7th EAP Priority Objective 3:
To safeguard the Union's citizens from environment-related pressures and risks to health and well-being

European Environment Agency

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Outdoor air quality in urban areas

Indicator	EU indicator past trend		Selected objective to be met by 2020	Indicative outlook of the EU meeting the selected objective by 2020
Exceedance of air quality standards in urban areas (nitrogen dioxide: NO_2; dust particles: PM_{10}; fine particulate matter: $PM_{2.5}$; ozone: O_3)	NO_2, PM_{10}, $PM_{2.5}$	O_3	Meet Air Quality Directive standards for the protection of human health — Air Quality Directive	

There have been reductions in the urban population exposure to exceedances of the air quality standards for particles and nitrogen dioxide while the trend for the ozone standard is unclear. Because of their widespread exceedance levels in urban areas it is unlikely that the air quality standards for these pollutants will be met by 2020

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2017

The Seventh Environment Action Programme (7th EAP) includes the objective of ensuring that outdoor air quality in the EU will have improved significantly by 2020, moving closer to World Health Organization (WHO) guidelines. Observing the existing EU air quality legislation standards is a chief milestone in this respect. Despite some improvements, thanks to the implementation of EU legislation on emissions of air pollutants and air quality, key EU air quality standards for the protection of human health — concentrations of particulate matter (PM), ozone (O_3) and nitrogen dioxide (NO_2) — are currently not being met in various air quality monitoring stations in the EU. This is particularly true for urban areas, where more than 70 % of the EU population lives. This can be mainly attributed to the high level of emissions from road traffic and residential combustion in urban areas and unfavourable conditions for the dispersion of emissions due to topography and meteorological issues. Because of their widespread exceedances in urban areas, it is unlikely that the air quality standards for these pollutants will be met by 2020, while achieving air quality in line with the WHO guidelines is much further away. It should be noted that in 2015 compared with 2014 there has been more urban population exposed to exceedances of the air quality standards for ozone, nitrogen dioxides and dust particles. Further action will be needed, in particular in relation to road traffic and residential combustion in urban areas.

Setting the scene

The 7th EAP (EU, 2013) aims to significantly improve outdoor air quality and move closer to World Health Organization (WHO) guidelines (WHO, 2006) by 2020. Air pollution is the number one environmental cause of death in the EU, responsible for more than 400 000 premature deaths per year (EEA, 2017a). According to WHO studies (WHO, 2013, 2014), exposure to particulate matter (PM) can cause or aggravate cardiovascular and lung diseases, heart attacks and arrhythmias, affect the central nervous system and the reproductive system and cause cancer. Exposure to high ozone (O_3) concentrations can cause breathing problems, trigger asthma, reduce lung function and cause lung diseases. Exposure to nitrogen dioxide (NO_2) increases symptoms of bronchitis in asthmatic children and reduces lung function growth. Health-related external costs range from EUR 330 billion to EUR 940 billion per year, depending on the valuation methodology, with evidence on the impacts of chronic ozone exposure adding around 5 % to this total (EC, 2013).

Policy targets and progress

A chief cornerstone of the EU environmental acquis in the field of air quality is the Air Quality Directive (EU, 2008). This directive sets a number of air quality standards not to be exceeded by a certain year and thereafter.

The communication on the 'Clean Air Programme for Europe' (EC, 2013) sets the short-term objective of achieving full compliance with existing legislation by 2020 at the latest, as well as the long-term objective of seeing no exceedances of the WHO guideline levels for human health. The most troublesome pollutants in terms of harm to human health are particulate matter (PM), nitrogen dioxide (NO_2) and ground-level ozone (O_3) (EEA, 2016). The European air quality standards and the WHO air quality guidelines (WHO, 2006) for these pollutants are displayed in Table 1.

Table 1. Air quality standards, under the EU Air Quality Directive, and WHO air quality guidelines

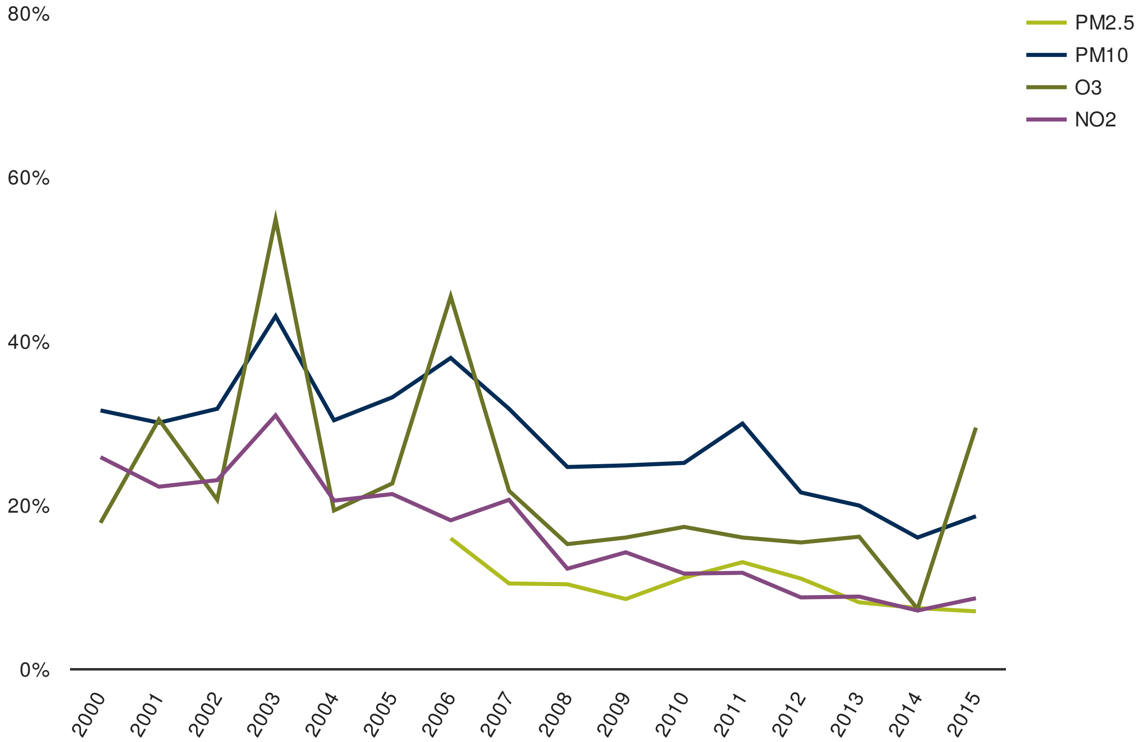
		Air Quality Directive		WHO guidelines	
Pollutant	**Averaging period**	**Objective**	**Comments**	**Objective**	**Comments**
$PM_{2.5}$	One day			25 µg/m³ (*)	99th percentile (3 days/year)
$PM_{2.5}$	Calendar year	Limit value, 25 µg/m³		10 µg/m³	
PM_{10}	One day	Limit value, 50 µg/m³	Not to be exceeded on more than 35 days per year.	50 µg/m³ (*)	99th percentile (3 days/year)
PM_{10}	Calendar year	Limit value, 40 µg/m³ (*)		20 µg/m³	
O_3	Maximum daily 8-hour mean	Target value, 120 µg/m³	Not to be exceeded on more than 25 days per year, averaged over three years	100 µg/m³	
NO_2	One hour	Limit value, 200 µg/m³ (*)	Not to be exceeded more than 18 times a calendar year	200 µg/m³ (*)	
NO_2	Calendar year	Limit value, 40 µg/m³		40 µg/m³	

Source: EU, 2008; WHO, 2006.

Note: 1. (*) Not considered in the indicator, where only the most stringent EU standards are used: the daily limit value for PM_{10} and the annual limit value for NO_2. According to the WHO air quality guidelines, the annual average for PM takes precedence over the 24-hour average, since, at low levels, there is less concern about episodic excursions.
2. In line with the Air Quality Directive: 'limit value' shall mean a level fixed on the basis of scientific knowledge, with the aim of avoiding, preventing or reducing harmful effects on human health and/or the environment as a whole, to be attained within a given period and not to be exceeded once attained; 'target value' shall mean a level fixed with the aim of avoiding, preventing or reducing harmful effects on human health and/or the environment as a whole, to be attained where possible over a given period.

Figures 1 and 2 show the percentage of the urban population exposed to air pollutant concentrations above both EU standards (Figure 1) and WHO guidelines (Figure 2).

Figure 1. EU urban population exposed to air pollutant concentrations above selected air quality standards of the EU Air Quality Directive

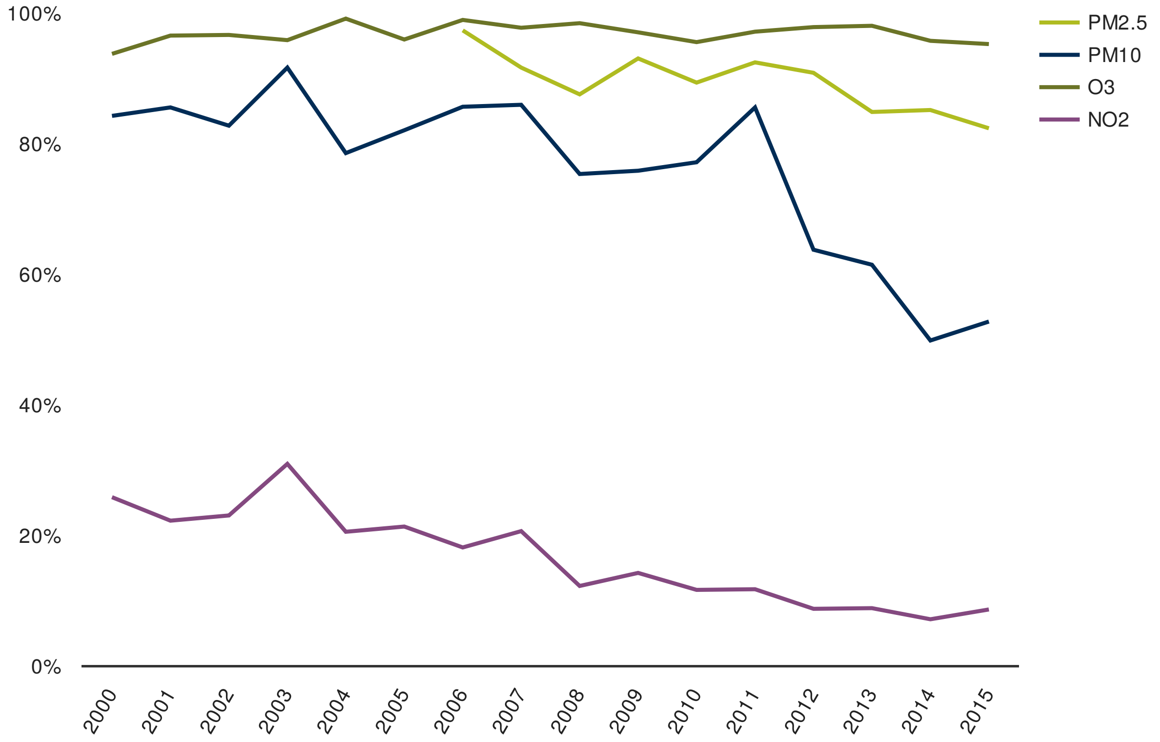


Data sources: a. Eurostat. Gisco - Urban Audit 2012 b. EEA. AirBase c. EEA. Air Quality e-Reporting (AQ e-Reporting)
d. EEA – Indicator CSI004

Note:
The rationale for selection of pollutants and corresponding selected air quality standards is given in the specification section of indicator CSI004.

Criteria:
- Percentage of the population exposed to annual $PM_{2.5}$ concentrations above 25 µg/m^3.
- Percentage of the population exposed to daily PM_{10} concentrations exceeding 50 µg/m^3 for more than 35 days a year.
- Percentage of the population exposed to maximum daily 8-hour mean O_3 concentrations exceeding 120 µg/m^3 for more than 25 days a year.
- Percentage of the population exposed to annual NO_2 concentrations above 40 µg/m^3.

Figure 2. EU urban population exposed to air pollutant concentrations above WHO air quality guidelines



Data sources: a. Eurostat. Gisco - Urban Audit 2012 b. EEA. Airbase c. EEA. Air Quality e-Reporting (AQ e-Reporting)
d. EEA – Indicator CSI004

Note:
The rational for selection of pollutants and corresponding WHO guidelines is given in the specification section of indicator CSI 004.
Criteria:
- Percentage of population exposed to annual PM2.5 concentrations above 10 µg/m3.
- Percentage of population exposed to annual PM10 concentrations above 20 µg/m3.
- Percentage of population exposed to maximum daily 8-hour mean O3 concentrations exceeding 100 µg/m3 for at least one day a year.
- Percentage of population exposed to annual NO2 concentrations above 40 µg/m3.

Around one quarter of Europeans currently living in urban areas are exposed to air pollutant levels exceeding some EU air quality standards. Moreover, up to 96 % are exposed to levels of some air pollutants deemed damaging to health by the WHO's more stringent guidelines (EEA, 2017b).

Particulate matter (PM)

Between 2006 and 2015, 8–16 % of the EU's urban population is estimated to have been exposed to concentrations of fine particulate matter ($PM_{2.5}$) in excess of the EU limit value set for the protection of human health[1] (Figure 1). With respect to the more stringent WHO guideline value (Figure 2), a much larger proportion of the urban population (82–97 %) was exposed to concentrations above this threshold.

Notwithstanding limitations in data coverage in the early 2000s, a significant proportion of the EU urban population (16–43 %) was exposed to concentrations of coarse dust particles (PM_{10}) in excess of the EU daily limit value set for the protection of human health during the 2000–2015 period (Figure 1). A slightly decreasing tendency can be observed throughout the whole period.

For the more stringent WHO guideline value (Figure 2), a higher proportion of the urban population (50–92 %) was exposed to concentrations above this threshold. Here, a decreasing tendency is also observed, as in the case of the EU limit value.

PM may be categorised as either primary (i.e. directly emitted to the atmosphere) or secondary (i.e. formed in the atmosphere from the so-called precursor gases).

Primary PM originates from both natural and anthropogenic sources. The main emitter sector is 'commercial, institutional and household fuel combustion'. For PM_{10} 'industry' and 'agriculture' are listed in second and third place; and for $PM_{2.5}$ 'transport' and 'industry'. All these sectors reduced their PM emissions in the EU in the 2000–2015 period, although higher relative reductions were observed for industry and transport and only small reductions were observed for the other two sectors.

With the exception of ammonia, in the EU, reductions in emissions of the other secondary PM precursors (nitrogen oxides, sulphur oxides, and non-methane volatile organic compounds) were much larger than those in emissions of primary PM from 2000 to 2015.

However, the reductions in both primary PM and precursors have not led to equivalent drops in the concentrations of PM. This is because chemical reactions of the precursors form secondary particles, and therefore the relationships between emissions and concentrations are not linear. It can also be explained by uncertainties in the reported emissions of primary PM from the 'commercial, institutional and household fuel combustion' sector, by intercontinental transport of PM and its precursor gases from outside Europe, and by the contribution of natural sources to PM concentrations (EEA, 2016).

The contributions of the different emission sources to ambient air concentrations depend not only on the amount of pollutant emitted, but also on proximity to source, emission conditions (such as height and temperature) and other factors, such as dispersion conditions and topography. Sectors with low emission heights, such as traffic and household fuel combustion, generally make a more significant contribution to surface concentrations than emissions from high stacks.

Ozone (O_3)

Although reductions in European emissions of O_3 precursors have led to lower peak concentrations of O_3, the current target value is frequently exceeded. In the 2000–2015 period, between 8 % (in 2014) and 55 % (in 2003) of the urban population was exposed to concentrations above the target value (Figure 1).

In relation to the more stringent WHO guideline (Figure 2), the proportion of the population exposed to concentrations above the guideline value is as high as 94–99 %, with no discernible change over time.

O_3 concentrations are determined by emissions of its precursors and by meteorological conditions: ozone is formed in sunny conditions with high temperatures. Apart from reductions in anthropogenic emissions of O_3 precursors, there have been increases in natural emissions and also in the intercontinental transport of O_3 and its precursors (Maas and Grennfelt, 2016). Additional factors that are also likely to mask the effects of European measures to reduce anthropogenic emissions of O_3 precursors include climate change, emissions of non-methane volatile organic compounds from vegetation (difficult to quantify) and fire plumes from forest and other biomass fires (EEA, 2010). Formation of tropospheric ozone from increased concentrations of methane may also contribute to the sustained O_3 levels in Europe.

Nitrogen dioxide (NO_2)

Between 2000 and 2015, the fraction of the urban population exposed to concentrations in excess of the EU limit value and the identical WHO guideline value gradually decreased to around 10 %, with a minimum of 7 % in 2014 (Figures 1 and 2). At 31 %, the highest exposure of the urban population to NO_2 occurred in 2003.

Enforcement of current legislation has resulted in a reduction in NO_x emissions in all sectors. Nevertheless, emissions from transport keep NO_2 concentrations high close to main roads.

Based on the current trends explained above, and because of their widespread exceedances in urban areas, it is unlikely that air quality standards for these pollutants will be met by 2020, while achieving air quality in line with the WHO guidelines is much further away (except for NO_2 for which both EU standard and WHO guideline are the same). Effective air quality policies require action and cooperation on global, European, national and local levels, which must reach across most economic sectors and engage the public. Holistic solutions must be found that involve technological development, structural changes — including the optimisation of infrastructures and urban planning — and behavioural changes. These will be necessary to deliver a level of air quality across the EU that is conducive to the protection of human health (EEA, 2016).

Country level information

Table 2 provides information on the urban population exposed to concentrations of air pollutants above the EU air quality objectives by country for the year 2015. Variations from country to country are not only related to the different pollutant concentrations but also to:

- the number of available data series (monitoring stations and/or selected cities), which will influence the total monitored population;
- the uneven distribution of traffic and background stations in the different countries.

Table 2. Urban population exposed to concentrations of air pollutants above selected air quality standards of the Air Quality Directive, 2015

COUNTRIES	PM_{10} (daily limit value)	O_3 (target value)	NO_2 (annual limit value)
Austria	0	98	5
Belgium	0	0	3
Bulgaria	78	0	< 1
Croatia	81	94	3
Cyprus	6	0	0
Czech Repuplic	19	89	1
Denmark	0	0	2
Estonia	0	0	0
Finland	0	0	1
France	1	17	4
Germany	< 1	37	5
Greece	4	97	3
Hungary	27	100	2
Ireland	0	0	0
Italy	60	80	35
Latvia	4	0	4
Lithuania	2	0	0
Luxembourg	0	0	9
Malta	100	NA	0
Netherlands	0	0	2
Poland	81	38	1
Portugal	1	0	2
Romania	54	12	1
Slovakia	6	60	5
Slovenia	100	100	0
Spain	5	34	16
Sweden	0	0	< 1
United Kingdom	0	0	11
EU-28	19	30	9

The colour coding of exposure estimates refers to the fraction of urban population exposed to concentrations above the reference level:

0%	< 5%	5-50%	50-75%	> 75%

Note: NA = no available data, for further information please see indicator CSI004.
Source: Air pollution country fact sheets (EEA, 2014) updated with 2015 data. The 2015 data aggregated at EU level are also available in (EEA, 2017a, 2017c).

Outlook beyond 2020

In 2013, the European Commission proposed a Clean Air Policy Package for Europe (EC, 2013), which aims to achieve full compliance with existing air quality legislation by 2020 and to further improve Europe's air quality by 2030 and beyond. As a result of this package, the 2001 National Emission Ceilings Directive (EU, 2001) was reviewed. The new National Emission Ceilings Directive (EU, 2016) establishes national emission reduction commitments applicable from 2020 and stricter commitments from 2030 for sulphur dioxide, nitrogen oxides, non-methane volatile organic compounds, ammonia and $PM_{2.5}$. In addition, and as part of the package, a new directive, the Medium Combustion Plant Directive, was approved in November 2015 (EU, 2015). This directive regulates sulphur dioxide, nitrogen oxides and dust emissions from the combustion of fuels in medium-sized combustion plants (with a rated thermal input of 1 and up to 50 megawatts).

These new commitments, together with the on-going implementation of air quality improvement measures at national, regional and local levels, are expected to improve air quality in Europe. However, the changes in meteorological conditions due to climate change are expected to increase O_3 concentrations as a result of expected increased emissions of both specific O_3 precursors and emissions from wildfires, with the latter likely to increase under periods of extensive drought (EEA, 2015).

Finally, it is expected that the age group composition of the EU population will continue to shift towards higher numbers of the elderly because of continuing increases in life expectancy (Eurostat, 2016). The overall potential air pollution-related health impact of this change remains uncertain.

About the indicator

This indicator shows the proportion of the EU urban population that is exposed to various potentially harmful concentrations of pollutants in excess of both EU standards and WHO guidelines set for the protection of human health. For further information on the methodology, please refer to the EEA indicator CSI004 'Exceedance of air quality standards in urban areas (EEA, 2017b).

The indicator focuses on those pollutants that are most relevant in terms of health effects and urban concentrations: PM, both PM_{10} and fine PM, i.e. $PM_{2.5}$; O_3; and NO_2. When there is more than one standard, only the most stringent one is used. The indicator is based on measurements of air pollutants reported under the Air Quality Directive (EU, 2008) and the Decision on the exchange of information (EU, 2011).

Most air pollution is man-made and derives from the combustion of fossil or biomass fuels used in industry, transport and heating; industrial and agricultural processes; and other sources (EEA, 2017a). As most of these sources, particularly emissions from cars, are concentrated in urban areas where most of the European population lives, air quality in urban areas is a useful proxy for tracking progress towards meeting the standards set out in the Air Quality Directive.

References

[1] Please note that this year's scoreboard assessed the past trend for fine particulate matter exceedances (2006-2015) as an improving trend, i.e. it was depicted by a green triangle. Last year's scoreboard assessed the past trend (2006-2014) as unclear, i.e. it was depicted by a yellow triangle. This is because this year with an additional year of data the time series was considered by the experts sufficiently long to judge the past trend and to therefore conclude that it was improving.

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Published on 30 Nov 2017

Environment and health

Air pollutant emissions

Indicator	Indicator past trend		Selected objective to be met by 2020	Indicative outlook of the EU meeting the selected objective by 2020
	EU 28	**EEA 33**		
Emissions of the main air pollutants in Europe (sulphur oxides: SO_2; nitrogen oxides: NO_x; ammonia: NH_3; non-methane volatile organic compounds: NMVOCs; fine particulate matter: $PM_{2.5}$)	SO_2, NO_x, NMVOCs, $PM_{2.5}$ ▲ NH_3 ▲	SO_2, NO_x, NMVOCs, $PM_{2.5}$ ▲ NH_3 ▲	Reduce air pollutant emissions in accordance with the requirements of the amended Gothenburg Protocol and of the new EU National Emission Ceilings Directive by the following percentages: SO_2 59 %, NO_X 42 %, NH_3 6 %, NMVOCs 28 %, $PM_{2.5}$ 22 % compared with 2005 levels	SO_2, NO_x, NMVOCs, $PM_{2.5}$ ● NH3 ●

Air pollutant emissions have declined and current projections suggest that the EU is on target to meet its 2020 EU and international air pollutant emission reduction commitments. However, since ammonia emissions increased the past two years (2014 and 2015) it has become uncertain if the ammonia reduction commitment will be met by 2020

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2017

The Seventh Environment Action Programme (7th EAP) sets out commitments to improve the implementation of existing legislation on emissions to air and to secure further reductions in air pollution. Ceilings for 2010 were set for emissions of key air pollutants under the Gothenburg Protocol of the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution (LRTAP) and under the old EU National Emission Ceilings Directive (NECD). The amended Gothenburg Protocol and the new NECD further specify emission reduction commitments for 2020 for selected pollutants.

Emissions of these pollutants have generally decreased over the period examined (2005 to 2015). While the EU as a whole is on course to meet its 2020 emission reduction commitments with the potential exception of ammonia, a number of EU Member States continue to report emissions above their respective Gothenburg Protocol and NECD ceilings for 2010.

Setting the scene

Air pollution is responsible for more than 400 000 premature deaths in Europe each year. It also harms crop growth and ecosystems, and damages the built environment (EEA, 2016). In Europe, the most problematic pollutants in terms of harm to human health are particulate matter (PM), ground-level ozone (O_3) and nitrogen dioxide (NO_2) (EEA, 2016). PM is emitted directly from emission sources but can also form in the atmosphere from various precursor pollutants including sulphur dioxide (SO_2), nitrogen oxides (NO_x) and ammonia (NH_3). Ground-level O_3 is similarly formed in the atmosphere from various precursor species including NO_x and non-methane volatile organic compounds (NMVOCs). Each of these pollutants can contribute to premature mortality and morbidity including respiratory illness and cardiovascular disease. SO_2, NO_x and NH_3 also cause ecosystem acidification and eutrophication, as well as damage to buildings and vegetation. When absorbed by plants, O_3 damages plant cells, impairing their ability to grow and reproduce, and leading to reduced agricultural crop yields, decreased forest growth and reduced biodiversity. The 7th EAP (EU, 2013) sets out commitments to improve the implementation of existing legislation and to secure additional reductions in air pollution. Air quality state and impacts are discussed in the briefings on outdoor air quality in urban areas (AIRS_PO3.1, 2017) and on the eutrophication of terrestrial ecosystems due to air pollution (AIRS_PO1.1, 2017).

Policy targets and progress

The earlier NECD (EU, 2001) and the Gothenburg Protocol (UNECE, 1979) set emission ceilings for 2010 for European countries for SO_x (SO_2 in the NECD), NO_x, NMVOCs and NH_3. The 2012 amended Gothenburg Protocol (UNECE, 2012) and the new NECD (EU, 2016) now also set 2020 emission reduction commitments for these same four pollutants, as well as for primary $PM_{2.5}$ emissions. The new NECD ensures that the old NECD 2010 emission ceilings apply until the end of 2019, transposes the amended Gothenburg Protocol 2020 reduction commitments and sets more ambitious reduction commitments for 2030 and the years beyond; for the latter see further information in the ‘Outlook beyond 2020’ section.

Anthropogenic emissions of certain air pollutants have decreased in both the EU (Figure 1, left panel) and the EEA-33 (the 33 member countries of the European Environment Agency, which includes the 28 EU Member States) between 2005 and 2015 (Figure 1, right panel). However, for both NH_3 and $PM_{2.5}$, little progress has been made in reducing emissions.

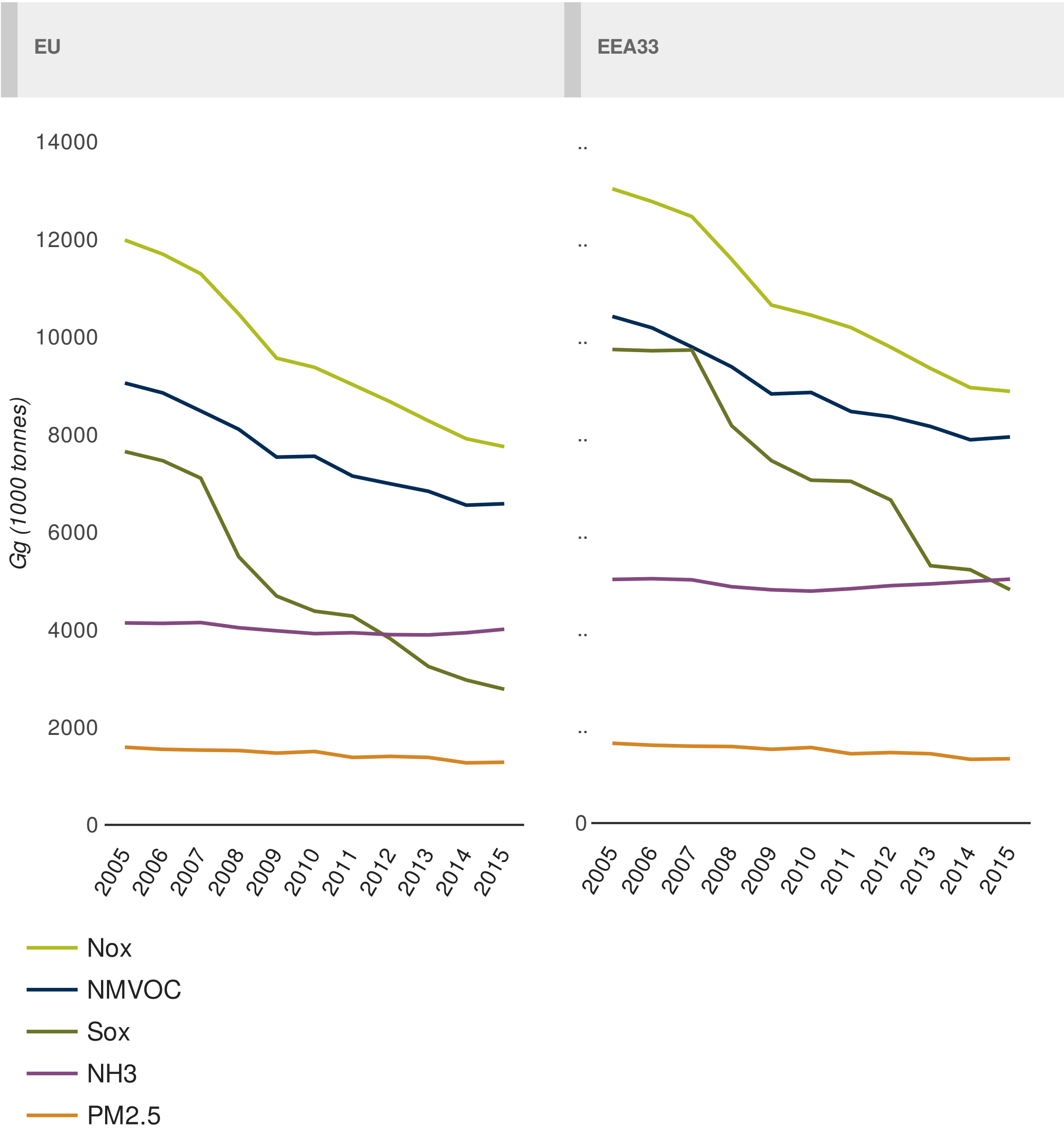
A number of Member States have reported emissions above the levels of their 2010 emission ceilings set out in the NECD (EEA, 2017a):

- NO_x: 13 Member States exceeded their emission ceilings in 2010 and six Member States continued to exceed them in 2015 (Austria, Belgium, France, Germany, Ireland and Luxembourg).
- NMVOCs: six Member States exceeded their emission ceilings in 2010 and five Member States continued to exceed them in 2015 (Denmark, Germany, Hungary, Ireland and Luxembourg).
- SO_2: all Member States have met their emission ceilings for SO_2 since 2010.
- NH_3: six Member States (Austria, Denmark, Finland, Germany, Sweden and Spain) have exceeded their emission ceilings since 2010.

The new NEC Directive allows Member States, under certain circumstances, to adjust their reported emissions for compliance assessment with the national ceilings. In 2017, adjustment applications were submitted by nine Member States (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg and Spain). These applications are being reviewed by the European Commission, and if approved, the number of Member States exceeding one or more emission ceilings in 2015 would decrease.

Future reductions in emissions are still required in most Member States in order for them to meet their respective emission reduction commitments for 2020, as set out in the amended Gothenburg Protocol and the new NECD.

Figure 1. Trends in emissions of air pollutants in the EU (left) and in the EEA-33 (right)



Source: National emissions reported to the Convention on Long-range Transboundary Air Pollution (LRTAP Convention), EEA, 2017b

Note: All emissions presented here for 2015 both at EU and EEA-33 level are underestimated since they do not account for the emissions from Greece; Greece did not report as yet its 2015 emissions.

In the paragraphs below, the trends in emissions of the individual pollutants over the 2005 to 2015 period are discussed.

Nitrogen oxides

NO_x emissions for the EEA-33 and the EU continue to decrease and are more than 30 % below 2005 levels. Emission reductions have, however, not been as great as originally anticipated. This is because real-world driving emissions in the road transport sector — especially for diesel passenger vehicles and vans — are, on average, four or five times higher than the European emission standards by vehicle type that all vehicles must meet in a laboratory testing procedure. The transport sector contributed 39 % of total EU NO_x emissions (38 % in the EEA 33).

Sulphur oxides

In 2015, SO_x emissions had fallen by approximately 64 % of their 2005 levels for the EU and 51 % of their 2005 levels for the EEA-33. The energy production and distribution sector has been responsible for the largest reductions in emissions. This has happened for various reasons, including the closure of a number of old or uneconomical large combustion plants, which typically burn coal, and improvements in energy efficiency at industrial facilities, which have also reduced emissions.

Non-methane volatile organic compounds

NMVOC emissions for the EEA-33 and the EU have fallen by approximately 24 % and 27 % compared with their 2005 levels. The largest source of NMVOC emissions is 'solvent and product use'. Various EU measures have helped to reduce emissions over the last decade, including stricter requirements for industrial facilities, limits on the solvent content of paints and mandatory vapour recovery equipment at petrol stations. However, compared with 2014, NMVOC emissions in 2015 increased slightly, i.e. by 0.4 % in the EU and by 0.7 % in the EEA-33.

Ammonia

NH_3 emissions have remained largely stable since 2005 compared with the other pollutants — they fell by only 3 % from their 2005 level in the EU, while in the EEA-33 they have increased by 0.1 % since 2005[1]. Agriculture dominates emissions of NH_3: they arise primarily from the decomposition of animal manure and the application of fertiliser. There are a number of technical measures available to mitigate ammonia emissions, yet little progress in reducing them is evident in the agricultural sector. However, in 2014 and 2015, NH_3 emissions increased in the EU by 1.1 % and 1.8 % respectively (and by 1 % and 0.9 % in the EEA-33). One main reason for the high or even rising NH_3 emissions in some countries is the increasing number of pig or poultry facilities without implementing measures and/or technologies to limit emissions.

Particulate matter

Emissions of primary $PM_{2.5}$ (particulate matter with a diameter of 2.5 µm or less) have reduced by almost 20 % for both the EEA-33 and the EU compared with their 2005 levels. Most $PM_{2.5}$ emissions come from small combustion plants at commercial and institutional facilities, as well as from households. Although the recently agreed Medium Combustion Plants Directive (EU, 2015) will help reduce future emissions of $PM_{2.5}$ from many facilities, it remains challenging for many authorities to regulate and reduce emissions from residential combustion. The latter is an important source of air pollution in many Member States. Road transport is the second most important source of $PM_{2.5}$.

Current projections suggest that the EU is on target to meet the 2020 EU and international emission reduction commitments (IIASA, 2014). However, the increase in ammonia emissions for the past two years in a row (2014 and 2015) results in an uncertain outlook for meeting by 2020 the reduction commitments for ammonia.

Country level information

Table 1 compares the 2015 emissions by country with the respective emission reduction commitments for 2020. With regard to the EU Member States, the 2020 emission reduction commitments correspond to those of the new NECD. Regarding non-EU EEA member countries, the 2020 emission reduction commitments correspond to those in the Gothenburg Protocol. The colours indicate to what extent 2015 emissions exceeded the 2020 emission reduction commitment for each country and for the EU as a whole.

Table 1. 2015 emissions of air pollutants and 2020 air pollutant emission reduction commitments (Gothenburg Protocol or National Emission Ceilings Directive), by country

	NH_3		NMVOC(*)		NO_x(*)		$PM_{2.5}$		SO_x	
	Total emissions in 2015	Reduction commitments 2020	Total emissions in 2015	Reduction commitments 2020	Total emissions in 2015	Reduction commitments 2020	Total emissions in 2015	Reduction commitments 2020	Total emissions in 2015	Reduction commitments 2020
EEA33	5008.70		7936.40		8871.20		1319.50		4797.10	
EU	3942.00	3823.00	5725.00	5839.00	7059.00	6435.00	1281.00	1238.00	2647.00	2905.00
Austria	66.90	64.06	111.33	103.75	120.83	106.45	16.60	16.38	14.90	19.20
Belgium	65.50	66.78	88.95	115.24	174.14	172.45	27.00	28.31	42.64	81.19
Bulgaria	33.60	46.14	76.99	67.76	131.62	109.14	28.80	22.80	142.06	171.30
Croatia	29.80	37.54	53.19	62.60	50.81	56.19	20.00	33.10	15.14	26.55
Cyprus	4.50	5.25	6.54	6.47	15.10	11.84	1.00	1.44	13.15	6.44
Czech Republic	69.70	69.25	139.36	171.44	164.56	180.01	23.10	28.91	123.15	114.25
Denmark	72.80	66.54	71.72	72.98	97.56	81.66	19.90	17.39	10.83	16.98
Estonia	11.60	9.53	17.87	25.59	29.15	33.08	9.20	12.06	31.81	51.85
Finland	31.80	29.22	71.19	87.37	125.22	121.64	22.00	24.85	42.06	48.73
France	678.60	632.29	622.63	664.53	835.45	707.33	164.70	184.17	152.55	204.62
Germany	759.30	644.20	811.70	964.44	1059.92	890.32	99.50	97.61	351.77	372.63
Greece	No data reported (***)									
Hungary	76.30	69.39	117.29	94.43	108.32	104.58	53.70	33.41	24.11	22.54
Iceland	No Commitment under Gothenburg Protocol									
Ireland	108.10	109.84	57.99	52.02	73.46	66.31	13.90	15.27	17.63	25.90
Italy	393.30	400.61	841.50	800.68	738.83	724.85	159.80	149.13	123.11	265.38
Latvia	18.80	16.30	33.83	30.98	32.17	28.80	17.70	18.76	3.66	7.78
Liechtenstein	No Commitment under Gothenburg Protocol									
Lithuania	28.90	29.19	49.91	43.75	45.34	27.62	17.90	16.16	18.23	13.91
Luxembourg	5.80	5.41	7.53	6.56	11.99	8.66	2.00	1.30	1.26	1.59
Malta	1.50	1.54	2.06	2.57	2.85	5.42	0.20	1.01	3.33	2.62
Netherlands	127.60	135.36	140.60	166.00	215.43	186.68	12.80	12.44	30.29	46.21
Norway	26.68	25.00	155.92	130.50	151.33	151.00	28.08	27.10	16.33	21.60
Poland	267.10	296.08	530.61	407.45	673.79	568.90	124.60	133.64	690.26	477.07
Portugal	51.10	51.25	179.98	176.39	174.70	168.79	46.00	49.20	49.71	72.14
Romania	162.90	177.85	243.78	224.08	212.98	173.79	112.20	82.45	151.87	138.27
Slovakia	30.40	29.17	79.75	76.89	79.65	65.54	30.10	23.95	71.42	39.77
Slovenia	19.20	20.54	26.29	31.33	33.60	30.55	11.70	9.49	5.46	15.18
Spain	473.70	477.00	476.79	537.54	764.39	801.48	123.00	127.12	260.88	413.66
Sweden	60.30	53.21	132.24	136.61	116.39	109.23	19.20	21.62	19.21	28.17
Switzerland	60.66	59.00	77.50	70.80	64.49	55.20	7.35	7.30	6.76	12.00
Turkey	No Commitment under Gothenburg Protocol									
United Kingdom	292.80	282.76	733.16	729.24	918.34	723.63	104.80	79.44	236.12	291.52

Distance to Emission Reduction Commitment (**)

- Target has been achieved
- 0–10 % to target
- 10–20 % to target
- > 20 % to target

(*) Emissions from 3B (Manure Management) and 3D (Crop Management) are not taken into account for the EU Member States in line with the new NECD.

(**) For the EU Member States the 2020 Emission Reduction Commitments under the new NECD were considered. For Norway and Switzerland the 2020 Gothenburg Protocol Ceilings were considered.

(***) Greece has not reported data

Source: EEA, 2017 b, 2017 d

As noted earlier, future reductions in emissions will still be required in most countries so that they meet their respective emission reduction commitments for 2020. However, a number of countries already report emissions below the level required by 2020.

Outlook beyond 2020

In 2016 the EU adopted a new NECD, which sets emission reduction commitments for NO_x, NMVOCs, SO_2, NH_3 and $PM_{2.5}$ for 2020 as well as more ambitious reduction commitments for 2030 and beyond. The 2030 commitments aim to cut the health impacts of air pollution (in terms of premature mortality) by half compared with 2005. Additional measures beyond the new NECD are still needed if Europe is to achieve the long-term objective of air pollution levels that do not lead to unacceptable harm to human health and the environment.

About the indicator

This indicator deals with the emissions of key anthropogenic air pollutants. It covers anthropogenic emissions of the air pollutants SO_x, NO_x, NH_3, NMVOCs, and $PM_{2.5}$ for the years 2005 to 2015. Data for the EU Member States are taken from the latest EU emission inventory submission to the United Nations Economic Commission for Europe (UNECE) Long-range Transboundary Air Pollution (LRTAP) Convention. Data for the non-EU countries that are members of the European Environment Agency are taken from the reporting under the UNECE LRTAP Convention to the LRTAP Centre on Emission Inventories and Projections (EEA, 2017a, 2017b).

Footnotes and references

[1] Last year's scoreboard assessed the EU ammonia emissions past trend as improving since there was a 4 % decrease in the emissions between 2005 and 2014. This year's scoreboard assessed the trend as stable since the decrease between 2005 and 2015 was 3 %. According to the scoreboard methodology, a difference of up to 3 % in the indicator value from the base year to the latest available year is not considered significant enough to qualify a trend as improving or deteriorating. Similarly, last year's scoreboard assessed the EEA-33 ammonia emissions past trend as deteriorating since there was an almost 10 % increase in the emissions between 2005 and 2014. This year's scoreboard assessed the trend as stable since the increase between 2005 and 2015 was 0.1 % mainly as a result of significant changes in the 2005-2014 data that were submitted by Turkey in its latest submission (2017).

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> Environmental indicator report 2017 – In support to the monitoring of the 7th Environment Action Programme, EEA report No21/2017, European Environment Agency

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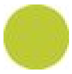
Environment and health

Quality of bathing waters

Indicator	EU indicator past trend	Selected objective to be met by 2020	Indicative outlook of the EU meeting the selected objective by 2020
Bathing water quality		Increase the number of bathing waters classified as 'excellent' or 'good' under the Bathing Water Directive	
The share of bathing waters that meet excellent and good quality standards is likely to increase further due to implementation of the Bathing Water Directive, in particular the effect of measures on poor quality waters For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2017			

The Seventh Environment Action Programme (7th EAP) includes an objective that, by 2020, citizens throughout the EU will benefit from high standards of bathing water. The Bathing Water Directive requires that Member States take realistic and proportionate measures to increase the number of bathing waters classified as ‘excellent’ or ‘good’. Minimum water quality standards were met by 96.3 % of all EU bathing waters identified for the 2016 bathing season. Overall, bathing water quality is improving over time due to investment in the sewerage system, better wastewater treatment and the reduction of pollution from farms.

Setting the scene

The 7th EAP (EU, 2013) includes an objective that, by 2020, citizens throughout the EU will benefit from high standards of bathing water. Bathing water quality is a cause for concern for public health, as swimming at beaches or bathing lakes contaminated with faecal bacteria can result in illness. The major sources of pollution responsible for faecal bacteria are sewage and water draining from farms and farmland. Such pollution increases during heavy rain and floods, when pollution is washed into rivers and seas, and as a result of overflowing sewerage networks. In addition to good water quality for bathing, clean unpolluted water is required for ecosystems and to support economic activities such as tourism.

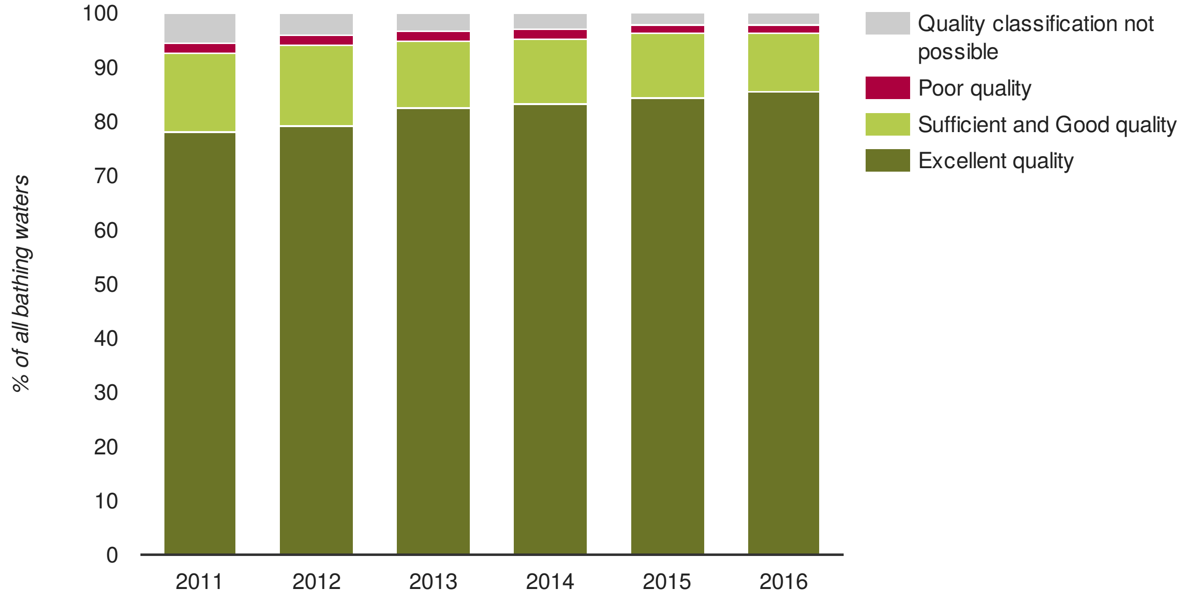
Policy targets and progress

The Bathing Water Directive (EU, 2006) has the aim of increasing the number of bathing waters classified as 'excellent' or 'good'. It also includes a shorter term goal that, by 2015, all waters should have been of at least 'sufficient' quality. In the context of this briefing, and with the aim of linking the objective of the 7th EAP regarding bathing water to the Bathing Water Directive, bathing waters that meet the minimum water quality standards of the Directive (meaning that they were of at least 'sufficient' bathing water quality) are considered to have achieved the high standards called for under the 7th EAP.

Minimum water quality standards were met by 96.3 % of all EU bathing waters identified for the 2016 bathing season, which represents an increase of 0.2 percentage points when compared with 2015. In total, 300 EU bathing waters were of poor quality in 2016. The proportion of poor quality bathing waters dropped to 1.4 % in 2016. This represents a 0.2 percentage point decrease compared with the previous season (EEA, 2017).

Figure 1 provides an overview for 2011 to 2016 of the classification of EU bathing waters into the excellent, sufficient (including good) and poor categories, as well as those bathing waters that could not be classified.

Figure 1. Overall bathing water quality in the EU



Data sources: EEA. WISE bathing water quality database (data from annual reports by EU Member States)

Note:
The category "quality classification not possible" includes waters for which there were not enough samples, new bathing waters, bathing waters with changes or bathing waters that had been closed.

The share of bathing waters in the EU whose status is excellent increased from 78.1 % in 2011 to 85.5 % in 2016. The proportion of bathing waters whose status is poor remained relatively constant (between 1.4 % and 2.0 %) during the 2011–2016 period (EEA, 2017).

Overall, bathing water quality is improving over time. It is encouraging to observe that more and more bathing waters are not only reaching the minimum quality standards set by the Bathing Water Directive but are achieving the highest (excellent) quality standards. The outlook towards the 2020 goal is therefore positive.

Many years of investment in the sewerage system and better wastewater treatment, and the reduction in pollution from farms have led to Europe's bathing waters being much cleaner today than they were some 40 years ago when the original Bathing Water Directive was adopted (EU, 1976). The implementation of the Urban Wastewater Treatment Directive (EU, 1991) and a focus on reducing overflow from sewers have been instrumental in reducing pollution and in improving the quality of several low-quality bathing waters (EEA, 2017).

However, as figure 1 shows, there are still poor quality bathing waters. The major sources of pollution responsible for faecal bacteria in bathing waters today are still insufficiently treated or untreated wastewater as a result of system failures, overflows from sewage treatment works or from scattered houses with misconnected drains and poorly located or poorly maintained septic tanks, poorly stored slurry or manure from livestock that washes into streams, and animal (mostly dog) and bird faeces on beaches or crowded beaches with many swimmers.

In wet summers, large amounts of rainwater affect bathing water quality by causing stormwater overflow and the release of diluted sewage into bathing waters or streams that discharge close to beaches. Rainwater also washes animal waste from urban and rural areas into surface water drains and rivers.

In years with below average sunshine, water quality is also affected, as the sun's ultraviolet rays kill the faecal bacteria found in the water.

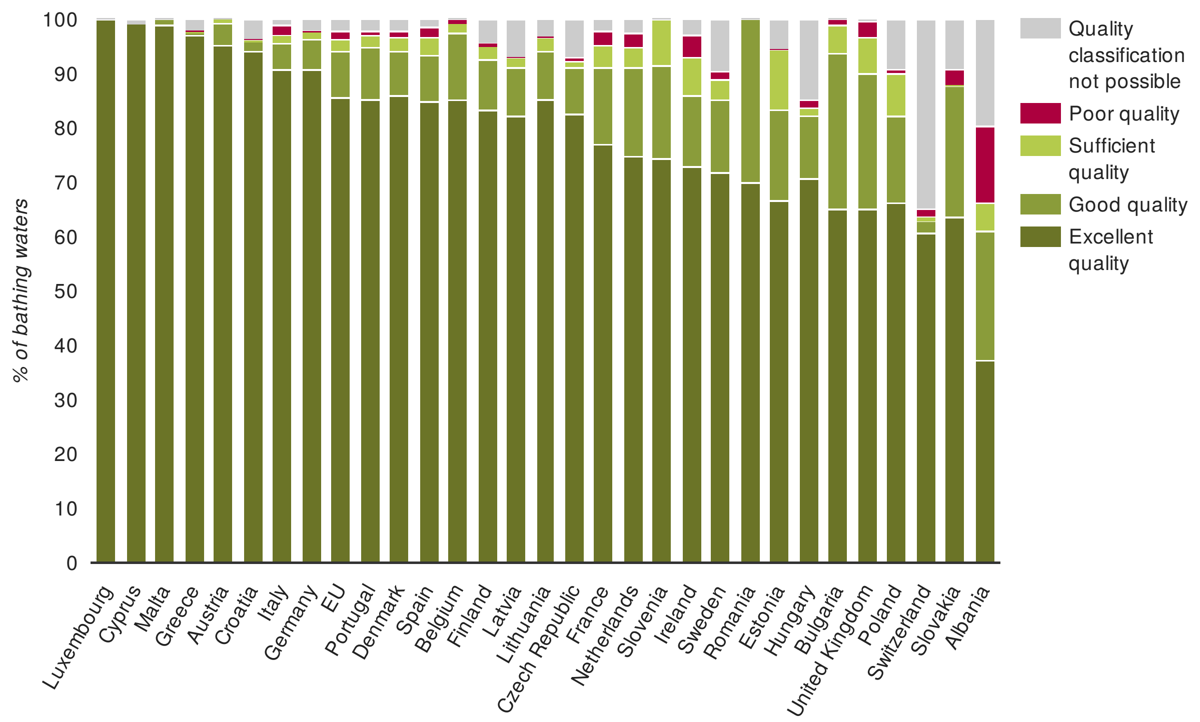
In the case of poor quality bathing waters, it is imperative that the sources of pollution be assessed. The bathing water profiles prepared under the Bathing Water Directive should provide an indication of pollution sources in the catchment area of the bathing water and, together with historical data on rainfall, stream flow and sea currents, should provide information on the upstream sources of pollution to be targeted with measures. Management measures are primarily implemented for sufficient or poor quality bathing waters.

The share of bathing waters that meet excellent and good quality standards is likely to increase due to the implementation of the Bathing Water Directive and in particular the effect of measures for poor quality waters.

Country level information

Figure 2 provides the results for bathing water quality in 2016 for the EU Member States and two other countries. In general, bathing water quality was of a high standard across the countries.

Figure 2. Bathing water quality in 2016, by country



Data sources: EEA. Bathing Water Directive - Status of bathing water

Note:
The category "quality classification not possible" includes waters for which there were not enough samples, new bathing waters, bathing waters with changes or bathing waters that had been closed.

All reported bathing water sites in Austria, Croatia, Cyprus, Estonia, Greece, Lithuania, Luxembourg, Latvia, Malta, Romania and Slovenia for which classification was possible achieved at least sufficient quality in 2016 (according to minimum quality standards set in the Bathing Water Directive). In five countries, 95 % or more bathing waters were assessed as being of excellent quality: Luxembourg (all 11 reported bathing waters), Cyprus (99 % of all sites), Malta (99 % of all sites), Greece (97 % of all sites), and Austria (95 % of all sites).

In 2016, there were 300 sites with poor quality bathing water in the EU. Italy (100 bathing water sites or 1.8 %), France (82 sites or 2.4 %) and Spain (39 sites or 1.8 %) were the countries with the highest number of poor bathing water sites. In some EU Member States, more than 3 % of the bathing water sites were of poor quality: Ireland (six bathing waters or 4.3 %), the United Kingdom (20 bathing waters or 3.2 %), and Slovakia (one bathing water or 3 %) (EEA, 2017).

Outlook beyond 2020

Bathing water quality is not only essential for public health reasons. Clean unpolluted water is necessary to improve ecosystem resilience. Both can be achieved with more integrated and sustainable water resource management. This would require more robust implementation of the Water Framework Directive (EU, 2000), with River Basin Management Plans developed to improve the poorer quality bathing waters. This would serve to maintain the trend towards consistently high-quality EU bathing waters beyond 2020.

About the indicator

This indicator provides an overview of the bathing water quality in 2016 at more than 21 000 bathing waters in the Member States of the EU. It also presents the evolution of bathing water quality from 2011 to 2016 at EU aggregated level. During the bathing season, samples from coastal and inland bathing waters are taken and analysed against two microbiological parameters that may indicate the presence of faecal pollution, namely intestinal enterococci and Escherichia coli (also known as E. coli). After the end of the bathing season, and based on four years of data, bathing waters are classified into one of the bathing water quality classes (excellent, good, sufficient or poor). Some bathing waters have not been classified because there were insufficient samples or because they are new or have undergone changes affecting water quality. The full separation of the good and sufficient water quality classes has been possible only for the last two reporting years (2015 and 2016), which is why the time series in Figure 1 shows the good and sufficient classes together.

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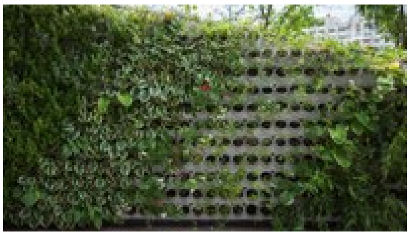
Environment and health

Number of countries that have adopted a climate change adaptation strategy/plan



Indicator	EU indicator past trend	Selected objective to be met by 2020	Indicative outlook of the EU meeting the selected objective by 2020
Number of countries that have adopted a climate change adaptation strategy and/or plan	N.A.[1]	Make decisive progress in adapting to the impact of climate change — 7th EAP	

There has been an increase in the number of countries that have adopted a national adaptation strategy and/or plan and this is expected to continue. However, information on the 'decisive progress' of these policies towards reducing vulnerability and enhancing resilience to climate change is limited, preventing firm conclusions with respect to the 2020 outlook

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2017

The Seventh Environment Action Programme (7th EAP) calls for decisive progress to be made in adapting to the impact of climate change. Climate change has had and will continue to have many impacts on the environment, human health and the economy. Adaptation of Europe's society to climate change is necessary to address the adverse impacts of climate change and complement efforts to mitigate climate change. Action to mitigate climate change and adapt to it will increase the resilience of the EU's economy and society, while stimulating innovation and protecting the EU's natural resources. To date, 25 EU Member States have adopted a national adaptation strategy (NAS) and 15 have developed a national adaptation plan (NAP). There has been an increase in the number of countries that have adopted national adaptation strategies and/or plans and this is expected to continue and to deepen, with additional countries adopting follow-up adaptation policies and implementation plans. However, information on the progress of these policies in reducing vulnerability and enhancing resilience is limited, so the outlook towards 2020 for this 7th EAP objective remains uncertain.

Setting the scene

The 7th EAP calls for decisive progress to be made in adapting to climate change to make Europe more climate resilient (EU, 2013a). Climate change impacts can be seen in global sea level rise, changes in precipitation (e.g. increases in northern and north-western Europe and decreases in southern Europe), decreasing snow cover, glaciers, sea ice and ice sheets. These changes lead to a wide range of often adverse impacts on environmental systems, economic sectors, and human health and well-being in Europe (EEA, 2017a; IPCC, 2014). Climate change adaptation addresses the adverse effects of climate change and builds resilience to reduce vulnerabilities and risks to the environment, human health and the economy (including infrastructure).

Policy targets and progress

The European Commission's White Paper (EC, 2009) and EU strategy on adaptation to climate change (EC, 2013) encourage all Member States to adopt comprehensive adaptation strategies. The strategy promotes action in cities and the mainstreaming of adaptation in relevant EU policies and programmes. In addition, it provides funding for actions, enhances research under the Horizon 2020 programme for environment and climate action[2], and promotes information sharing through the European Climate Adaptation Platform[3]. In 2017-2018, the European Commission will perform an evaluation (EC, 2016) assessing whether or not the action being taken by the EU and in the Member States is sufficient. The European Commission will publish the results in a report due in 2018, which will include an adaptation preparedness scoreboard, with key process-based indicators for measuring Member States' levels of readiness.

Adaptation policy receives EU financial resources from the EU budget in the period 2014-2020. It is intended that 20 % of the budget should be used for climate-related actions (i.e. adaptation and climate change mitigation).

National Adaptation Strategies (NASs) usually address overarching issues that allow them to position adaptation on the policy agenda. These strategies recognise the importance of expected climate change impacts and the need to adapt, and they facilitate the process of coordinating the adaptation response, increasing awareness of adaptation and stakeholder involvement, assessing risks and vulnerabilities, and identifying knowledge gaps.

National Adaptation Plans (NAPs) usually aim to implement NASs and to organise activities for achieving their objectives, typically through sectoral implementation. Although adaptation implementation at national level is still at an early stage, adaptation planning work is under way in most countries.

Country level information

Table 1 provides an overview of progress with the adoption of national and sectoral climate change adaptation strategies and plans by EEA member countries. To date, 25 EU Member States and three other EEA member countries have adopted NASs. In addition, 15 EU Member States and two other EEA member countries have developed NAPs. Table 1 shows that over the last five years there has been a steady increase in the number of NASs and NAPs being adopted by countries, and this is expected to continue as the EU Member States not having a NAS today are in the process of drafting one, with additional countries adopting NAPs as well as implementing more specific adaptation policies and actions in line with their strategies and plans. Over the same period, several countries that adopted their NAS some years ago reviewed and adopted a revised NAS.

Table 1. Overview of national and sectoral climate change adaptation strategies and plans, by country

EEA member countries	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Austria													
Belgium													
Bulgaria													
Croatia													
Cyprus													
Czech Republic													
Denmark													
Estonia													
Finland										*			
France													
Germany													
Greece													
Hungary													
Ireland													
Italy													
Latvia													
Lithuania													
Luxembourg													
Malta													
Netherlands												*	
Poland													
Portugal											*		
Romania												*	
Slovakia													
Slovenia													
Spain													
Sweden													
United Kingdom													
Iceland													
Liechtenstein													
Norway													
Switzerland													
Turkey													

	No policy
	National adaptation strategy (NAS) in place
	National adaptation strategy (NAS) and national and/or sectoral adaptation plans (NAP/SAP) in place
*	National Adaptation Strategy (NAS) updated

Data source: EEA, 2014, 2017b.

Note: information reported by EU Member States under the European mechanism for monitoring and reporting information relevant to climate change (EU, 2013b) and additional information provided on a voluntary basis to EEA up to September 2017 and the draft country fiches of the European Commission Adaptation Scoreboard (EC, 2017) for other EEA member countries information provided on a voluntary basis to the EEA up to September 2017.

Regarding the implementation of adaptation policies and actions (EEA, 2017b), sectors addressed mostly in NAS and NAP are freshwater management, flood risk management, agriculture and forestry. The adaptation actions in these sectors have mostly consisted of mainstreaming adaptation priorities into these national sectoral policy areas. Several countries have also developed national health strategies and action plans, including early warning systems for heatwaves and enhanced surveillance of infectious diseases (EEA, 2014).

A limited number of countries have started to monitor and report on adaptation policies and actions at national level (EEA, 2014). So far, even fewer countries evaluate adaptation policies at national level; there are various reasons, including the fact that implementation of adaptation has only just begun (EEA, 2015). The countries that monitor these use mainly 'process-based' methods, assessing to what extent agreed stages in the process of taking actions have taken place. Very few countries use 'outcome-based' approaches, assessing if and how vulnerability has decreased and/or resilience has increased, because this is methodologically very complex and also resource intensive. It will therefore not be possible to determine with any certainty whether or not decisive progress in adapting to the impact of climate change can be achieved by 2020.

Transnational cooperation in adaptation to climate change has increased with the recognition of the importance of adaptation as a cross-cutting policy area. Adaptation actions take place, for example, within the EU Baltic Sea region strategy, the Danube Commission and the Carpathian and Alpine conventions. Adaptation action is often linked to the sharing of natural resources such as transboundary water catchments (EEA, 2017a).

Outlook beyond 2020

Because of expected future climate change impacts, efforts to adapt to climate change and to make Europe more climate resilient need to be strengthened in future. NASs and NAPs, together with the EU's adaptation strategy (EC, 2013), are expected to be further implemented, and mainstreaming of climate change adaptation in policies is expected to continue. Key global agreements that can also enhance action on adaptation in Europe include the Paris Agreement (UNFCCC, 2015), which requires countries to take adaptation action, complementary to climate change mitigation action, and the 2015 UN Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR) (UNISDR, 2015), which acknowledges climate change as one of the drivers of disaster risk and requires countries to take risk prevention and reduction measures.

About the indicator

This indicator shows the number of countries that have adopted an adaptation strategy and/or plan. It indicates how many countries have made progress on adapting to climate change by putting this issue on the policy agenda (through adaptation strategies) and by organizing specific activities that will help achieve the aims of their adaptation strategies (through national and/or sectoral adaptation action plans). Many of these action plans have been in place for only a few years (see Table 1), so implementation has started rather recently. There is limited quantitative information available, and in only a few countries, on the effectiveness of adaptation strategies and plans regarding enhanced resilience and reduced vulnerabilities and risks. This indicator is therefore not yet able to show the effectiveness of these strategies and plans in making Europe more climate resilient. More information on this is expected to become available in future when more countries implement monitoring, reporting and evaluation adaptation schemes.

Footnotes and references

[1] N.A. It is not possible to measure a trend, since this is a binary measure, i.e. whether or not a policy has been adopted.

[2] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/fighting-and-adapting-climate-change-1 accessed 4 April 2017.

[3] http://climate-adapt.eea.europa.eu/ accessed 4 April 2017.

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Environment and health

Environmental noise

Indicator	EU indicator past trend	Selected objective to be met by 2020	Indicative outlook of the EU meeting the selected objective by 2020
Exposure to environmental noise		Significantly decrease noise pollution – 7th EAP	
Efforts to reduce environmental noise tend to be offset by an increase in the number of people being exposed to high noise levels, in particular due to increasing road and aviation traffic and an increase in the number of city inhabitants For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2017			

The Seventh Environment Action Programme (7th EAP) includes an objective that noise pollution in the EU should be decreased significantly by 2020, moving closer to World Health Organization (WHO) recommended levels. Exposure to outdoor noise is monitored under the Environmental Noise Directive (END) against two thresholds, an indicator for the day, evening and night periods (L_{den}) that measures exposure to noise levels associated with 'annoyance' and an indicator for night periods (L_{night}) that is designed to assess sleep disturbance. These thresholds do not correspond directly to the WHO recommended values and currently there is no mechanism in place for tracking progress against the latter values. Data reported under the Directive suggest that noise remains a major environmental health problem in Europe. For example, in 2012 — the year for which the most recent data has been reported — an estimated 100 million people in the EU were exposed to daily road traffic noise levels exceeding the threshold specified in the END. During the more sensitive night period, over 69 million people were estimated to be exposed in the EU to night road traffic noise levels exceeding the Directive's night-time noise threshold. As a result of such exposures, approximately 16,600 cases of premature death from noise exposure occur each year in Europe, predominately from road traffic. Where comparable, reported data suggest that noise exposure levels remained relatively stable between 2007 and 2012. Efforts to reduce the noise from individual sources are being offset by continuing migration to urban areas and increases in vehicle traffic. This is likely to continue in the future, with transport demand set to increase, including road transport, and with predicted increases in aircraft noise. It is therefore unlikely that noise pollution will decrease significantly by 2020.

Setting the scene

Noise exposure from transport sources and industry can lead to annoyance, stress reactions, sleep disturbance, and increases in the risk of hypertension and cardiovascular disease. Environmental noise causes approximately 16 600 cases of premature death in Europe[1] each year, with almost 32 million adults estimated to suffer annoyance and over 13 million adults estimated to suffer sleep disturbance (ETC-ACM, 2016) [2]. The WHO (2011) identified noise as the second most significant environmental cause of ill health, the first being air pollution (AIRS_PO3.1, 2017). The 7th EAP (EU, 2013) includes an objective to significantly decrease noise pollution by 2020, moving closer to WHO recommended levels.

Policy targets and progress

The Environmental Noise Directive (END) is the main EU instrument through which land-based noise emissions are monitored and actions developed. It defines environmental noise as ‘unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity’ (EU, 2002). It places an obligation on EU Member States to assess noise levels by producing strategic noise maps for all major roads, railways, airports and urban areas[3]. Based on these noise-mapping results, Member States must prepare action plans containing measures that address noise issues and their effects for those areas where the specific END indicator thresholds (55 dB averaged across the day, evening and night periods (L_{den}) and 50 dB averaged across the night period (L_{night})) have been surpassed. The Directive neither sets limit values for noise exposure, nor prescribes measures for inclusion in the action plans. Finally, Member States are required to select and preserve areas of good acoustic environmental quality, referred to as ‘quiet areas’, in order to protect the European soundscape.

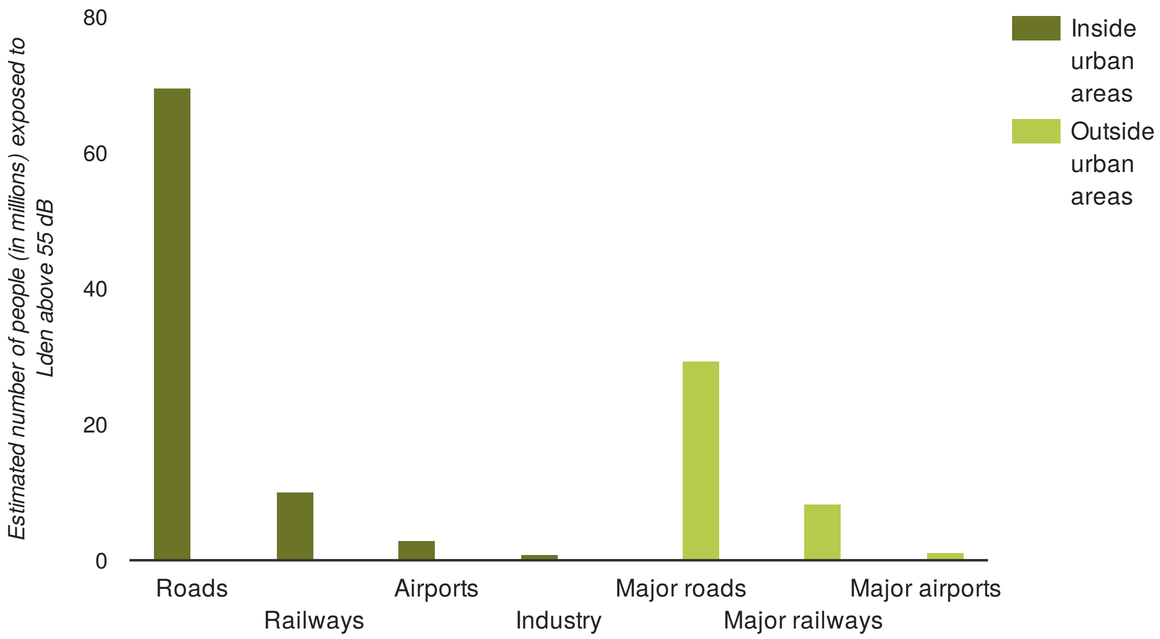
High environmental (i.e. outdoor) noise levels are defined in the 7th EAP as noise levels for L_{den} above 55 dB and for L_{night} above 50 dB.

During the night, high outdoor noise levels can cause sleep disturbance, such as body movements and wakening, starting at L_{night} levels below 40 dB, and with effects on the cardiovascular system that become apparent above 55 dB. All these impacts can contribute to premature mortality (WHO, 2009). The WHO established a night-time outdoor noise guideline for L_{night} of 40 dB with the aim of protecting the public, including vulnerable groups such as children, the chronically ill and the elderly. An outdoor noise L_{night} value of 55 dB was recommended as an interim target for countries where the night-time noise guideline cannot be achieved in the short term and where policymakers adopt a stepwise approach. The WHO night-time noise guideline is stricter than the L_{night} threshold of 50 dB set under the END, providing a higher level of protection for human health. However, assessments cannot be made by comparing noise levels in the EU with WHO recommended levels, as Member States are not obliged to report this information.

Figure 1 provides an overview of the number of people exposed to levels of environmental noise in the EU within and outside urban areas that are above the daily (24 hour period) noise indicator threshold set by the END. The major source of noise pollution (measured in terms of number of affected people), both inside and outside urban areas, is road traffic. Noise from trains and aircraft has a much lower impact in terms of overall population exposure to noise, but it remains a major source of localised noise pollution (EEA, 2015).

It is estimated that 100 million people in the EU are exposed to L_{den} levels from road traffic noise that are above 55 dB. Night-time road traffic is another major source of noise exposure, with approximately 69 million EU citizens exposed to harmful L_{night} levels above 50 dB (ETC_ACM, 2016 and EEA 2017a, EEA 2017b). In addition, many people are also exposed to rail, aircraft and industrial noise, particularly in towns and cities. While high levels of aircraft noise do not affect a wide geographical area, its harmful effects have been shown to include a reduced ability of younger generations to concentrate in schools that are affected by aircraft flight paths (EEA, 2014).

Figure 1. Estimated number of people in the EU exposed to high daily average noise levels, 2012



Data sources: a. EEA. Reported data on noise exposure covered by Directive 2002/49/EC b. EEA – Indicator CSI051

Note: 1. Urban areas are the urban agglomerations, defined as such in the Environmental Noise Directive, that are the part of the territory, delimited by the Member State, having a population in excess of 100 000 persons and a population density such that the Member State considers it to be an urbanised area.
2. The numbers of people exposed can only be summed for the same source inside and outside urban areas and not across sources, since the latter could lead to double counting.
3. 55 dB Lden is the EU threshold for excess exposure defined in the Environmental Noise Directive. It indicates an annual average level during the day, evening and night; dB=decibel.

Examples of measures to reduce noise exposure currently being undertaken at the national level include installing road and rail noise barriers and optimising aircraft movements around airports. However, it is widely acknowledged that the most effective actions to reduce exposure tend to be those that reduce noise at source, for example reducing the number of vehicles on the road, introducing quieter tyres for road vehicles or laying quieter road surfaces.

A major problem for the effectiveness of such measures is that, given the different factors that determine traffic noise, a single measure alone is often not sufficient to significantly reduce exposure.

In terms of assessing past trends in noise exposure, data were reported to the EEA in 2007 and in

2012 under two rounds of noise mapping assessments. There are comparability issues between the two reporting rounds because of a lack of common assessment methods and incomplete reporting of exposure assessments, with as little as 62 % of the expected amount of data, depending on source, being delivered in the second reporting round.

However, the analysis of a sub-set of the reported data that were comparable revealed that exposure to noise has remained broadly constant between 2007 and 2012.

Efforts to reduce the noise from individual sources were offset by the higher numbers of people being exposed to high noise levels, mainly due to increasing passenger road and aviation traffic (EEA, 2017c) and increasing numbers of city inhabitants (Eurostat, 2016). The construction of new roads may have also exposed new areas and populations to road traffic noise.

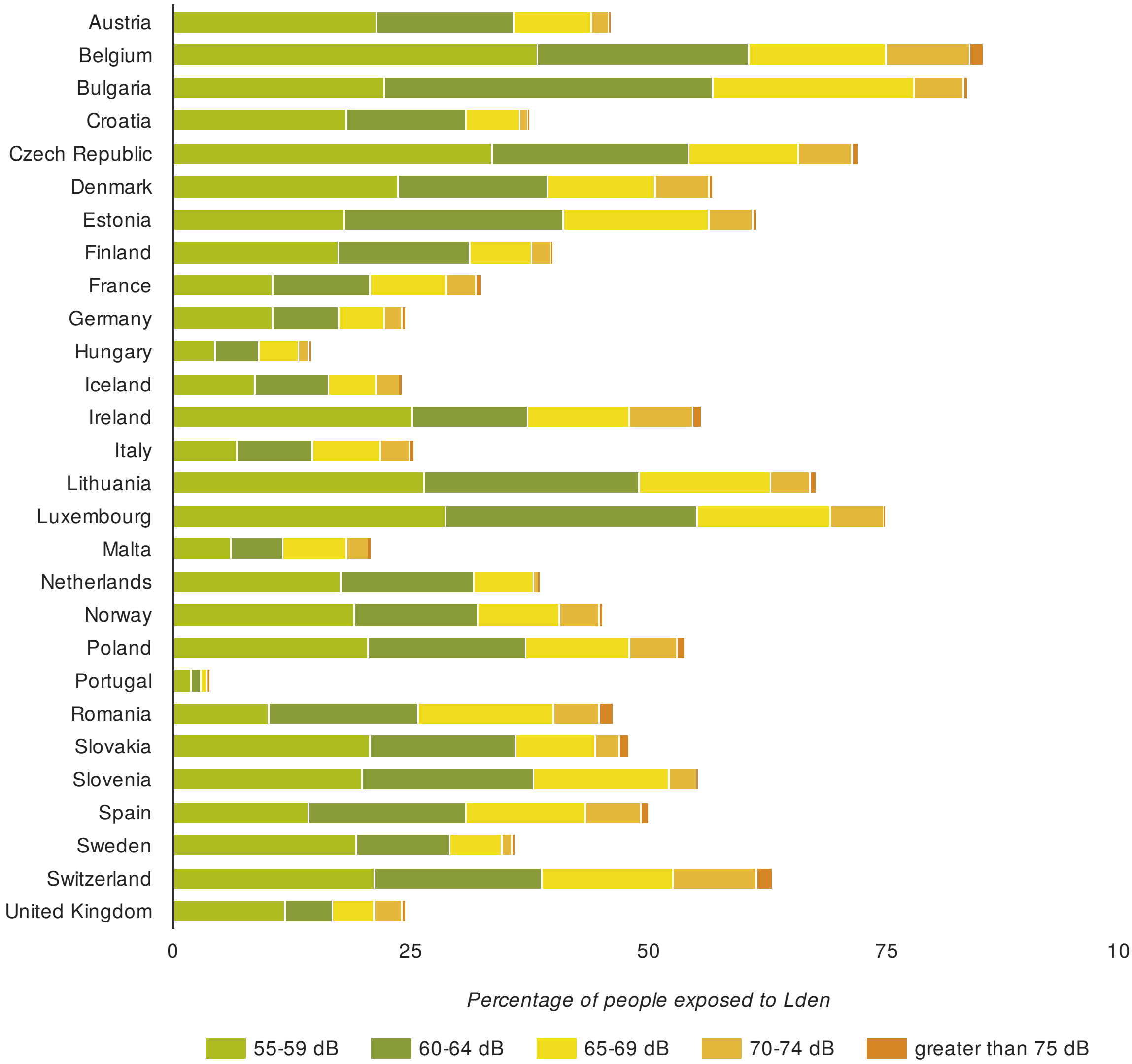
Finally, it is unlikely that noise pollution will decrease significantly by 2020, given that transport demand is expected to increase (EC, 2016), air traffic noise has been predicted to increase (EASA et al, 2016) and the number of city inhabitants is also set to increase (Eurostat, 2016).

Country level information

Road traffic is the most widespread noise source in Europe and is the source that causes the largest number of people to be exposed to noise levels above the Environmental Noise Directive threshold levels for L_{den} and L_{night}. This is true at the European scale, at country scale and both inside and outside urban areas. Nevertheless, a wide variation can be identified between countries in the number of people exposed to road traffic noise in urban areas. This is significantly influenced by factors such as the number of urban areas per country, the total number of inhabitants per urban area, and differences between the methods countries have used to estimate noise exposure. The correlation between the total number of inhabitants in an urban area and the number of people exposed to road traffic noise is very strong.

The Czech Republic, Denmark, Estonia, Ireland, Lithuania, Luxembourg, Slovenia, Poland and Switzerland reported that more than 50 % of inhabitants in urban areas (an urban agglomeration with more than 100 000 inhabitants) were exposed to road noise L_{den} levels above 55 dB, while Belgium and Bulgaria reported figures of more than 75 % for the equivalent exposure (Figure 2). At the other end of the scale, the number of inhabitants exposed to road noise L_{den} levels above 55 dB in Germany, Hungary, Malta and Portugal remained below 25 %. As mentioned above, however, country-specific data are not necessarily comparable.

Figure 2. Percentage of population exposed to high road noise daily average levels within urban areas, by country, 2012



Data sources: EEA. Reported data on noise exposure covered by Directive 2002/49/EC

Note:
55 dB L_{den} is the EU threshold for excess exposure defined in the Environmental Noise Directive. It indicates an annual average level during the day, evening and night; dB=decibel.

Outlook beyond 2020

Regarding the long-term outlook for exposure to environmental noise in Europe, there are a number of challenges to reducing population exposure to noise pollution. Economic growth and expanding transport networks can lead to increased transport levels that could, in turn, increase noise pollution. At the same time, trends towards increasing urbanisation (Eurostat, 2016) could lead to higher numbers of people being exposed. Transport demand, including for passenger cars is expected to increase by 2050 (EC, 2016 and EEA, 2015), with noise from road traffic representing the dominant source of environmental noise and noise from air traffic also set to increase (EASA et al, 2016). While the use of electric cars currently contributes to lower noise levels at low speeds in urban areas, the new EU regulation on the sound levels of motor vehicles (EU, 2014) will require the installation of artificial sound generators in all electric and hybrid vehicles by 2021 to improve safety for pedestrians. Whether or not exposure to noise increases or decreases beyond 2020 depends on the relative rates of these as well as of other developments.

About the indicator

The Environmental Noise Directive (END) requires two main indicators to be applied in the assessment and management of environmental noise. The first indicator (L_{den}) is the noise level for the day, evening and night periods and is designed to measure 'annoyance'. The END defines an L_{den} threshold of 55 dB. The second indicator (L_{night}) is the noise level for night-time periods and is designed to assess sleep disturbance. The END defines an L_{night} threshold of 50 dB. Member States must report the numbers of people who are exposed to noise levels above both thresholds for each noise source (e.g. roads, railways, airports, industry). The EEA uses the reported data to publish an indicator for environmental noise in Europe that focuses on environmental noise exposure to L_{den} since this covers the full 24 hour period (EEA, 2017b). A complete assessment of exposure to environmental noise and a prognosis regarding the future outlook are hindered by the fact that exposure estimates reported by countries are not complete, with as little as 62 % of the expected amount of data, depending on source, being delivered in the second reporting round (EEA, 2014). The gaps in the reported data have been filled with expert estimates. The lack of comparable and common assessment methods often causes significant inconsistencies between exposure estimates from different countries, for regions and cities within a single country and across the two main reporting rounds (2007 and 2012).

Footnotes and references

[1] The estimates cover the 28 EU Member States as well as the five member countries of the European Environment Agency (Iceland, Liechtenstein, Norway, Switzerland and Turkey).

[2] The 2012 noise data were updated in this environmental noise (2017) briefing compared to the 2012 noise data presented in the environmental noise briefing that was published in 2016. The update reflects the more recent country submissions and redeliveries under the Environmental Noise Directive. The number of premature deaths and of adults estimated to suffer annoyance and sleep disturbance was also updated in line with this as well as by applying an improved methodology (ETC-ACM, 2016).

[3] The END defines major roads as those having more than three million vehicle passages a year, major railways as those having more than 30 000 train passages per year, and major airports as those having more than 50 000 flight movements (take offs or landings) per year.

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Environment and health

Consumption of hazardous chemicals

Indicator	EU indicator past trend	Selected objective to be met by 2020	Indicative outlook of the EU meeting the selected objective by 2020
Consumption of chemicals, by hazard class		Risks for the environment and health associated with the use of hazardous substances, including chemicals in products, are assessed and minimised — 7th EAP	
While the consumption of chemicals that are hazardous to health and the environment has declined over the years, it is not possible to equate this to a reduction in the risks to environment and health and the outlook towards 2020 is therefore unclear For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2017			

The Seventh Environment Action Programme (7th EAP) includes an objective of assessing and minimising risks to the environment and health associated with the use of hazardous substances. The consumption of chemicals provides benefits to society, but can also entail risks to the environment and human health. Risk depends on both the hazard presented by chemicals and exposure to them and, while the availability of data on the hazardous properties of chemical substances is improving, environmental and human exposure is poorly documented. Tracking the consumption volumes of industrial chemicals that are hazardous to human and environmental health is, therefore, used as an imperfect proxy for human exposure. From 2006 to 2015, there was a decline of 7.5 % in EU consumption of chemicals that are hazardous to health and the environment. This was driven by a large decrease (19 %) over the 2006-2009 period. However, as consumption volumes are not directly related to actual human and environmental exposure to chemicals, the decline in the consumption of chemicals that are hazardous to health and the environment provides a weak indication of progress towards this objective. Furthermore, some types of hazard are not yet included in the reporting and assessment. Rather, this briefing serves to highlight gaps in the evidence base for assessing risks to the environment and human health associated with the use of hazardous substances.

However, there is some cause for concern as consumption volumes have not decreased since 2011 and this may question whether the objective can be reached by 2020.

Setting the scene

The 7th EAP (EU, 2013) includes a number of chemical-related goals, one of which states that health and environmental risks associated with the use of hazardous substances, including chemicals in products, should be assessed and minimised by 2020. Under the Regulation on the classification, labelling and packaging of substances and mixtures, chemicals are classified as hazardous on the basis of properties that generate physical, environmental and health hazards (EU, 2008). While the consumption of chemicals provides benefits to society, exposure to hazardous chemicals emitted throughout the chemical life cycle (i.e. production, use and disposal/incineration/recycling) can generate significant risks to health and ecosystems. Impacts of chemical exposure to humans and the environment is a result of the sum of exposures from a multitude of sources, from mixtures of chemicals with various toxicities. Such health impacts are associated with a number of disease outcomes (Prüss-Ustün et al., 2011), while chemical pollution degrades air and water quality, and can impact negatively on ecosystem services. Hazardous chemicals have been detected in human populations and linked to environmental, product and dietary exposures (Smolders et al., 2015), as well as workplace exposures.

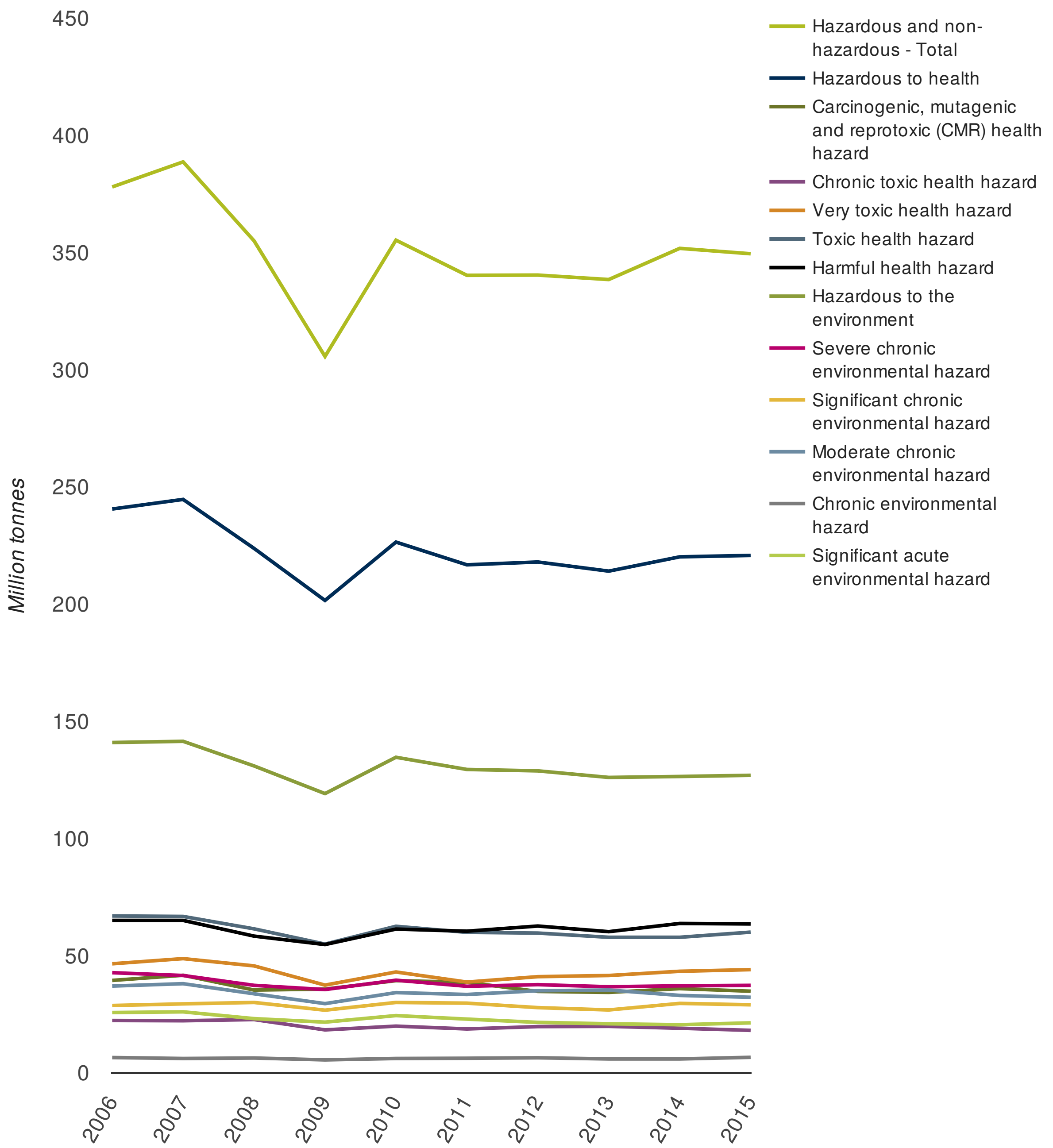
Policy targets and progress

The Regulation on the registration, evaluation, authorisation and restriction of chemicals (REACH) (EU, 2006) aims to improve the protection of human health and the environment from the risks posed by chemicals. REACH also calls for the progressive substitution of the most hazardous chemicals, when suitable alternatives have been identified [1].

Eurostat developed a set of indicators to monitor progress towards two major goals of REACH: to improve the quality of data for chemical risk assessment, and to reduce the risks posed by chemicals to humans and the environment (Eurostat, 2009). An analysis using these indicators suggests that REACH implementation resulted in better risk control of known chemicals of concern, for which specific actions had been set, e.g. for substances of very high concern (SVHCs) (Eurostat, 2012). However, since the SVHC indicator only measures chemicals registered as SVHCs, it does not indicate if the replacement chemicals are less toxic. Regulation of groups of chemicals rather than single substances is being considered by the European Commission (EC, 2017) as a means to speed up the risk assessment and to avoid the so-called ‘regrettable substitution’.

Figure 1 provides an EU overview of the total consumption of chemicals, and the proportion that is hazardous to health and the environment. It covers the 2006-2015 period.

Figure 1. Consumption of chemicals, by hazard class, EU



Data sources: Eurostat. Production and consumption of chemicals by hazard class [env_chmhaz]

There has been a 7.5 % decrease in the consumption of 'hazardous and non-hazardous' chemicals; the non-hazardous chemicals included here are chemicals that might have hazardous properties, but which are not classified as such. The main decrease took place in 2009 (it dropped by 19 % compared with 2006), following the aftermath of the 2008 economic downturn. From 2009 to 2010, consumption increased by 16 % and has remained more or less stable since then.

Similar trends are seen for chemicals that are hazardous to human health (-8 % in the 2006-2015 period) and for chemicals that are hazardous to the environment (-10 % in the 2006-2015 period).

Looking at developments from 2013 to 2015, there was a small increase of 3.1 % in the EU's total consumption of hazardous and non-hazardous chemicals, as well as in the consumption of chemicals that are hazardous to health and to the environment.

For chemicals that are hazardous to the environment, the 'moderate chronic environmental hazard' decreased by 8.8 %, but this has been offset by increases in the four other hazards, including the two most hazardous ('severe chronic' and 'significant chronic').

Likewise, in the same 2013-2015 period, 'chronic toxic health hazards' decreased by 8.5 %, but all the four other health hazards increased, including substances that are carcinogenic, mutagenic and toxic for reproduction (CMR substances). These are considered to pose the most significant risks to human health. However, from 2006 to 2015, the EU chemical consumption of CMR substances declined by 12 %. This trend may be indicative — considering the indicator limitations outlined below — of a decrease in consumption of chemicals of high concern, driven by substitution, as was also seen in the Eurostat report 'The REACH baseline study 5 years update' (Eurostat, 2012).

In making the link between the consumption of chemicals that are hazardous to human and environmental health and the resulting risks, the assumption is that reduced consumption volumes will equate to a reduction in the overall risk profile of chemicals, including those incorporated into products and sold in the EU.

However, consumption volumes for chemicals that are hazardous to health do not provide direct insight into risks, since consumption is not synonymous with exposure, nor does it consider the specific toxicity of the chemicals. On the one hand, some chemicals are handled in closed systems, or as intermediate goods in controlled supply chains, implying that no, or limited, exposure takes place (Eurostat, 2014). On the other hand, a number of factors have not been included in the consumption of chemicals, which may contribute to exposure. For instance, it is possible that reductions in the consumption of chemicals that are hazardous to health are being offset by increased imports of products that contain such chemicals, potentially leading to exposure throughout the product life cycle, inside or outside the EU. Accumulated persistent and legacy chemicals will add to human and environmental effective exposure. Production of chemicals in the EU, which are not consumed, but exported, can pollute at the location where the production occurs. Likewise, chemicals that are produced and used outside Europe can reach Europe via air, water and food as well as in products. It is, therefore, of concern that the global production and consumption of industrial chemicals is increasing (EU, 2017 and Bernhardt et al., 2017).

Another limitation of using this indicator to describe risk, is that the information on the types and potency of the hazards is incomplete. Endocrine disruptors, mixture effects and nanomaterials are not specifically addressed. Early exposure to chemicals having neuro-developmental toxicity and immuno-developmental toxicity may lead to late and inter-generational effects and this is not consistently addressed in the hazard evaluations. In addition, many substances on the market may have unrecognised hazardous properties and may consequently not be listed as hazardous, and not included in the current indicator on substances with known hazardous properties.

These factors make it difficult to use EU consumption volumes of chemicals that are hazardous to health and the environment as a proxy for risk to chemicals. It is, therefore, not possible to accurately report progress towards the goal of minimising risks to the environment and health on the basis of this indicator. It is, however, of concern that the consumption volumes have more or less stabilised since 2011. This may question the ability to reach the objective by 2020.

Additional concerns focus on the health impacts of chemicals that are endocrine disruptors, toxic to the neuro- and immunodevelopment of unborn children, persistent chemicals accumulating in humans and the environment, nanomaterials and effects of combinations of chemicals. The indicator on the consumption of chemicals that are hazardous to health and the environment does not provide specific insight on these concerns.

Outlook beyond 2020

Chemical risk is an area characterised by incomplete information on the hazards posed by chemicals, uncertainties regarding exposure levels, as well as the associations between exposure and health outcomes, and the causal mechanisms involved. New initiatives to generate data on the link between exposure to chemicals and the health of the European population using human biomonitoring should serve to improve the evidence base for strengthening the protection of human health from chemical risks.

The outlook beyond 2020 gives cause for concern. The global production of chemicals is expected to rise (Bernhardt et al., 2017); a circular economy may increase exposure to legacy chemicals; the European population spends more time indoors and climate change may remobilise chemicals from landfill (EU, 2013 and EC, 2017).

The 7th EAP calls for the development of an EU strategy for a non-toxic environment by 2018. This should address the concerns listed above, as well as exposure to chemicals in products, including imported products. It mentions the need to promote non-toxic material cycles, to reduce indoor exposure to harmful substances, and to identify measures to decrease impacts from e.g. endocrine disrupters, persistent chemicals and nanomaterials, particularly for vulnerable groups or ecosystems. This strategy is expected to set a framework for actions to minimise chemical risks beyond 2020.

Current efforts to promote a circular economy also have implications for chemicals in products. The reuse or recycling of products that are contaminated with hazardous chemicals may lead to unforeseen exposure. Further research is required to identify material flows that may be contaminated and to understand the potential exposure resulting from recycling these materials. Such knowledge might inform decisions on how to guarantee the quality of recycled materials, for instance by separating out contaminated materials, or by using green and sustainable chemistry and non-chemical solutions. Preventing hazardous chemicals from entering material flows from the start might achieve multiple goals of increasing the quantity of recycling, while minimising risk.

The importance of maintaining a high level of protection of human health and the environment, through a non-toxic environment strategy, was emphasised by the European Environment Council in their conclusions from 19 December 2016 (Council, 2016). In August 2017, the European Commission published a final report describing the topics and listing a set of possible actions that could be elements of a non-toxic environment strategy (EC, 2017).

At the United Nations level, in 2002, participants at the World Summit of Sustainable Development, including the EU and its Member States, made a commitment to the sound management of chemicals throughout their life cycle. This commitment aims ‘to achieve, by 2020, that chemicals are used and produced in ways that lead to the minimization of significant adverse effects on human health and the environment’ (UN, 2002). This goal was reaffirmed at Rio+20 (UN, 2012), with the 7th EAP explicitly calling for action to attain this goal at EU level. Work has also been launched at the UN level to prepare recommendations for a future platform for the sound management of chemicals and waste beyond 2020. In addition, the Sustainable Development Goals (UN, 2015) set a global agenda until 2030 and define the risks from chemicals under several topics, including goals to ensure sustainable consumption and production patterns, to ensure healthy lives and promote well-being for all at all ages, and to ensure availability and sustainable management of water and sanitation for all.

About the indicator

The indicator tracks the consumption of industrial chemicals that are hazardous to human health and the environment. It includes five toxicity classes of chemicals that are hazardous to human health and five toxicity classes of chemicals that are hazardous to the environment; the classes are illustrated in Figure 1. These classes of chemicals exhibit properties that impact on human health and the environment, and are derived from the hazard statements described under the Regulation on the classification, labelling and packaging of substances and mixtures (EU, 2008).

The scope of the indicator is limited, since it does not cover all possible impacts on human health or the environment, or the ways in which exposure may occur. By taking the consumption of chemicals that are hazardous to health and the environment as an imperfect proxy for exposure, a fall in consumption may imply a reduction in exposure. However, there are a number of limitations when extrapolating exposure from consumption, as described in the policy targets and progress section.

Footnotes and references

[1] In addition to the horizontal REACH legislation, products may be regulated through a number of thematic regulations, which may have specific policy targets. These include the regulations on biocides (EU, 2012), fertilisers (EU, 2004a), pharmaceuticals (EU, 1967), detergents (EU, 2004b), cosmetics (EU, 2009) and food contact materials (EU, 2004c). The thematic regulations typically aim at minimising exposure to hazardous chemicals during the use-phase of the final (commercial) product, and typically do not assess chemical exposure to the environment (or humans) during the production or disposal/reuse phases. The product sources are also relevant for human health, but they are not part of the chemical consumption data.

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Environment and health

Pesticide sales

Indicator	EU indicator past trend	Selected objective to be met by 2020	Indicative outlook of the EU meeting the selected objective by 2020
Total sales of pesticides		The use of plant protection products does not have any harmful effects on human health or unacceptable influence on the environment, and such products are used sustainably — 7th EAP	

The selected indicator does not allow, at present, for an evaluation of progress towards the 2020 objective. Rather, the analysis serves to highlight gaps in the knowledge base for assessing progress towards this objective

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2017

The Seventh Environment Action Programme (7th EAP) sets the objective that by 2020 the use of plant protection products does not have any harmful effects on human health or unacceptable influence on the environment, and such products should be used sustainably. Total reported sales of pesticides in the EU stayed relatively constant between 2011 and 2015. The quantity of pesticides sold on the EU market may — to some extent — be linked to exposure to pesticides, but cannot be directly equated to a level of risk to human health and the environment. Other factors, including the hazardous properties of pesticides and associated use patterns, play a significant role in determining these risks. It is, therefore, not possible to draw a firm conclusion on whether or not the 2020 goal will be reached on the basis of this evidence. Rather, the briefing serves to highlight gaps in the evidence base regarding the harmful effects of plant protection products on human health and the environment. It is, nevertheless, disconcerting that total reported pesticides sales — including the shares of the main pesticide groups — remained relatively stable over the period examined.

Setting the scene

The 7th EAP (EU, 2013a) sets the objective, that by 2020 the use of plant protection products should not have any harmful effects on human health or unacceptable influence on the environment, and that such products should be used sustainably.

Pesticide (or plant protection product) use plays an important role in agricultural production by keeping plants healthy and preventing their destruction by disease and infestation. However, pesticides applied to crops can enter soil and surface waters via leaching and run-off, and can enter groundwater, with the risk of negatively affecting non-target species in both terrestrial and aquatic ecosystems. This impacts habitat function and contributes to biodiversity loss, including large reductions of insect populations (Ewald, 2015 and Hallmann, 2017).[1] This reduces the quality of ecosystem services, such as insect-mediated pollination, soil formation and composition, and the provision of clean drinking water. Pesticide residues in food may also pose a risk for human health (Bjørling-Poulsen et al., 2008), while residues in animal feed pose risks to animal health and can enter the food chain. Particular concerns have been raised regarding the health impacts of human exposure to pesticides with endocrine-disrupting properties (Mnif et al., 2011) and the associated costs to human health (Trasande et al., 2015.).[2] Other human health concerns relate to the neurotoxicity of e.g. insecticides and biocides, which can affect the brain function, particularly if exposure occurs during foetal development (Bjørling-Poulsen et al., 2008).

Policy targets and progress

Adopted in 2009, the Directive on the Sustainable Use of Pesticides (EU, 2009a) aims to reduce impacts on human health and the environment. To this end, Member States established National Action Plans including quantitative objectives, targets, measures and timetables. These plans should promote low-pesticide-input pest management and non-chemical methods, including both integrated pest management and organic farming. With the aim of protecting the aquatic environment and drinking water, Member States should adopt measures to minimise off-site pollution from spray drift, drain flow and run off. These include establishing buffer zones to separate the usage or storage of pesticides from rivers, lakes and waterways, in particular those used for drinking water abstraction. The first National Action Plans were communicated to the Commission in 2012 and are to be reviewed by the Member States at least every 5 years. Member States are to take all necessary measures to achieve the targets set out in the National Action Plans.

Under the Regulation on plant protection products (EU, 2009b), the Commission is required to identify active substances (i.e. active ingredients) with certain properties as candidates for substitution. Member States will then evaluate whether or not these active ingredients might be replaced by other pesticides that are less harmful. While this process is currently in the early stages of implementation, over time it should promote the use of less harmful pesticides and provide incentives to industry to develop pesticides with less hazardous properties. Apart from the active pesticide ingredients, plant protection products contain substantial amounts of additives called adjuvants and synergists, which are added to alter e.g. the uptake and potency of the active substances. Adjuvants can be toxic to both humans and the environment (Mesnage et al., 2014)[3] and fall within the scope of the Regulation (EU, 2009b). Currently no specific rules for the authorisation of adjuvants (including data requirements, notification, evaluation, assessment and decision making procedures) have been set at EU level.

Water quality legislation also generates obligations to control environmental exposure to pesticides. The contamination of surface waters with pesticides is managed under the Water Framework Directive (EU, 2000), which requires upstream controls to reduce emissions, discharges and losses of those pesticides, that have been identified as priority substances or priority hazardous substances under the Priority Substances Directive (EU, 2013b). The Drinking Water Directive (EU, 1998) stipulates a maximum concentration of 0.1 µg/L for any single pesticide and its relevant metabolites (to a maximum of 0.5 µg/L for total pesticides) in potable water. In 2013 about 7% of the groundwater stations reported excessive levels for one or more of the 31 measured pesticides and their degradation products. In river stations up to 5% had excessive levels, but for two pesticides it was up to 35% and 43% of all stations that had excessive levels (Eurostat, 2013). The next planned update of the agri-environmental indicator on pesticide pollution of water is in 2018.

Thresholds are also applied for pesticide residues in food and feed (EU, 2005), and as undesirable substances in animal feed (EU, 2002). The latest annual report by the European Food Safety Authority concluded that 97.2% of the samples analysed fell within the maximum pesticide residue levels in food permitted in EU legislation (EFSA, 2017).

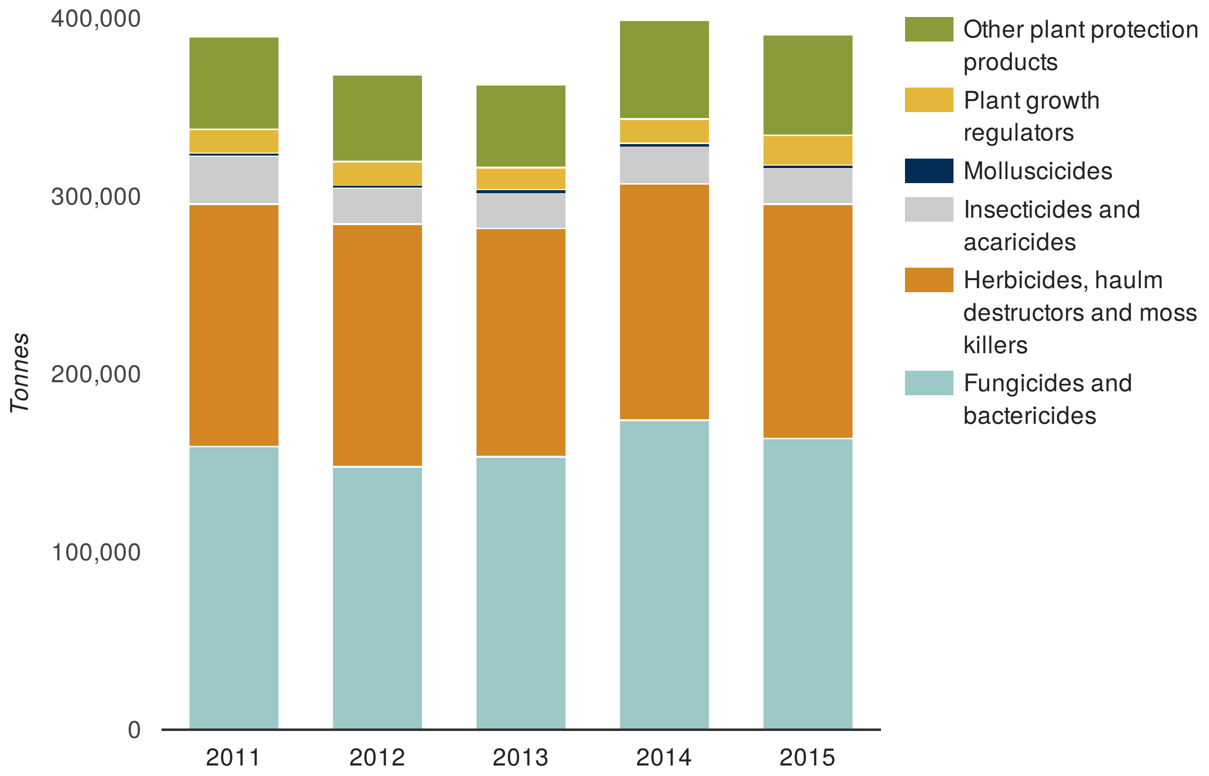
As shown in Figure 1, total sales of pesticides across the EU as a whole stayed constant between 2011 and 2015 (there was an insignificant increase of 0.2 %). After a small decline from 2011 to 2013, sales increased again in 2014 to just under 400 000 tonnes and came back to the 2011 level in 2015. The groups of pesticides sold also remained relatively stable over the 2011 to 2015 period (Figure 1). The EU demand for pesticides has therefore remained nearly stable, which could indicate that the risks of pesticides to humans and the environment have remained constant, despite implementation of the National Action Plans under the Directive on the Sustainable Use of Pesticides.

This analysis is based on the fact that the risks of pesticide use depend on both the exposure to pesticides, related to the amount, application methods and use patterns of pesticides, and to the hazards of the active ingredients and adjuvants present in the pesticide product.

Exposure to pesticides cannot be directly equated with pesticide sales, which is why the indicator tells us little about the absolute magnitude of the specific risks. The climate, landscape, habitat and soil characteristics of the receiving ecosystem, as well as proximity to water bodies, also influence how pesticides disperse in the environment. The analysis therefore relies on some assumptions. For example, taking the sales of pesticides as a proxy for exposure to pesticides assumes that use patterns have not fundamentally changed between 2011 and 2015. Indeed, variations in weather do not explain the lack of decrease in EU pesticide sales over the 2011-2015 period since comparison of 2-3 year averages within this period shows increases in the pesticide sales of 1.4 to 5.8 % [4]. The assumption that the hazards stay constant if the volume of sold pesticides in each category stays constant, does not consider whether some pesticides, within a category e.g. insecticides, have been replaced by other pesticides that are more or less toxic to organisms other than the targeted pest. To properly assess this risk would have required information on the individual pesticides within each pesticide category which currently is not available (EC, 2017b). These various aspects also influence the risk to environment and health and are not accounted for by measuring the volumes sold on the market.

With the aim of enabling an assessment of EU-level progress in reducing the risks and adverse effects of pesticides on human health and the environment, the Directive on the Sustainable Use of Pesticides foresees the establishment of harmonised risk indicators. Development of these indicators is dependent on access to data on pesticide use. The Regulation on pesticide statistics (EU, 2009c) was expected to deliver data in 2016 on the agricultural use of pesticides by crop for 5-year periods, which would facilitate a better understanding of the risks to the environment and human health. Such data are nevertheless not yet available.

Figure 1. Total pesticides sales, EU



Data sources: Eurostat. Pesticide sales [aei_fm_salpest09]

Note: : Where no data were reported, the gaps were filled by using data from the closest year, with preference to the previous year, when available.

Monitoring (mixtures of) pesticides [5] in the European environment and in humans could provide a robust basis for assessing exposure that, in combination with ecological and human toxicity data, could enhance our understanding of current risks to human health and the environment. Under the Water Framework Directive, Member States have established a network of monitoring stations through which to investigate the presence of priority substances and priority hazardous substances in surface waters - several of these substances are pesticides. In addition, ground water monitoring data are currently in the process of being reported to the EEA and the EEA plans to publish the results in the course of 2018. With regard to human exposure, a European Human Biomonitoring Research Initiative has been established to deliver data on the exposure of the European population to chemicals, including pesticides. These activities should serve to support a more robust assessment of the risks from pesticides to human health and the environment.

Overall, the selected indicator does not currently enable a proper evaluation of progress towards the 2020 objective. The quantity of pesticides sold on the EU market cannot be directly equated to a level of risk to human health and the environment, while the limited availability of the past time series (only five data points) adds further uncertainty to a plausible 2020 outlook.

Nevertheless, the fact that the total volume of sales of pesticides in 2015 has not been reduced compared with the baseline year of 2011, and that there has hardly been any change in the main groups of pesticides sold over the same period, raises concerns as to the likelihood of the objective being met by 2020.

Country level information

In 2015, the countries in which the highest quantities of pesticides were sold were France, Spain, Italy, Germany and Poland, together making up 72 % of the EU's pesticide sales (Eurostat, 2017a).

Figure 2 shows the percentage change in the sales of pesticides (in kilograms of active ingredients) per country for the average pesticide quantity sold in the period 2014-2015 compared with 2011-2013. Values were averaged over more than a year in order to minimize variations due to weather.

In more than half of the EU countries as well as in Switzerland the average quantity of pesticides sold in 2014-2015 increased compared with the average quantity sold in 2011-2013 [6]. The biggest increases were in Finland, Latvia and Estonia (20-23 %). The biggest decreases were in Denmark (56 %) and Greece (43 %).

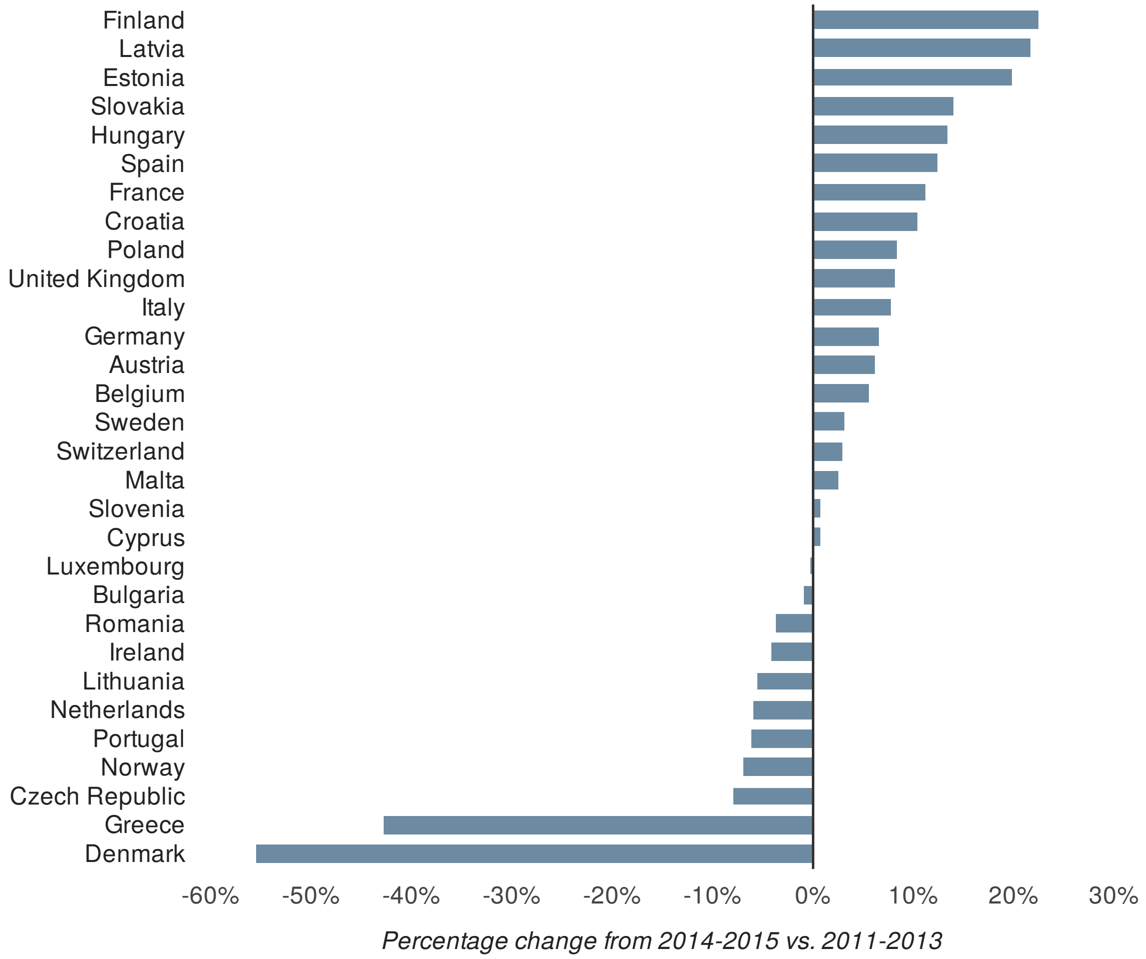
The average agricultural land (statistically known as utilised agricultural area[7]) remained constant at EU level between the two periods: 2011-2013 and 2014-2015 (Eurostat, 2017b). The changes at country level were also small between these two periods and therefore did not play a considerable role in the observed changes.

In the case of Estonia, the agricultural land increased between these two periods by almost 5 % (Eurostat, 2017b). The increase in sold pesticides observed in figure 2 can therefore only partly be explained by the increase in the agricultural land. Nevertheless, Estonia has a pesticide use per hectare of agricultural land below the EU average.

It should also be noted that some of the large decrease in the amount of pesticide sold in Denmark, may reflect farmers decisions to stockpile pesticides before the introduction of a new tax in Denmark on pesticides in 2013.

In 2015, the countries with the highest pesticide sale per hectare of agricultural land were Malta, the Netherlands, Cyprus, Belgium, Ireland, Italy and Portugal. These countries were above 5 kg of pesticide active ingredient/ha, with Malta at 15 kg active ingredient/ha. The EU average was 3.8 kg of pesticide active ingredient/ha. These calculations were EEA own calculations based on Eurostat data for pesticide sales (Eurostat, 2017a) and for utilised agricultural area excluding grasslands (Eurostat, 2017b).

Figure 2. Percentage change in pesticide sales by country



Data sources: Eurostat. Pesticide sales (aei_fm_salpest09)

Note: 1. Where no data were reported, the gaps were filled by using data from the closest year, with preference to the previous year, when available.
2. The chart shows the percentage change in the sales of pesticides (in kilograms of active ingredients) per country for the average pesticide quantity sold in the period 2014-2015 compared with 2011-2013. Values were averaged over more than a year in order to minimize variations due to weather. The methodology is available through the online chart.

Outlook beyond 2020

There are a number of conflicting trends expected to influence future demand for pesticides. The implementation of National Action Plans by Member States should foster the sustainable use of pesticides in the long term, as well as promoting integrated pest management and organic farming. The EU has seen an upward trend in organic farming, with the total organic area in the EU having increased from 5.6 % in 2012 to 6.7 % in 2016 of the total utilised agricultural area (Eurostat, 2017c). While a continuation of this trend in future years may serve to reduce overall EU demand for pesticides, there is a significant variation in the proportion of organic farming in agricultural production among different EU Member States. On the other hand, global food production will need to increase in order to feed a population estimated to rise above 9.6 billion by 2050 (EEA, 2015). The associated increase in demand may drive further intensification of agricultural production and lead to an increased demand for agrochemicals. Further research is also needed to fully understand how the adjuvants and synergists in the pesticide formulations, may present risk in themselves, or promote the risk of pesticides to the environment or to people (Martin et al. 2011).

In terms of technological developments, precision agriculture and smart technology offer the potential to optimise the relationship between productivity and inputs, thereby increasing the sustainability of agricultural production. The approach employs sensors and global navigation satellite systems to manage spatial and temporal variability in the demand for agricultural inputs. In the case of pesticides, this involves ensuring that application rates are precisely tailored to needs, for example, by responding to variability in the scale and density of crops or the presence of natural enemies of insect pests. Further research is required to fully understand the environmental benefits of precision agriculture and to promote its uptake, where relevant (JRC, 2015).

About the indicator

The indicator provides data on the volumes of sales of the active substances (or active ingredients) contained in pesticides; the data are broken down by main pesticide groups. Sales data for active substances are reported by the Member States to Eurostat under the Regulation on pesticide statistics (EU, 2009c). This Regulation covers pesticides, or plant protection products, defined as products consisting of or containing active substances, safeners or synergists, and intended for one of the following uses:

- protecting plants or plant products against all harmful organisms or preventing the action of such organisms, unless the main purpose of these products is considered to be for reasons of hygiene rather than for the protection of plants or plant products;
- influencing the life processes of plants, such as substances influencing their growth, other than as a nutrient; preserving plant products, in so far as such substances or products are not subject to special European Community provisions on preservatives;
- destroying undesired plants or parts of plants, except algae, unless the products are applied on soil or water to protect plants; or
- checking or preventing undesired growth of plants, except algae.

An active substance (ingredient) is a substance or micro-organism, including viruses, that has general or specific action against harmful organisms or on plants, parts of plants or plant products. This indicator does not address biocides.

Pesticide sales data can only provide a proxy for the actual use of pesticides, as they do not account for storage for later use, wastage, or the transport of pesticide products across borders. Data on the actual application of pesticides by crop and by region, as well as monitoring for a wider range of pesticides and pesticide adjuvants in the environment, water and in human blood would allow improved understanding of the risks to human health and the environment. The European Commission report on the implementation of the Regulation on pesticide statistics explains, inter alia, why data on the use of pesticides are not yet available (EC, 2017b).

Footnotes and references

[1] Pesticides in European streams have been linked to a reduction in regional biodiversity by up to 42 % for invertebrates (Beketov et al., 2013), and, from 1989 to 2013, some areas had declines of up to 78 % for insects, 86 % for pollinators such as bees, and a 27 % reduction in species (Vogel G, 2017). This has been linked to a combination of pesticides use (Geiger et al. 2010) and land-use changes. As a consequence, certain bird species populations (for example farmland birds) and the ability to produce fruits, berries and honey are declining in Europe.

[2] In September 2017, the European Commission adopted scientific criteria to identify endocrine disruptors in plant protection products and in biocides (EC, 2017a) with the aim of protecting human health and the environment.

[3] https://detoxproject.org/glyphosate/roundup-is-more-toxic-than-glyphosate/, and Mesnage R, Defarge N, de Vendomois JS, Séralini GE. Major pesticides are more toxic to human cells than their declared active principles. BioMed Res Int. 2014;2014. doi:10.1155/2014/179691.

[4] The EU average yearly pesticide sales of 2014-2015 (395 million tonnes) versus 2011-2013 (373 million tonnes) corresponded to an increase of 5.8 % while the EU average yearly pesticide sales of 2013-2015 (384 million tonnes) versus 2011-2012 (379 million tonnes) corresponded to an increase of 1.4 %.

[5] Pesticides are formulations that contain mixtures of active ingredients, synergists to promote toxicity and adjuvants.

[6] The country average volumes of sold pesticides (kg of active ingredient) for the periods 2011-2013 and 2014-2015 are available online through figure 2. Please mouse underneath the figure, press explore and then select Table.

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