



Introduction

Hepworth Plumbing Products is committed to promoting measures for limiting the adverse environmental impact of its operations. With the increasing awareness of environmental issues and growing legislative controls, an environmental policy and cohesive management system has been implemented to co-ordinate, control and continually improve standards of environmental performance. Where possible, the environmental management system (EMS) is integrated with all the manufacturing operations undertaken at Hepworth Plumbing Products' manufacturing plants.

The endorsement of a product for any particular application is increasingly influenced by its potential impact on our environment. The two main factors taken into account in calculating this impact are:

- the period of time for which a product fulfils its intended use before the need for replacement – otherwise known as its 'sustainability'.
- the negative impact a product has on the environment during its manufacture and use, both in terms of its fuel efficiency and environmental damage, and also taking the possibility of recycling.

The following information has been taken from a paper entitled 'Polybutene-I Piping Systems in Use' issued by the Polybutene Piping Systems Association.

Sustainability of Installations

Polybutylene (PB) has been successfully used in pipe applications in Europe for almost thirty years. In Austria and Germany, district heating and underfloor heating schemes of the early 1970's are still offering trouble-free operation.

Perhaps the most noteworthy success to date of polybutylene (PB) as a material for pipework is its use in the Vienna Geothermal Project. Since 1974, very aggressive geothermal water has been utilised as the heating medium and is still operating today at a constant temperature of 54°C and at 10 bar pressure. In the same application, metal pipes had proved totally unsuitable due to rapid corrosion problems.

The sustainability of polybutylene (PB) pipes is therefore proven through long-standing, trouble-free service. Since these first installations, advances in both material technology and production processes, combined with the introduction of stringent standards, has furthered the performance and reliability of polybutylene (PB) piping systems.

International standards now specify a minimum 50 years performance for polybutylene (PB) hot water pipes operating at 70°C and 10 bar pressure.

There are no international standardised requirements for the lifetime performance of metal pipes.

Environmental Impact

The impact which a material has on the environment in terms of, for instance, landscape scarring, emissions into the atmosphere, soil and water, and the potential for recycling is assessed in what is commonly referred to as a 'cradle to grave' study. Such a study was conducted by the Technical University of Berlin on various drinking water pipe installation systems, including both metals (galvanised steel and copper) and plastics, i.e. cross-linked polyethylene (PE-X), polybutylene (PB), polypropylene (PP-R), and chlorinated polyvinylchloride (PVC-C).

The study included the life cycle stages of a product (either of metal or plastics), from extraction of materials through to the end of its useful life, as shown in Table I .

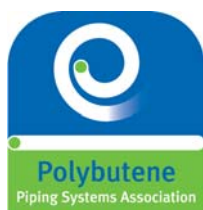


Table I The Life Cycle Stages of a Product

| Life cycle stage of product | Material of product | |
|------------------------------|---------------------|-------------------------------------|
| | Metals | Plastics |
| Raw material sourcing | Ore mining | Crude oil extraction |
| Raw material processing | Metal refining | Oil refining/cracking |
| Pipe material production | Smelting | Polymerisation |
| Pipe manufacture | Rolling | Extrusion |
| Fittings manufacture | Casting, re-shaping | Injection moulding |
| Pipe system installation | Soldering, clamping | Welding, clamping, gluing, push-fit |
| Installation life expectancy | Not standardised | Minimum 50 years |



Raw material sourcing

The mining of metallic ores, which is predominantly open cast mining, results in a lasting scar on the landscape. The fraction of metal extracted from the ore (1 to 2%) exacerbates this problem.

Crude oil in contrast, is extracted via a bore-hole and consequently has much less of a lasting effect on the landscape. Furthermore, almost 100% of crude oil is subsequently converted into useable products, e.g. oils, fuels and chemicals.

Raw material processing and pipe material production

The refining and smelting of metals consumes far more energy than the refining of oil and polymerisation of plastics. The emissions from metals production processes in terms of soil, air and water pollution also far exceed the impact of oil refining and plastics polymerisation.

The emissions into soil from metal refining are increased due to the large fraction of the electrical energy used for smelting being generated by coal combustion. The ore residues, together with the ashes from power production have a considerable polluting effect on the landscape. Emissions from these metal refining processes also have an impact on both water and air pollution due to the generation of sulphur dioxide, carbon dioxide, other gases and airborne particles, plus sulphates and other solid/chemical emissions. In contrast, the oil refining and plastics polymerisation processes generate very little in the way of emissions since they are essentially fully integrated processes.

Pipe and fitting manufacture

For both metals and plastics the production of pipes and fittings involves raising the temperature of the raw materials above their melting/softening points. The temperatures involved, however, are much higher for metals in comparison with plastics, with consequential differences in energy efficiency ratings.

Pipe systems installations

The weight of piping is an important factor in assessing the overall energy efficiency of the piping system. Due to their much lighter weight, plastics materials exhibit a distinct advantage over metal pipes in this respect. The total energy consumption to manufacture metal pipes required for the piping system of, for instance, a 16-family housing complex is significantly higher than for plastic pipes. Figure 33 shows the total energy consumed (total weight account for) in producing the complete piping network in each of the different materials.

Installation life expectancy

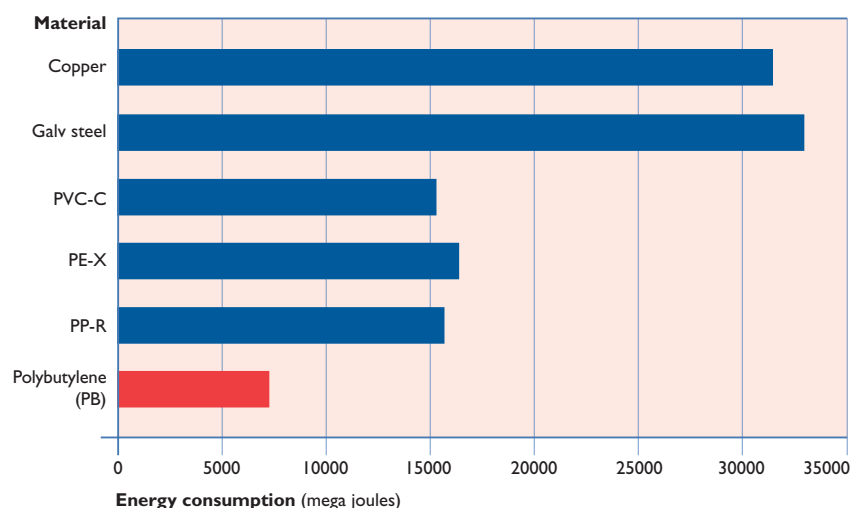
Two considerations should be taken into account with respect to the life expectancy of a piping installation. Firstly, the lifetime of a system delays the need for replacement, and hence reduces the environmental impact on a time-dependent scale. Secondly, when a material has completed its useful applicational life, its environmental impact is reduced if it can be recycled. Both metal and polyolefin thermoplastics, including polybutylene (PB), can be recycled. However, since the plastics piping systems are expected by standards accreditation to provide a service life in excess of 50 years, it is difficult to reliably predict the environmental impact of recycling on such a long timescale.



Hepworth's Doncaster manufacturing plant



Figure 33 Total Energy Consumption (during manufacture/installation/use) of the Complete Piping System for a 16-Family Housing Complex





Quantifying the environmental impact of emissions

To quantify the environmental impact of emissions, the Technical University of Berlin developed a standardised comparison method referred to as VENOB (Vergleichende Normierende Bewertung). This environmental analysis compares the energy consumption in relation to the resulting emissions in air, water and soil during each stage of a product's complete life cycle from raw material sourcing to the installation of the piping system. The University evaluated six different materials used for drinking water pipe installations according to DIN 1988 Part 3 on the basis of the 16-family housing complex with central hot and cold water distribution at 4 bar pressure.

Figures 34, 35 and 36 illustrate the standardised comparison (VENOB) of the various pipe materials' impact on the environment in terms of soil, water and air emissions respectively. The impact factor is a comparative number only. The material with the lowest number will have the least environmental impact.

Figure 34 Standardised Comparison (VENOB) of Various Pipe Materials' Impact on the Environment – Emissions in Soil

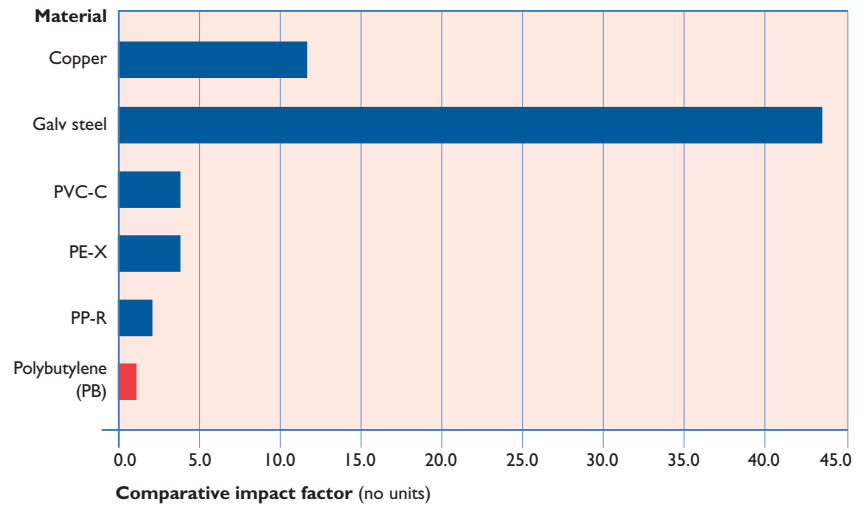


Figure 35 Standardised Comparison (VENOB) of Various Pipe Materials' Impact on the Environment – Emissions in Water

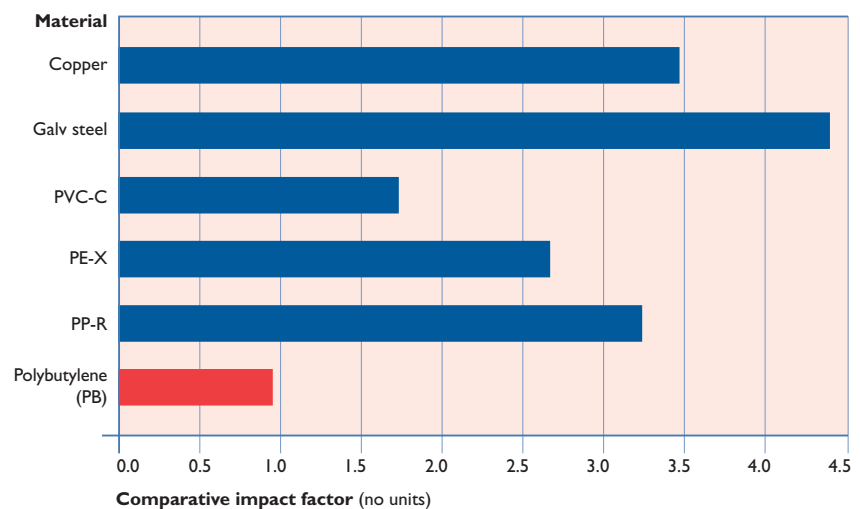
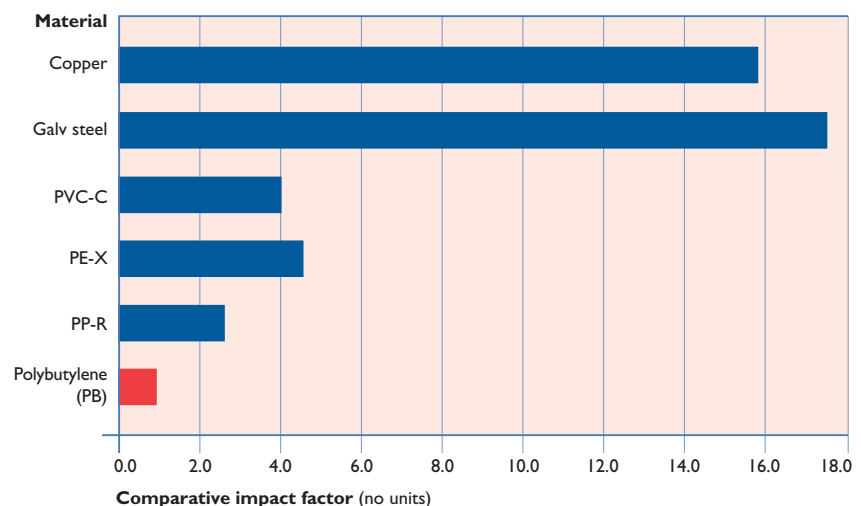


Figure 36 Standardised Comparison (VENOB) of Various Pipe Materials' Impact on the Environment – Emissions in Air



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