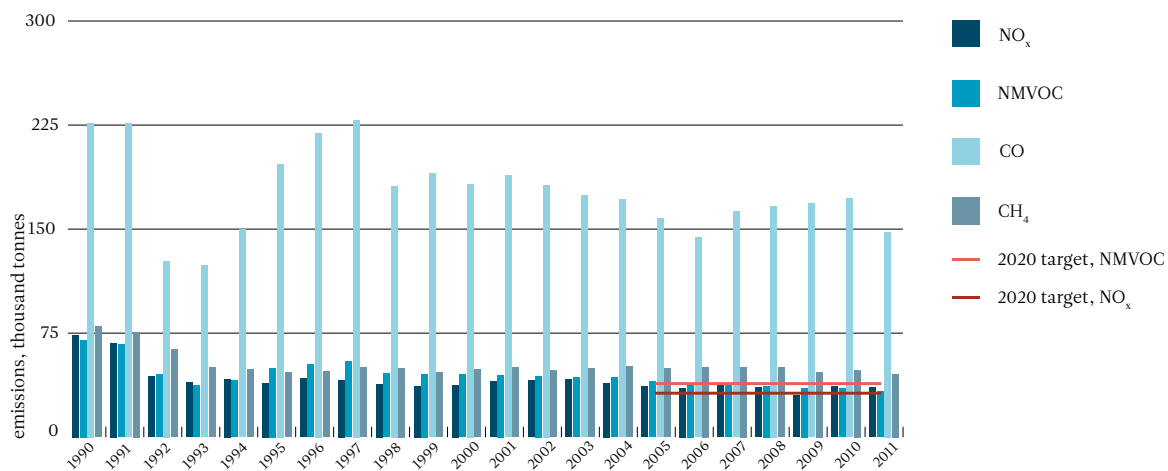


Figure 5.6. Emissions of nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), carbon monoxide (CO) and methane (CH₄) in 1990–2011 and emissions reduction targets agreed under the Gothenburg protocol. The targets are enforced after the ratification of the protocol and are to be achieved by 2020. Data: ESTEA.

5.3.1 Particulate matter (PM_{sum}; PM_{2.5}; PM₁₀)

In recent years, there has been an increasing focus on particulates and their fractions. The smaller the particle size, the deeper the penetration and potential damage to human health. Particulate matter includes fine particles (in essence, fine dust) – a complex mixture of extremely small particles and liquid droplets, which, in turn, are made up of a number of components, including acids (such as nitric and sulphuric acids), organic substances (poly-aromatic hydrocarbons – PAHs), metals and soil or dust particles. Fine particles with a(n) (aerodynamic) diameter of 10 micrometres (PM₁₀) and smaller come above all from soil, road surfaces and industrial enterprises. The ultrafine size fraction of particulate matter consists of particles with diameters less than 2.5 micrometres (PM_{2.5}). Dominant sources of ultrafine particles are traffic, combustion processes (boiler plants, local heat supply, industrial facilities) and atmospheric chemical reactions. Scientific research has shown that particulate matter, fine and ultrafine particles (PM_{0.1} < 0.1 µm) in particular, can be damaging to health at even lower concentrations than the limits currently in force.

The Gothenburg Protocol, as revised in 2012, also included emission limit values for fine particles. By 2020, Estonia will have to reduce the emissions of PM_{2.5} by 15% compared to 2005 (Figure 5.7).

In 2011, the total amount of **particulate matter** (PM_{sum}) emitted into ambient air in Estonia was 49,333 tonnes, of this 41,771 tonnes of **fine particles** (PM₁₀) and 26,461 tonnes of **ultrafine particles** (PM_{2.5}). A major part of total particulate matter was emitted by the energy sector (59%) and by non-industrial combustion plants firing mainly wood (26.7%).

The total emissions of particulate matter have decreased by 34% compared to 1990, mainly due to the renovation of boilers and abatement equipment of power plants firing oil shale as well as installation of more efficient abatement equipment in the cement production industry. The introduction of desulphurisation equipment in power plants has also decreased the emissions of particulate matter.

An increase in the emissions of fine particles last year was related to the increased production of electricity by a power plant firing oil shale. As the production volumes grew by 34%, the power plant was forced to deploy an energy block that has old, unrenovated electrostatic precipitators.

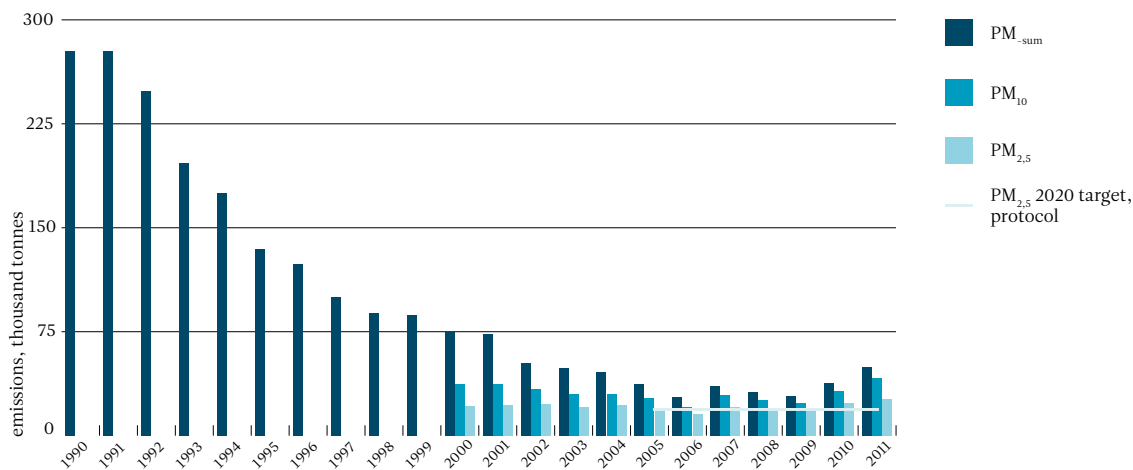


Figure 5.7. Emissions of particles in 1990–2011 and PM_{2.5} emissions reduction target agreed under the Gothenburg protocol. The target is enforced after the ratification of the protocol and is to be achieved by 2020. Data: ESTEA.

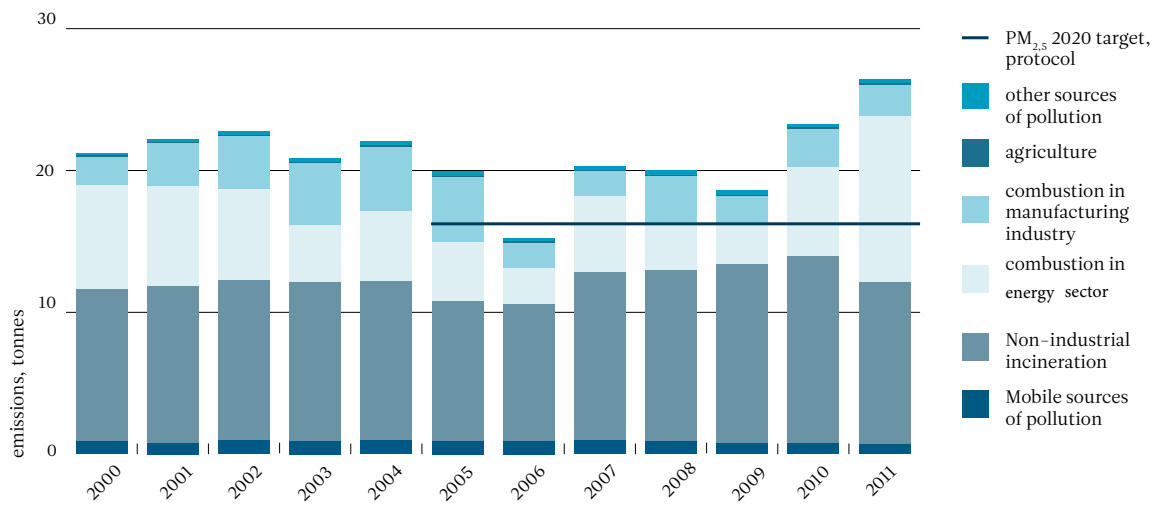


Figure 5.8. PM_{2.5} emissions by fields of activity in 2000–2011. Data: ESTEA.

5.3.2 Heavy metals

Heavy metals are a group of chemical elements with a specific gravity greater than 4.5 g/cm³ that fall between copper and bismuth on the periodic table. Most heavy metals are toxic in certain quantities. Heavy metals accumulate in organisms, causing damage to the liver and kidneys. Heavy metals are usually released into the environment by human activity, such as fuel combustion, industry or traffic (depending on the specific compound).

Pursuant to the Ambient Air Protection Act, lead (Pb), cadmium (Cd) and mercury (Hg) are the most important pollutants that must be considered in assessing and testing ambient air quality.

Lead, cadmium and mercury are mainly released as a result of combustion processes in the energy sector and processing industry.

A total of 37.14 tonnes of **lead** was emitted into ambient air in 2011. A major part of lead emissions was generated as a result of fuel combustion by the energy sector (94.8%). Road transport followed by 1.2%. The share of other sectors in generating lead emissions in 2011 was marginal. The greatest polluters were power stations firing oil shale. The emissions of lead into ambient air have decreased by 81.4% compared to 1990 (Figure 5.9). The emissions of lead mainly fell due to the decreased production of electricity and cement, modernisation of cleaning installations and increased use of unleaded petrol in the transport sector.

The effect of the introduction of unleaded petrol is clearly seen when the data on economic activities from 1990 and 2011 are compared – while in 1990 nearly 36% of lead emissions originated from road transport, in 2011 the share of road transport as a source of lead emissions was just 1.2%. Leaded petrol has not been used in Estonia since 2000 and one of the environmental requirements for liquid fuels is that petrol with lead content more than 5 mg/l may not be used in Otto engines. The quality of motor fuels is analysed by the designated body – a fuel lab operated by the Estonian Environmental Research Centre.

In 2011, the emissions of **cadmium** and **mercury** into ambient air constituted 0.65 and 0.63 tonnes, respectively. The bulk of the emissions of both types of heavy metal resulted from fuel combustion in the energy sector (93.4% of total Cd emissions and 96.5% of total Hg emissions).

Compared to 1990 (Figure 5.10), Hg and Cd emissions into ambient air have dropped by 43.7% and 85.1%, respectively, due to a decrease in electricity and cement production as well as the modernisation of abatement equipment. Similarly to lead emissions, an increase in emissions in recent years can be attributed to the increase in the production of electricity by power plants firing oil shale.

The emissions of other heavy metals considered besides Pb, Cd and Hg are those of arsenic (As), chromium (Cr), copper (Cu), nickel (Ni), selenium (Se), vanadium (V) and zinc (Zn).

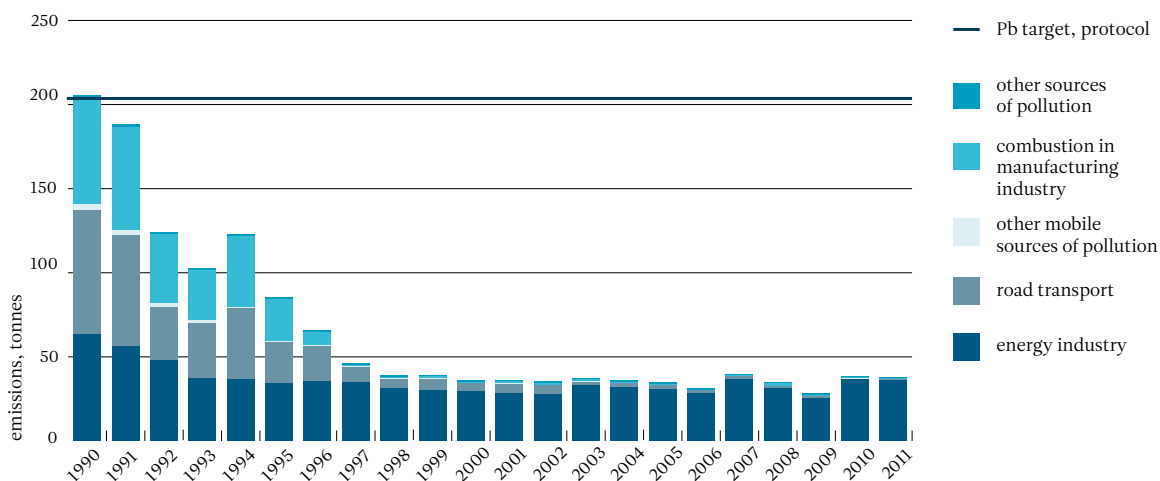


Figure 5.9. Lead emissions by fields of activity in 1990–2011 and the limit of emission set by the Protocol on Heavy Metals of the Convention on Long-range Transboundary Air Pollution. Data: ESTEA.

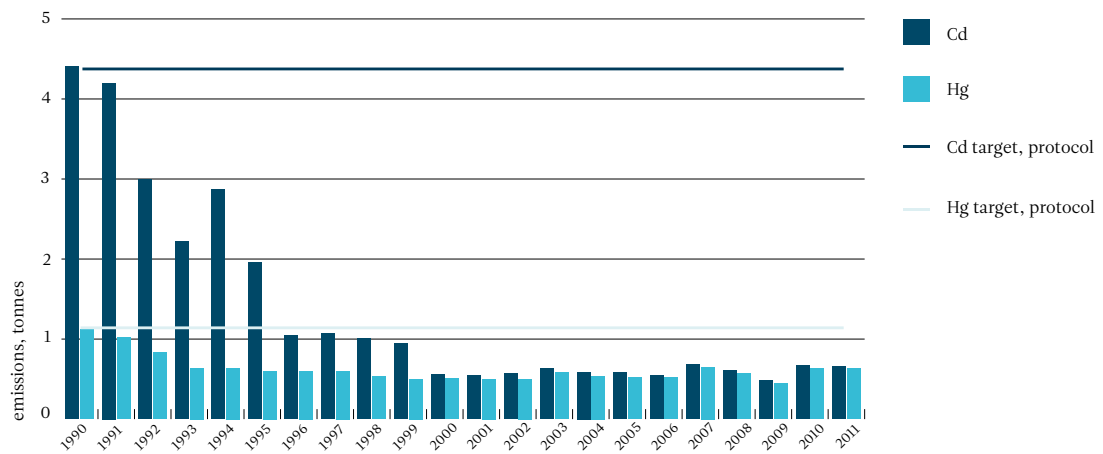


Figure 5.10. Emissions of cadmium and mercury in 1990–2011 and limits set by the Protocol on Heavy Metals of the Convention on Long-range Transboundary Air Pollution. Data: ESTEA.

5.3.3 Persistent organic pollutants

Persistent organic pollutants (POPs) are a group of chemicals that persist in the environment in a stable form, are capable of long-range transport, accumulate in fatty tissue and are toxic.

The primary sources of airborne organic pollutants in Estonia are energy production units at power plants, i.e. the burning of oil, peat and wood chips in the energy sector, along with the combustion of heavy and light fuel oils and shale oil. A large part of persistent organic pollutants is generated by combustion processes in households (combustion of solid fuels).

Persistent organic pollutants include dioxins and furans³(PCDD/PCDF), which are mainly generated as by-products in industrial processes and by the combustion of fuels, including oil shale, wood, non-hazardous and hazardous waste. Particularly high levels of emissions are released as a result of the uncontrolled burning of waste by households as well as landfill, forest and spring brush clearing fires. The burning of hospital waste also generates high levels of dioxin emissions.

Dioxin emissions had fallen 4.2% by 2011 compared to 1990, while, compared to 2006, emissions have grown by 89%, brought about by increased use of waste as fuel by the energy sector. The increases in dioxin emissions in the mid-1990s were caused by an increase in non-industrial incineration as well as in incineration in the processing industry in 2003.

In 2011, the greatest amounts of dioxins were released in the following sectors: the energy sector (57.5%); households (non-industrial boiler plants; 29.1%); combustion plants burning hazardous waste (6.7%); industrial combustion plants (4.1%) and mobile sources of pollution (2.6%) (Figure 5.11).

In 2011, the emissions of polycyclic aromatic hydrocarbons⁴ (PAH) amounted to 14.24 tonnes, which is 16.7% more than in 1990, but 12.9% less than in 2010 (Figure 5.12). The change is associated with increased use of the incineration method in the energy sector. The intermediate decrease can be explained by a downturn in economic activity. The high emissions in 1995–1997 are associated with the fact that households started to use more wood for heating and many boiler plants substituted wood chips for liquid fuels and gas.

The emissions of hexachlorobenzene (HCB) constituted 0.177 kg in 2011 – 195.2% more than in 1990. The emissions of HCB grew due to the increased burning of wood and wood waste by households and in the energy sector.

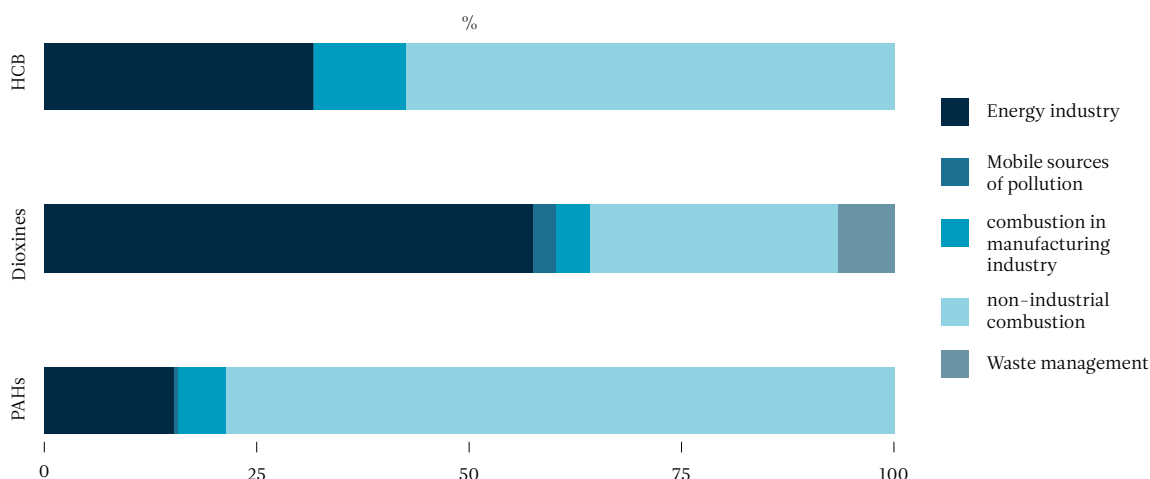


Figure 5.11. Distribution of the emissions of persistent organic pollutants by fields of activity in 2011. Data: ESTEA.

³ Polychlorinated dibenzo-p-dioxins and dibenzofurans.

⁴ The emissions of polycyclic aromatic hydrocarbons, also known as polyaromatic hydrocarbons, include the emissions of four PAHs: benzo(a)pyrene, benzo(k)fluoranthene, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene.

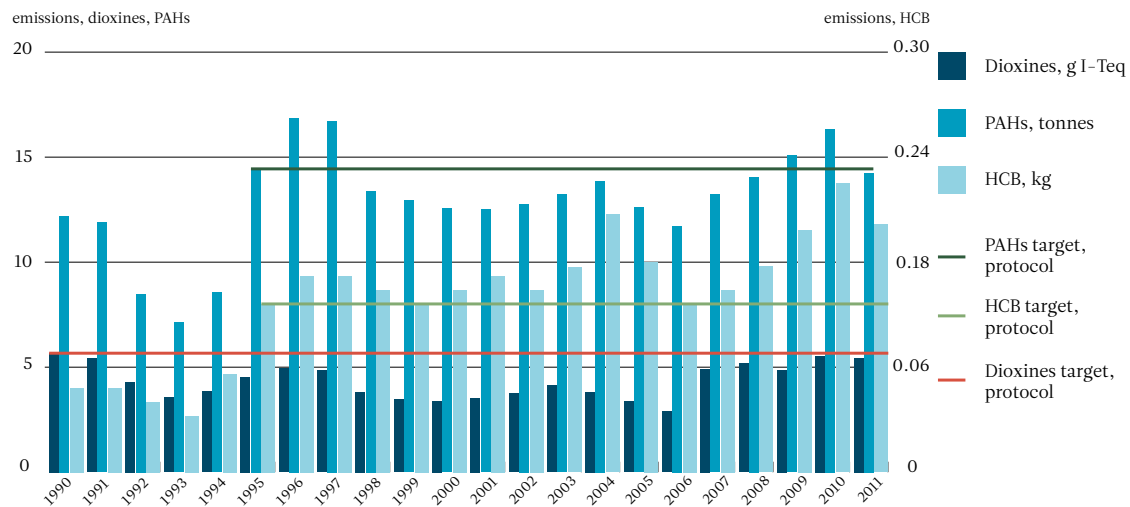


Figure 5.12. Emissions of persistent organic pollutants in 1990–2011 and limits set by the Protocol on POS of the Convention on Long-range Transboundary Air Pollution. Data: ESTEA.

5.4 Ambient air quality monitoring

Continuous urban air monitoring is performed in Estonia at six urban air monitoring stations, situated in Tallinn, Kohtla-Järve, Tartu and Narva. Background air monitoring is performed at three monitoring stations: on the island of Vilsandi, in Lahemaa National Park in northern Estonia and in Saarejärve, Jõgeva County (Figure 5.13).

Air quality monitoring stations are located on streets with busy traffic, residential districts or industrial areas. Most of the pollutants monitored are related to transport as this is the main source of ambient air pollution in urban areas. Urban air is continuously checked for SO₂, NO₂, PM₁₀, PM_{2.5}, CO and O₃ contents and occasionally for the concentrations of heavy metals (As, Cd, Ni, Pb) and benzo(a)pyrene. Background monitoring stations continuously measure the concentrations of SO₂, NO₂, O₃ and PM_{2.5} and the station in Lahemaa also measures the CO content. Once a week, samples of fine particles are taken in Lahemaa to determine the contents of heavy metals (As, Cd, Ni, Pb) and polyaromatic hydrocarbons (PAHs), including benzo(a)pyrene. Air samples taken from Lahemaa are also analysed for the content of carbonyls and for gaseous mercury, elemental carbon and organic carbon contents in PM_{2.5} fractions. The Kohtla-Järve monitoring station also measures the pollutants of local importance, such as NH₃ and H₂S. The concentrations of formaldehyde, hydrogen sulphide, ammonia and phenols are determined in Narva and Kohtla-Järve by wet chemical methods. The benzene concentration in urban air is measured in Tallinn, Kohtla-Järve, Narva and Tartu by using passive sampling.

Despite the increasing number of cars, the average annual levels of **nitrogen dioxide** have shown a downward trend in recent years at all monitoring stations in Tallinn (Figure 5.14). The main reason is that new cars generate fewer pollutants compared to the vehicles of previous generations. No monitoring station detected the average hourly limit value (200 µg/m³) in 2012. The annual average levels remained below the limit value (40 µg/m³) at all monitoring stations.

Sulphur dioxide levels have dropped continuously over years. This directly reflects the impacts of the sulphur content limits established on fuel in Europe. If the current trend continues, sulphur dioxide will cease to be an important environmental impact factor, with the exception of seaport areas where the levels of sulphur dioxide are relatively high. However, here too the situation is changing due to more stringent requirements established for the sulphur content in marine fuels. An issue worth mentioning is the relatively high concentrations of sulphur dioxide in the region of Kohtla-Järve where the monitoring data of recent years suggest a noticeable increase in the level of pollution (Figure 5.15). The annual average level of pollution in Kohtla-Järve is 8 times higher than that

measured at other urban air monitoring stations. However, the levels measured at all monitoring stations have remained below the relevant average hourly and 24-hour limit values (350 µg/m³ and 125 µg/m³, respectively).

The level of hydrogen sulphide continues to be a problem in Kohtla-Järve where the levels measured last year exceeded the average hourly limit value (8 µg/m³) in a total of 17 cases, while the highest value measured was 22.3 µg/m³.

Carbon oxide levels show a downward trend. The measurements taken to this point suggest that carbon dioxide is not a problematic urban pollutant in Estonia. The maximum recorded level is significantly lower than the limit value (8h average 10 mg/m³) and no values exceeding the limit have been recorded by Estonian monitoring stations in recent years. The levels of carbon oxide are higher than the average in residential areas during the heating season.

Annual average levels of ozone in urban air have increased somewhat, partly because the levels of other pollutants that react with ozone have dropped. No values exceeding the limit (8h average 120 µg/m³) were recorded last year. This may be due to the cool and cloudy spring and summer because the generation of ozone also depends, besides other factors, on the intensity of solar radiation.

As always, the levels of **fine particles** (PM₁₀) posed a problem in urban air everywhere. However, the results of air monitoring in recent years suggest a downward trend (Figure 5.16). It is difficult to point out a single reason but the more extensive uptake of vehicles with new, cleaner diesel engines and declining numbers of vehicles with old diesel engines (including buses) has definitely played a role. The overall level of fine particles in ambient air is also affected by the decreased use of studded tyres and the snowy winters of recent years.

The monitoring of **ultrafine particles** (PM_{2.5}) began at Õismäe monitoring station in 2006 and at Tartu and Narva monitoring stations in 2008. The measured levels of ultrafine particles have been below the relevant average annual target value (25 µg/m³) at all monitoring stations.

The 2012 monitoring data show relatively high levels of **benzo(a)pyrene** in Tartu, caused by wood burning in private housing areas. The relevant average annual concentration (2.8 ng/m³) exceeded the established target value (1 ng/m³) nearly threefold.

Based on the data gathered under different monitoring programmes, the overall quality of ambient air in Estonia is good or very good and there are no major problems. Most issues identified are of a local nature. For example, regarding the impact of air quality on human health, we can highlight the high level of fine particles in urban air in private housing areas during the heating season and the high levels of hydrogen sulphide and phenols in Kohtla-Järve. The residents of areas not covered by the national monitoring programme, such as the areas adjacent to the ports of Muuga and Sillamäe, are affected by hydrocarbons and hydrogen sulphide released into

ambient air during the loading of oil products.

Urban air monitoring focuses on measuring the concentrations of fine and ultrafine particles, which according to current knowledge are among the main factors in urban air that have a negative effect on human health. It is not entirely clear, however, what role is played by particles, their size and chemical composition as well as the content of toxic compounds, in creating health problems. Therefore, besides conventional measuring of mass concentration, increased attention is being paid to the (continuous) measuring of the chemical

composition of particles and fractions of different sizes. Data from single monitoring stations are insufficient to assess health impacts; therefore, mathematical models are used to calculate the level of pollution. Using mathematical models to assess the status of the environment is increasingly more common in Estonia. However, mathematical methods are linked to the real world by actual monitoring, i.e. these methods supplement rather than exclude each other.

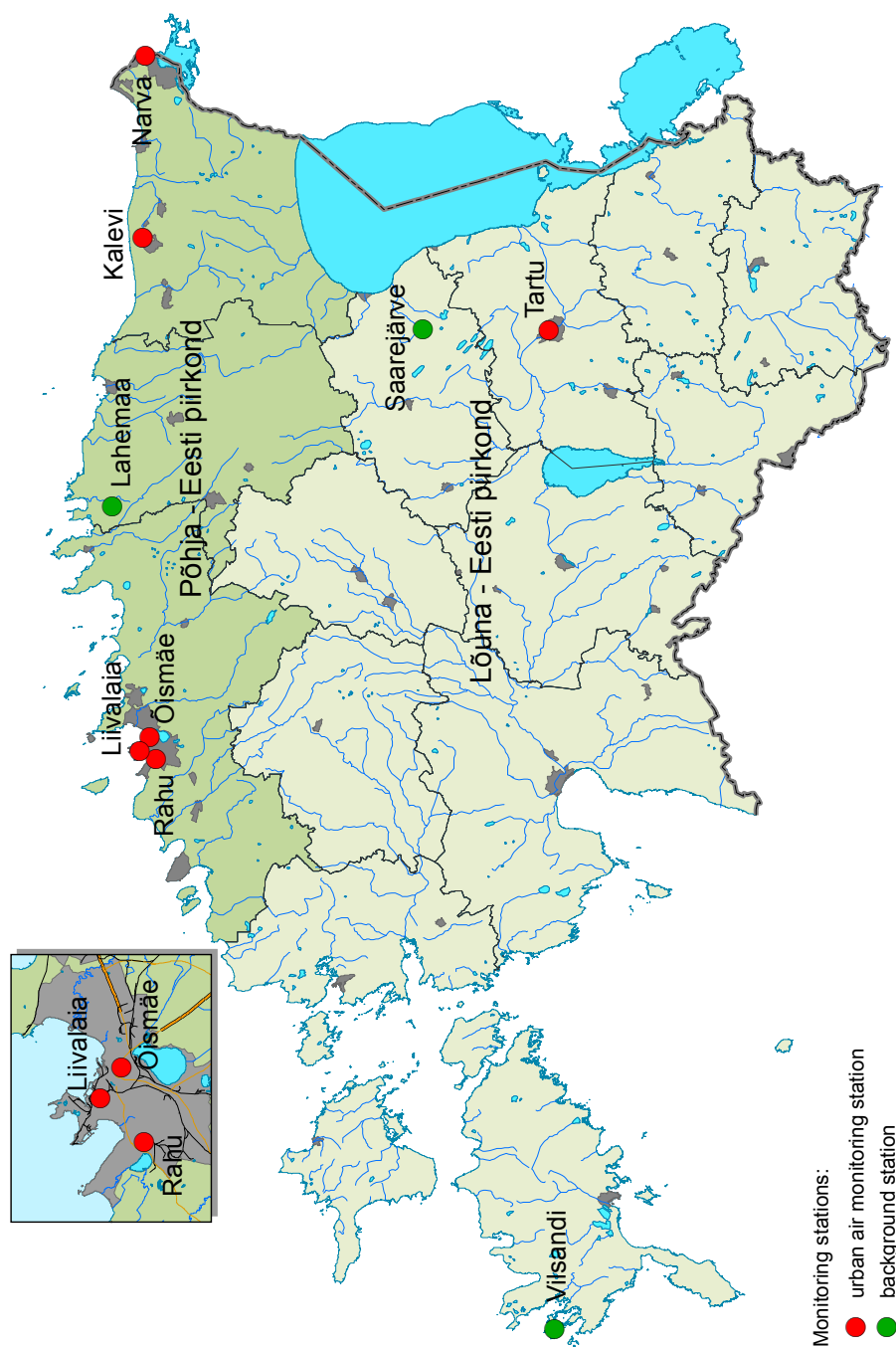


Figure 5.13 Ambient air monitoring stations.

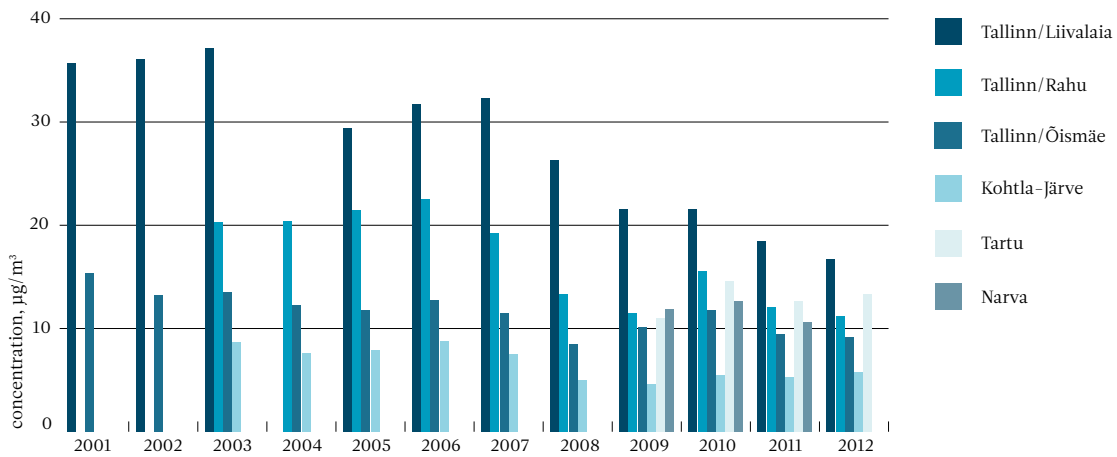


Figure 5.14. Annual average concentration of nitrogen oxide at urban air monitoring stations. Data: EERC.

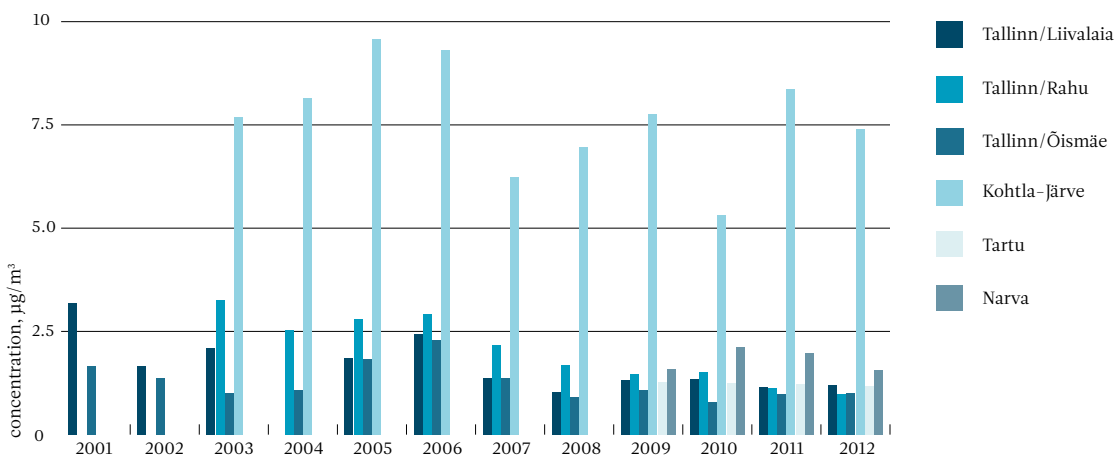


Figure 5.15. Annual average concentration of sulphur dioxide at urban air monitoring stations. Data: EERC.

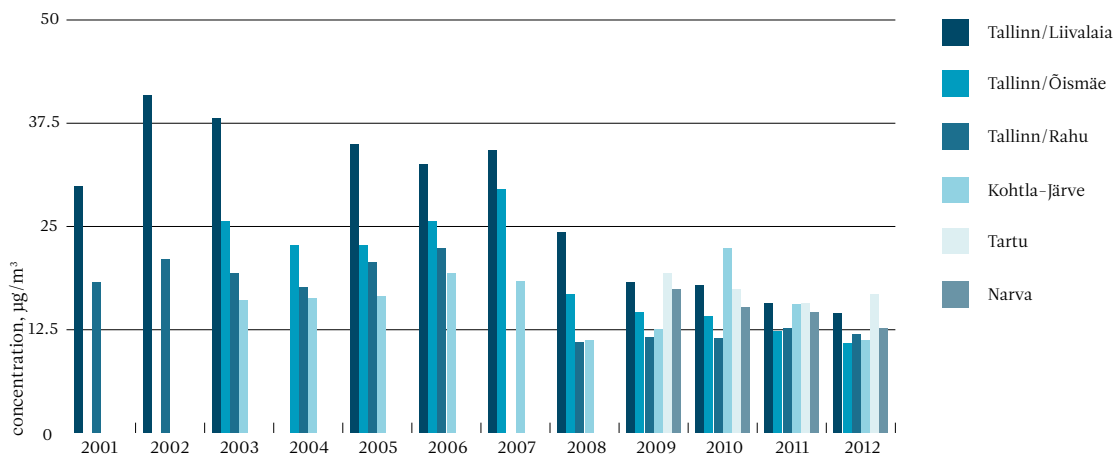


Figure 5.16. Annual average concentration of fine particles (PM₁₀) at urban air monitoring stations. Data: EERC.

5.5 Fuel monitoring

Fuel used in internal combustion engines is a factor that directly affects the quality of ambient air, especially in cities. Fuel that does not conform to requirements creates more emissions, and breathing in these exhaust gases increases the chances of illness.

The main legal act aimed at improving fuel quality is European Commission Directive 98/70/EC, which is amended by Directives 2003/17/EC and 2009/30/EC.

The directives impose on Member States the obligation to analyse the liquid fuels marketed on their territories by implementing a fuel quality monitoring system that conforms to the European monitoring standard EN-14274.

The fuel lab of the Estonian Environmental Research Centre is responsible for the performance of these obligations and it also maintains the fuel monitoring database⁵, which has an important function in exchanging data between authorities testing the quality of fuels.

While the main focus of fuel monitoring is on engine fuels, fuel oil and marine fuels are also monitored.

5.5.1 Motor fuels

National motor fuel monitoring for each type of fuel is a year-round process, with samples taken during the two main seasons – summer and winter.

The following indicators for petrol are determined: octane numbers, vapour pressure, distillation parameters⁶, the content of oxygen and oxygen compounds, as well as sulphur and lead. In the winter of 2011, also the manganese content of petrol samples was determined.

For diesel fuels, the cetane number⁷, density at a temperature of 15 °C, distillation parameters, polycyclic aromatic hydrocarbon and sulphur content, special marking substance and marker content are determined.

An average of 554 motor fuel (petrol and diesel fuel) samples were taken from 230 filling stations in 2009–2012 (Figure 5.17).

The main irregularities identified in the course of monitoring in 2009–2012 were related to the non-compliance of distillation parameters and also non-compliant marker contents, sulphur and water contents and cloud points. As regards petrol, non-compliances were also detected, besides high sulphur content, in relation to vapour pressure, octane number as well as benzene and aromatic hydrocarbon contents.

Over the last four years, the average share of non-compliant motor fuel samples identified during fuel monitoring has been around 3% of all samples (2009 – 4%, 2010 – 5%, 2011 – 3%, 2012 – 2%). The number of non-conformities is falling.

5.5.2 Fuel oils, fuels used in ships and biofuels

High-sulphur fuels, such as light and heavy fuel oils and marine fuels, are subject to quality requirements established by a number of European Union directives – directives 99/32/EC, 2012/33/EU and 2005/33/EC. The objective of these requirements is to gradually reduce the sulphur content of fuels and thereby reduce the environmental impact from sulphur compounds. The use of biofuels is regulated by EU Directive 2003/30/EC, which aims to promote the use of biofuels in the transport sector – in each period specified in the directive, biofuel must make up the required percentage of all liquid fuels consumed by motor vehicles.

For these purposes, Estonia carried out the monitoring of fuel oils, fuels used in ships and biofuels in 2009–2012. Laboratory analysis determines the sulphur content in fuel samples. In order to determine the sulphur content, a total of 20 samples were taken in 2009–2012 from fuel oils and 30 samples from fuels used in ships.

⁶ Distillation parameters are the amount of vaporisation of motor fuels, expressed in the percentage by volume, at 100 °C and 150 °C.

⁷ The cetane number is a measurement of the auto-flammability and combustion quality of diesel fuel.

⁵ Fuel monitoring database <http://kytus.keskkonnainfo.ee>

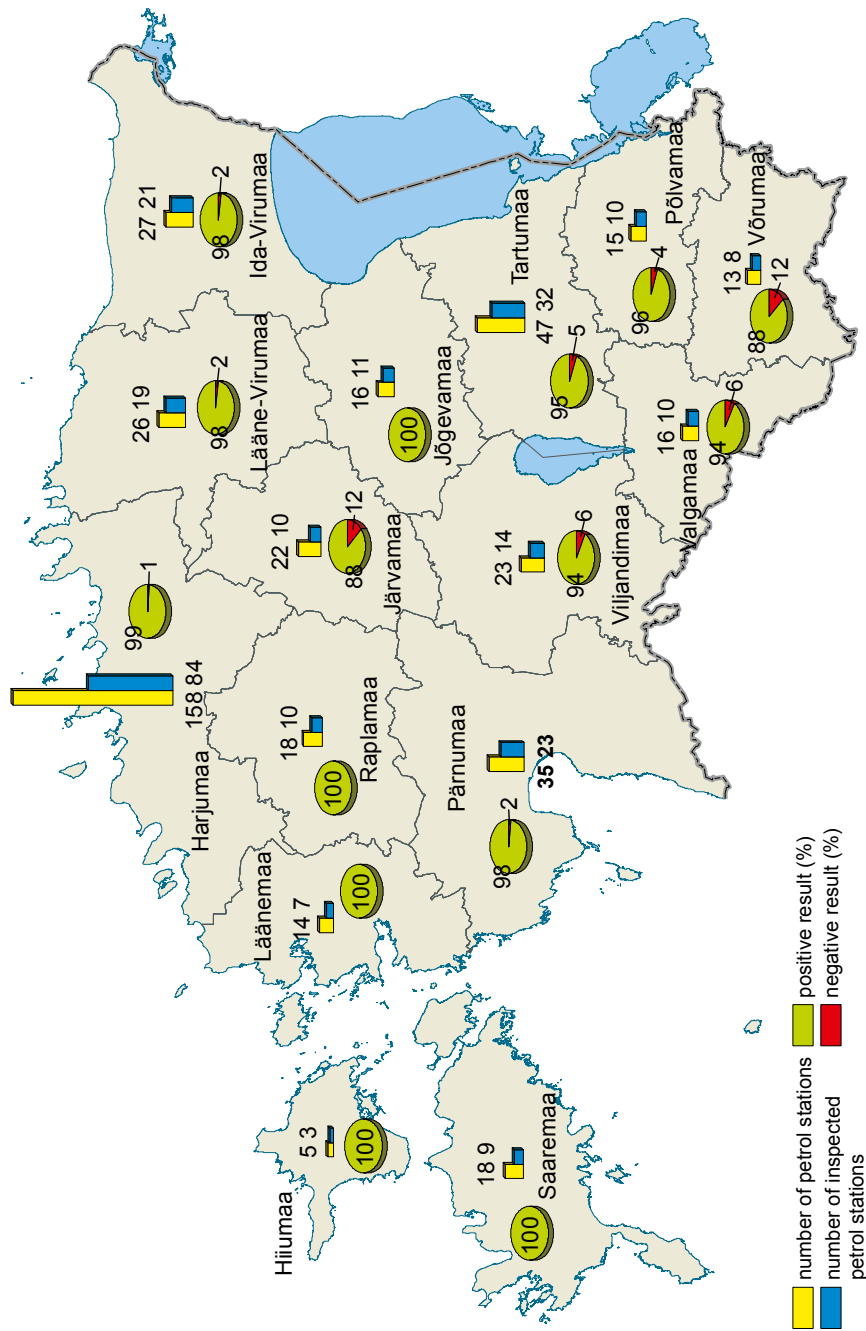


Figure 5.17. Number of petrol stations in each county and fuel monitoring results in 2012. Data: ESTEA.