



# Handbook Environmental Prices 2017

Executive Summary

	Projected Cost	Actual Cost
HOUSING	€ 1,500.00	€ 1,400.00
Mortgage or rent	€ 60.00	€ 100.00
Phone	€ 50.00	€ 60.00
Electricity	€ 200.00	€ 180.00
Gas	€ 50.00	€ 48.00
Water and sewer		



**CE Delft**

Committed to the Environment

# Handbook Environmental Prices 2017

Executive Summary



# Summary

Environmental prices are constructed prices for the social cost of pollution, expressed in euros per kilogram of pollutant. Environmental prices thus indicate the loss of economic welfare that occur when one additional kilogram of the pollutant finds its way into the environment. These prices can also be applied to immaterial forms of pollution such as noise nuisance and ionizing radiation. In such cases the environmental price is expressed in euros per unit of nuisance or exposure (in decibels, for example).

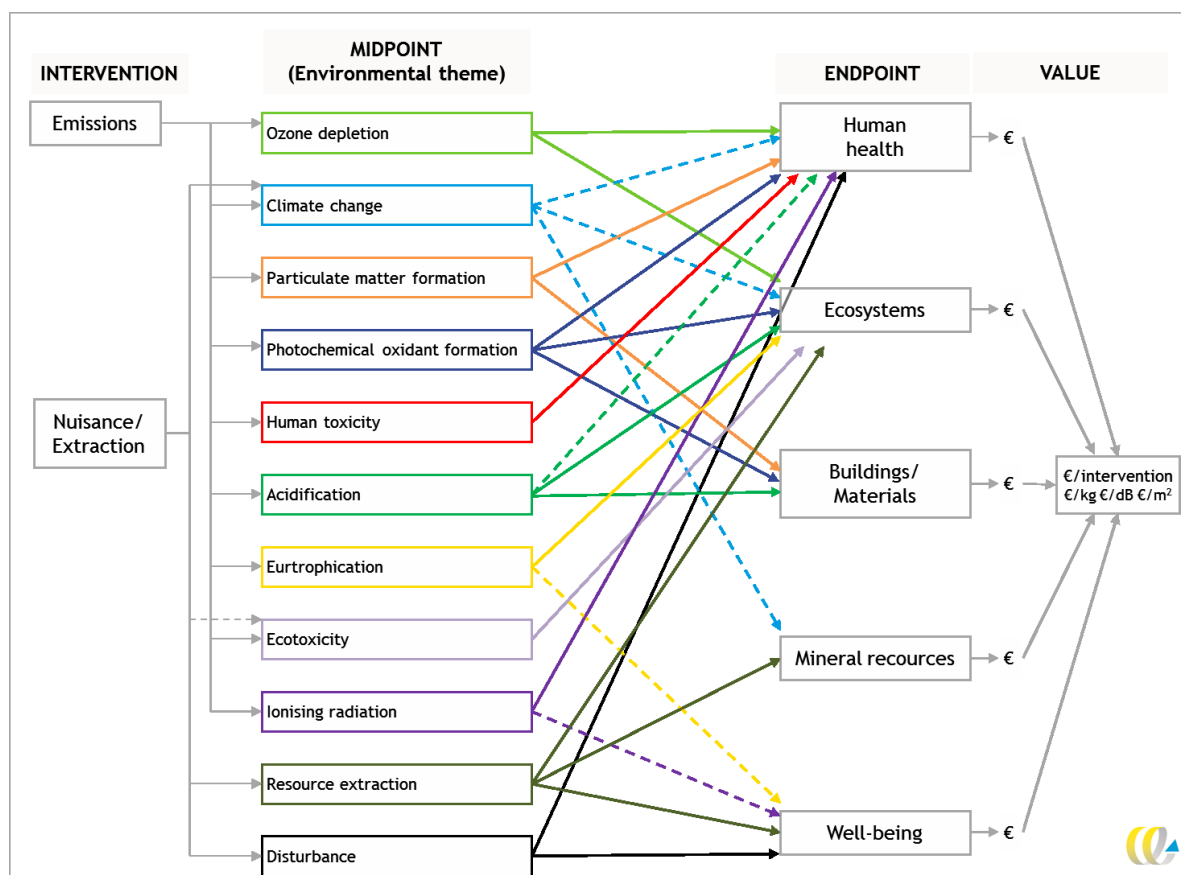
Environmental prices provide average values for the Netherlands, for emissions from an average emission source at an average emission site in the year 2015. In this manual these prices are presented at three levels:

1. At pollutant-level: a value for emissions of environmentally damaging substances.
2. At midpoint-level: a value for environmental themes such as climate change or acidification.
3. At endpoint-level: a value for the impacts of environmental pollution, such as damage to human health or ecosystem services.

The methodology used in this Environmental Prices Handbook is designed to harmonize the values at pollutant-, midpoint- and endpoint-level, to achieve consistent valuation of the impacts of pollution in the Netherlands.

Figure 1 provides an overview of the relationships covered in this Handbook, with each arrow representing a relationship that has been mapped.

Figure 1 The relationships mapped in this Environmental Prices Handbook



Note: Dashed lines represent relationships examined and (partly) quantified in the context of this Handbook, dotted lines relationships that were not directly quantified as a relationship because a different approach was adopted to quantify impacts.

## Results: pollutant-level environmental prices

Prices at pollutant-level, giving information on the cost of environmental pollution, are the ones most frequently used in analyses. This Handbook and the associated webtool provide such environmental prices for over 1,000 pollutants. Table 1 lists the values of the substances most commonly encountered in the context of air pollution and climate change.

Table 1 Environmental prices in €<sub>2015</sub>/kg emission for average emissions in the Netherlands

Stof		Lower	Central	Upper
Carbon dioxide*	CO <sub>2</sub>	€ 0.014	€ 0.057	€ 0.057
Chlorofluorocarbons*	CFC <sub>11</sub>	€ 99.6	€ 313	€ 336
Ultra-fine particulate matter	PM <sub>2,5</sub>	€ 56.8	€ 79.5	€ 122
Particulate matter	PM <sub>10</sub>	€ 31.8	€ 44.6	€ 69.1
Nitrogen oxides	NO <sub>x</sub>	€ 24.1	€ 34.7	€ 53.7
Sulphur dioxide	SO <sub>2</sub>	€ 17.7	€ 24.9	€ 38.7
Ammonia	NH <sub>3</sub>	€ 19.7	€ 30.5	€ 48.8
Volatile organic compounds	NMVOG	€ 1.61	€ 2.1	€ 3.15
Carbon monoxide	CO	€ 0.0736	€ 0.0958	€ 0.152
Methane*	CH <sub>4</sub>	€ 0.448	€ 1.75	€ 1.77

\* The value for greenhouse gas emissions includes VAT and increases by 3.5% per annum relative to the 2015 values, as detailed in Table 10.

The upper and lower pollutant-level values are recommended for use in social cost-benefit analyses, the central values in other applications.

## Midpoint-level

The midpoint-level environmental prices relate to the familiar set of environmental themes like climate change and eutrophication. They can be used as a weighting factor in life cycle assessment (LCA) or for calculating the external cost of particular materials or products. Table 2 lists the values to be used as external costs or weighting factors.

Table 2 Midpoint-level environmental prices in €<sub>2015</sub>/unit

Theme	Unit	External cost	Weighting factor
Climate change	€/kg CO <sub>2</sub> -eq.	€ 0.057	€ 0.057
Ozone depletion	€/kg CFC-eq.	€ 30.4	€ 123
Human toxicity	€/kg 1,4 DB-eq.	€ 0.158	€ 0.158
Photochemical oxidant formation	€/kg NMVOG-eq.	€ 2.1	€ 2.1
Particulate matter formation	€/kg PM <sub>10</sub> -eq.	€ 69	€ 69
Ionising radiation	€/kg kBq U235-eq.	€ 0.0473	€ 0.0473
Acidification	€/kg SO <sub>2</sub> -eq.	€ 5.4	€ 8.12
Freshwater eutrophication	€/kg P-eq.	€ 1.9	€ 1.9
Marine eutrophication	€/kg N	€ 3.11	€ 3.11
Terrestrial ecotoxicity	€/kg 1,4 DB-eq.	€ 8.89	€ 8.89
Freshwater ecotoxicity	€/kg 1,4 DB-eq.	€ 0.0369	€ 0.0369
Marine ecotoxicity	€/kg 1,4 DB-eq.	€ 0.00756	€ 0.00756
Land use	€/m <sup>2</sup> *year	€ 0.0261	€ 0.037

Note: External costs are characterized based on an individualistic perspective, weighting factors based on a hierarchical perspective. For explanation see Chapter 3 and Appendix A.



## Endpoint-level

This Handbook provides endpoint-level values for human health (mortality and morbidity), ecosystem services, damage to buildings and materials, mineral resource depletion and (noise and visual) nuisance. These values form the core element of this Handbook. Table 3 provides an overview of the values adopted.

Table 3 Endpoint-level environmental prices

Impact	Indicator/method	Value (lower-upper)
<b>Human health</b>		
Acute mortality	VOLY	€ 50,000-110,000
Chronic mortality	VOLY	€ 50,000-110,000
Morbidity	QALY**	€ 50,000-100,000
<b>Ecosystem services</b>		
Biodiversity loss	PDF	€ 0.16-1.23/PDF/m <sup>2</sup>
Production services*	Lost productivity, agricultural crops	
<b>Buildings, materials and infrastructure</b>		
Materials and buildings	Repair costs*	
<b>Mineral resource availability</b>		
Environmental benefits	Via environmental prices	
Scarcity and security of supply	Further study*	
<b>Nuisance</b>		
Noise nuisance	Depends on noise source and level	
Visual nuisance	Location-specific	

\* Not fully quantified in this Handbook.

\*\* Besides QALYs other quantifications have also been used, such as loss of IQ-points (€ 17,500/lost IQ-point).

Abbreviations: VOLY: Value of Life Years; QALY: Quality Adjusted Life Years, PDF: Potentially Disappeared Fraction.

## Using environmental prices

Environmental prices are used as a calculation tool in studies and practical applications by government and industry. There are three basis uses:

1. Use in social cost-benefit analyses. Environmental prices are used to assign a value to the environmental impacts of a particular measure or action. For use in this application, the upper and lower values of the pollutant-level price are recommended.
2. Use in the context of corporate social responsibility (CSV) and benchmarking. Companies can use environmental prices to quantify their environmental footprint as well as for preparing environmental annual reports, social business cases and ecological profit-and-loss accounts. In these applications the central pollutant-level value is recommended.
3. Use in life cycle assessment (LCA). LCA practitioners can use environmental prices to weight the calculated environmental impacts to produce a 'single score'. Companies can determine which materials have the least average environmental impact, for example, key information for optimizing the environmental footprint of its operations.

Environmental prices are average prices for average emissions in the Netherlands and are consequently less suitable for site-specific studies and applications. When considering particular situations involving toxic substances, as with lead soil pollution or hazards relating to plastic coatings on packaging cans, for example, it is not therefore recommended to use environmental prices. In such cases it is better to perform a dedicated study to determine the environment dispersal of the pollutant, its uptake in humans, animals and/or plants, and the effects of uptake on human health and/or ecosystem services.



Working with environmental prices in these kinds of situation is too coarse a methodology, given the uncertainties involved.

### **Reading guide**

This Handbook has a three-part structure. Part 1, Chapters 1 to 3, provides a user manual in which the procedures followed in the study are justified, the principal assumptions discussed and the environmental prices for the main pollutants presented. Part 2, Chapters 4 to 6, is a detailed elaboration of how the environmental prices have been calculated for each environmental theme and each endpoint adopted. Here we provide accountability for the choices made in this Handbook and discuss the relevant literature. The third part comprises the Appendices, in which certain issues are discussed in more detail. Appendix I, for example, gives the environmental prices of emissions of over 250 air, soil and water pollutants. All in all, the study underlying this Handbook calculated environmental prices for over 2,000 pollutants. These can be looked up alphabetically as well as under the relevant pollutant code (CAS code) at [www.ce.nl/milieuprijzen](http://www.ce.nl/milieuprijzen), which goes online in September 2017.

