ENVIRONMENTAL IMPACT CRITERIA

The environmental impact of each pipe material is assessed against seven different criteria across its full life cycle

Abiotic Resources Depletion (non-fossil) ADPn: the over-extraction of minerals, fossil fuels and other non-living, non-renewable materials which can lead to exhaustion of natural resources.

Abiotic Resources Depletion (fossil) ADPf: The over-extraction of fossil fuels including all fossil resources.

Acidification Potential AD: emissions, such as sulphur dioxide and nitrogen oxides from manufacturing processes, result in acid rain which harms soil, water supplies, human and animal organisms, and the ecosystem.

Eutrophication Potential EP: increased concentrations of nitrates and phosphates can encourage excessive growth of algae and reduce oxygen levels. This increases mortality in aquatic fauna and flora, leads to loss of species dependent on low-nutrient environments, reduces biodiversity and has knock-on effects on non-aquatic animals and humans.

Global Warming Potential GWP: the insulating effect of greenhouse gases (GHG) - CO2 and methane - in the atmosphere preventing the earth losing heat gained from the sun. As global temperature rises, it is expected to cause climatic disturbance, desertification, rising sea levels and spread of disease.

Ozone Depletion Potential ODP: depletion of the ozone layer (O_3) in the atmosphere caused by the emission of chemical foaming and cleaning agents allows the passage of greater levels of UV from the sun, causing skin cancer, damage to the immune system and reducing crop yields.

Photochemical Ozone Creation Potential POCP: Creation of ozone in the presence of sunlight, nitrogen oxides and volatile organic compounds. Ozone leads to chemical smogs that affect human health, food crops and the ecosystem in general. The effects vary according to geography and climate and are especially problematic in heavily urbanised areas with existing pollution.

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What do the numbers mean?

The numerical assessment of the product on the seven impact categories (abiotic is divided as non-fossil and fossil) are presented in an LCA for each stage in the product life cycle. This example is taken from the TEPPFA study on a polypropylene sewer piping system.

Impact category	Abiotic depletion (non-fossil)	Abiotic depletion (fossil fuels)	Acidification	Eutrophication	Global warming	Ozone layer depletion	Photochemical oxidation
	kg Sb eq	MJ	kg SO2 eq	kg PO4--- eq	kg CO2 eq	kg CFC-11 eq	kg C2H4 eq
Product stage	1,01E-05	1,02E+03	7,88E-02	1,86E-02	2,55E+01	9,60E-07	6,06E-03
Construction process stage	9,94E-06	1,07E+02	4,56E-02	9,73E-03	7,05E+00	1,29E-06	1,34E-03
Use stage	3,97E-07	1,02E+01	5,04E-03	1,08E-03	6,74E-01	1,21E-07	1,41E-04
End of life stage	1,95E-07	-1,14E+00	-4,69E-04	3,44E-05	8,52E-01	-1,54E-09	-3,06E-05
TOTAL	**2,06E-05**	**1,14E+03**	**1,29E-01**	**2,95E-02**	**3,41E+01**	**2,37E-06**	**7,52E-03**

The contributions to any one of the environmental impacts will be due to more than one item. Common sources of ozone depleting gases are refrigerants and blowing agents found in insulation foams. Interpretation of the impact would be too complex if the impact of each gas was reported separately, so a reference substance is chosen, which in the case of ozone depleting gases is chlorofluorocarbon-11 (CFC-11). The impact of each gas on the breakdown of ozone is calculated and then converted into the weight of CFC-11 needed to cause the same breakdown. The total impact for all ozone depleting gases from the product is reported as the equivalent weight of CFC-11 or “kg CFC-11 eq”.

	Reference Unit
ADP	Non-fossil: Weight of antimony to be extracted to deplete the reserve within the earth’s crust of the resource by the same proportion. Fossil: Calorific value of fuel being depleted.
AD	Weight of sulphur dioxide needed to provide the same acidification (SO2 combines with water to form sulphuric acid) as the acidic gas when it reacts with water in the atmosphere.
EP	Weight of phosphate needed to cause the growth of algae in water to the same extent as the pollutant (commonly nitrates, ammonia, phosphoric acid).
GWP	Weight of carbon dioxide (CO2) needed to have the same effect on trapping heat in the atmosphere as the GHG. This is typically based over 100 years (GWP100).
ODP	Weight of chlorofluorocarbon-11 (CFC-11) needed to breakdown the same quantity of ozone as the ozone depleting gas.
POCP	Weight of the non-methane volatile organic compound ethylene (C2H4) needed to produce the same quantity of ozone as the emitted gas.

The values created by the LCA can assume more or less significance when considering the impact of a product on the environment at a local rather than European level (normalization) and the relative importance of each category (weighting) to national climate change commitments.

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