Windows - A Transparent Case for PVC

British Plastics Federation

Windows Group
The Future for Windows, Doors and Conservatories

vinyls group

PVC

✓Good for Life...
✓Good for the Environment

The very fact that OSPAR has adopted these Decisions and Recommendations validates, on environmental grounds, the continued production of PVC.

PVC - The Facts

As part of a long-standing campaign against the commercial production of chlorine, some extreme environmental campaigners are seeking to position PVC (polyvinyl chloride) as an environmentally damaging material. However, when subjected to close scientific scrutiny, their claims are left stranded, allowing a quite different picture, one which underlines the sound environmental and technical performance of PVC, to emerge.

The industrial production of PVC has been **validated** by the OSPAR Commission.

PVC windows complement all architectural styles

The OSPAR (Oslo-Paris) Convention was set up to prevent land-sourced pollution of marine habitats, including the North Sea and the North Eastern Atlantic Ocean. At a Ministerial Meeting of the OSPAR Commission in July 1998, an agreement was signed between the contracting countries (including the UK) known as the Sintra Statement[1] (named after the venue in Portugal). There was no specific reference to PVC in this statement.

In fact, at the same series of meetings, two Decisions on Emission Limit Values for the production of s-PVC[2] from Vinyl Chloride Monomer and the manufacture of Vinyl Chloride Monomer (VCM) from ethylene dichloride (EDC)[3] were approved by the Ministers. These Decisions set Emission Limit Values (ELV) for PVC production sites in the OSPAR Convention region. In addition, Recommendations on Best Available Techniques (BAT) for the Manufacture of Suspension PVC from EDC (ethylene dichloride) and VCM (vinyl chloride monomer) were formally adopted by OSPAR in 1996.

PVC-U = unplasticised (or rigid) PVC PVC = generic term used for all types of polyvinyl chloride

What do other groups and organisations think about PVC and the environment?

PVC has distinct environmental, technical and commercial benefits and is one of the most thoroughly researched materials. A growing number of independent third parties from around the world support the continued use of PVC in construction applications, including PVC-U window profiles:

Some Independent Third Party Views of PVC:

✓ "I am pleased that the PVC Industry already has a voluntary commitment setting out a programme of precautionary measures to address potential risks and encourage industry to meet the challenge of sustainable development." **Rt. Hon. Michael Meacher MP, Minister for the Environment** in the **DEFRA** Press Release prefacing the **DEFRA** Life Cycle Analyses of PVC and Alternatives (March 2001)

✓ "The past year saw the publication of our 2020 Vision report on PVC…it has...succeeded in making people think more strategically and constructively about the future of PVC and other potentially sustainable materials." Extract from the **Forum for the Future** Annual Report 2001

✓ **Hans Christian Schmidt, Danish Environment Minister,** in an article in **Ingeniøren**, in August 2003, "I think it is now time for Greenpeace to change its attitude towards PVC. To me PVC is a very good material…I realise that the issues connected to the use as well as the disposal of the material will be solved." [4]

✓ Life Cycle Analyses of PVC and timber in window profiles were recently conducted by **Entec UK Ltd** for what is now **DEFRA** in early 2001 and for **Manchester City Council** in September 2001. Entec state that, "the difference found by the **German Federal Environmental Agency** between the environmental performance of wood and PVC-U profiles, are consistent with the findings of the DETR 2000 study such that, there are only marginal differences in the environmental performance. This will particularly be the case where recycled PVC-U is used in the profiles and lead and cadmium based stabilisers are avoided." [5]

✓ Life Cycle Assessments of window profiles, carried out by Dr. Richter, et al, at the **Swiss Institute for Testing Materials** (1992 and 1996), compared PVC-U with timber and aluminium. The detailed analysis demonstrated that there was no material or profile structure which displayed a clear advantage or clear deficits over their life cycle[6]. The authors noted, however, that "calls to boycott or prohibit the use of PVC-U for window applications have no objectively based legitimacy"[7]

✓ **John Emsley, Science Writer in Residence, Department of Chemistry, Cambridge University**, concluded in a chapter on PVC in his book, The Consumer's Good Chemicals Guide (1994): "As far as I am aware, no member of the public has ever been harmed by PVC, and many people owe their lives to it. It is time we learned to live in peace with a rather wonderful plastic"[8].

✓ An Environmental Guideline Report published by the **Dutch Foundation for Building Research** (April 1996), and officially sponsored by the **Dutch Ministry of the Environment** (VROM), which lists PVC as an environmentally preferred material for almost all applications in housing construction[9].

✓ A study on the environment health impacts of PVC in packaging and construction materials, carried out by **The National Centre for Business & Ecology** (June 1997) on behalf of a group of UK retailers, concluded that on the balance of probabilities 'none of the evidence reviewed provides an overriding scientific reason for the PVC Retailers' Group to immediately abandon the use of PVC in either food packaging or building/insulation materials...(provided that) the Retailers' Group is able to satisfy itself that the PVC it purchases is responsibly manufactured, used and disposed of...'[10]

✓ Reports published by Australia's **Commonwealth Scientific and Industrial Research Organisation** (1996 and 1998) which concluded that, 'the balance of evidence suggests that there is no alternative material to PVC in its major product applications that has less overall effect on the environment'[11].

✓ The **Minister of State for Science Energy and Industry in the UK Government**, John Battle MP, confirmed support for PVC when he stated that, "...concerning PVC and the chlorine based industry in general, Ministers have made clear that independent evidence, such as that from Professor Rappe, the independent scientific advisor to the EU and the World Health Organisation, demonstrates that PVC is a safe material in use and emissions from its manufacture and disposal are controlled by the Environment Agency"[12].

✓ The **German Council of Environmental Advisors** (SRU), which reports to the German Federal Government, included a new evaluation of PVC in its latest environmental report (1998). The SRU concluded that PVC related "risks" to health and the environment are not significant enough to justify any ban or wide restrictions. The SRU's chairman noted that "there are no longer reasons to discriminate against PVC"[13]. This is a very different view to that expressed by the SRU in 1991, and reflects the PVC industry's commitment and ability to successfully address environmental issues.

The UK PVC industry welcomes such balanced, independent studies as a major contribution to an informed scientific debate which, unfortunately, has so often been characterised by emotional arguments and ill-informed conjecture from PVC's detractors.

PVC-U can and does make a positive contribution to the environment. In fact, 646 tilt and turn PVC-U windows are playing a major role in the UK's first solar powered office block - sponsored by the EU, the Department of Trade and Industry and Greenpeace - at Northumbria University in Newcastle.

The European PVC Industry

PVC is one of the world's oldest plastics and has evolved since the 1940s to become a universally used, cost effective, adaptable, safe and environmentally efficient material. It represents a highly efficient conversion of raw materials. Effectively, salt and oil derivatives are combined to produce a plastic material which is specified for a broad range of applications across various market sectors.

Production processes for VCM and PVC have been continually improved over recent years and their environmental impact consistently reduced. Futhermore, the European PVC industry recognises that further improvements should be constantly pursued and their scope continually reviewed. For this reason, the European industry, under the auspices of the European Council for Vinyl Manufacturers (ECVM), have signed a European Industry Charter[14], committing to tighter limits on emissions from PVC production facilities.

As part of the Vinyl 2010 Voluntary Commitment, compliance with the Charter is being audited by an independent Norwegian foundation, Det Norsk Veritas (DNV). In 2003, DNV reported that 93% full compliance with the Charter was achieved, up from 88% in 1998.[15]

As part of its Technology Foresight Programme, the UK's Department of Trade and Industry published a leaflet focusing on the strategic need to maintain the competitiveness of the UK's chloralkali industry. The DTI identified PVC as a key element of this industry, a sector deemed to be a critical component of the UK's economy:

'PVC is perfectly safe and this is why it is used for bottles for mineral water, bags for blood transfusions, and fine bore tubing that is inserted into premature babies. PVC can be crystal clear or as black as coal, it can be as rigid or as flexible as we choose. It will stand up to extreme conditions and so is greatly used for windows, water pipes and insulation for electric wiring. Britain with its abundant supplies of salt and natural gas is an obvious place to manufacture this versatile plastic'[16]

The UK's Department of Environment and Rural Affairs (DEFRA)'s Waste and Resources Action Programme (WRAP) also recognises the important contribution of the PVC Industry as several key research and development projects funded by WRAP and led by industry from 2002 onwards, are looking specifically at creating more opportunities and improving the efficiency of PVC recycling. [17]

The UK's first solar-powered office block at Northumbria University in Newcastle

The inescapable conclusion is that if any actions were introduced to stop PVC production, the actual effect on dioxin levels would be negligible. Avoiding PVC will not significantly reduce dioxin emissions to the environment. It is, therefore, seriously misleading to focus on PVC as a source of dioxin emissions from manufacturing or waste incineration processes.

Environmental campaigners have sought to associate PVC with 6 of the 15 priority substances identified by OSPAR. But what is the actual relationship between these substances and the PVC industry?

Dioxins and Furans

The term "dioxin" is commonly used to refer to a family of compounds comprising around 75 dioxins and 135 related furans. The number and position of the chlorine atom on the molecule differs for each of the 210 compounds, and this also has a considerable effect on their relative toxicity - 17 of them are recognised as being highly toxic. Dioxins are not "synthetic chemicals" as they are produced both naturally and inadvertently as a consequence of a wide range of human activities. For example, they can be produced when any mixture containing carbon, hydrogen, oxygen and chlorine is burned and the gases produced are allowed to cool slowly. Therefore, a variety of processes including the incineration of wood, volcanic eruptions, forest fires, metal production, vehicle exhausts, even composting and sewage sludge, can all lead to the formation of dioxins[18].

The PVC industry's very low contribution to dioxin levels is confirmed by recent inventories of dioxin sources in the UK. DEFRA indicates that in 1999, the dominant dioxin emissions sources were metal processing and accidental fires[19]. Indeed, UK studies[20,21,22] also suggest that as much as 14% of the total UK annual emissions can be attributed to 'Bonfire Night' celebrations on 5th November. 'A Review of Dioxin Emission in the UK', which was published by Her Majesty's Inspectorate of Pollution (HMIP) in September 1995 [23] concurs that iron, steel and non-ferrous metals production are seen as the dominant contributors. According to the report, more dioxins are released to the atmosphere through sources involving the combustion of wood than are produced by the entire halogenated chemicals industry.

A UK study commissioned by the Department of the Environment, and completed by Lancaster University in March 1996, actually shows that dioxin emission levels in the UK have now fallen back to 1940's levels, from their peak in 1972[24]. In contrast, PVC production has steadily increased since the 1970s. A survey by the Environment Agency (EA) into dioxin levels in the Runcorn area also showed that PVC production facilities could not be blamed for dioxin levels in the region[25]. Runcorn has a well developed chemicals industry that includes chlorine and PVC manufacture, and the levels of dioxins identified there were, in fact, typical for a town of that size[26].

The EA also stated that it was satisfied that "the current restrictions contained in authorisations and licences exert sufficient control to protect the air, water and land environments"[27]. Studies on the trends in dioxin emissions carried out in the UK, USA and Germany have shown that, in these industrialised countries, dioxin emissions have actually fallen by over 50% since 1970[28]. Over the same period, PVC production has more than doubled in these same countries.

Plastics in general represent only 7-8% of municipal solid waste (MSW) and of that the PVC component is only about one tenth and is largely composed of used packaging, (where heavy metal additives are not used). It has been consistently shown that the presence or absence of PVC in the MSW stream makes no difference to the quantities of any dioxins produced upon incineration. Several trials of burning plastic waste at Würzberg in Germany[29], and at the South East London Combined Heat & Power (SELCHP) plant in the UK[30] have demonstrated this. One of the leading experts in this field, Prof. C. Rappe of the University of Umeå in Sweden concluded, on the basis of his own group's research, that the ability of PVC to contribute to dioxin formation was the same as that of sodium chloride (common salt)[31].

Furthermore, in the largest study of its kind, the American Society of Mechanical Engineers found that it was the operating conditions of an incineration plant that was the key factor in determining dioxin production and emissions, rather than the quantity or source of the chlorine entering the incinerator[32].

A study of PVC undertaken by the TNO Institute of Environmental and Energy Technology (Holland) on behalf of the European Commission's Directorate-General III, emphasised that PVC can be safely and cleanly incinerated[33]. The TNO report cites a review of numerous studies addressing the issue of dioxin formation in waste incinerators:

'In a review by Smit (1994) it is concluded that the amount of PVC in waste has little to no influence on dioxin formation in municipal waste incineration processes. Only a minimal amount (10^{-6}% or less) of the chlorine in waste is converted into dioxins. Chlorine is present in such excess amounts, that dioxins will be formed anyway in the incineration process. The level is not significantly affected whether PVC-free or PVC-containing waste is incinerated (Smit 1994). This means that very strict dioxin abatement measures are necessary for MSW incineration plants, even if PVC was to be banned or prevented as an input for these plants'. (p76 of TNO report).

Any of the currently available stabiliser systems can be used in safety to produce PVC-U articles, provided compliance with the current chemical and product specific regulations is maintained. The different metallic based stabilisers are used for a variety of good technical reasons and they have provided society with very valuable products, varying from life saving medical applications to high quality, long life building products[34].

Mercury

One of the essential components of PVC is chlorine. Chlorine can be produced by three main industrial electrolysis processes: amalgam, diaphragm and membrane. The amalgam process uses mercury and has come under criticism by some environmentalists. The PVC industry does not exclusively source its chlorine from suppliers employing the mercury-amalgam process. However, where amalgam technology is used to produce chlorine, the vast majority of the mercury used is recycled back in the process. Mercury emissions from European chlorine production facilities were cut by 91% since 1977 to 18 tonnes in 1995 [35]. These have dropped even further since then, approximately 5 tonnes to air and 0.1 tonnes to water in 2002[36]. This low figure should be viewed in the context of total emissions of mercury (from both natural and industrial sources), which the Organisation for Economic Co-operation and Development (OECD) has estimated to be around 20,000 tonnes per annum. Natural sources of mercury to the environment include volcanoes, geysers and hot springs, mineral ores, surface waters and oceans.

Additives

Special heat and UV stabiliser additives are an essential part of PVC formulations and are used to improve weatherability and processability of PVC products and materials. The choice of stabiliser will largely depend on the particular end-application, and there are good technical reasons why certain stabiliser types are used for specific applications. Stabilisers often comprise a metallic component together with various organic compounds - the simple elemental form of a metal is never used. There are several types of metal salts and soaps used to stabilise PVC, and some specific examples are discussed below:

Cadmium

Cadmium based stabilisers are no longer used for PVC-U window applications in Europe as the PVC Industry has phased them out as part of the Vinyl 2010 Voluntary Commitment, signed in March 2000. The move away from cadmium by manufacturers of window profiles has not been prompted by any major risk to people or the environment, but was instead part of a long-term sustainability strategy for the windows sector. Indeed, the 1992 revision of EC/76/769 Cadmium Directive recognised the lack of acute threat in allowing a phased reduction in the use of cadmium pigments and stabilisers, and in permitting their continued use in certain applications such as PVC-U window profiles. Cadmium stabilisers may be present in some older windows.

The Swedish Environmental Protection Agency recently confirmed that heavy metal stabilisers are, 'firmly bonded into the PVC material, and do not leach out' [37].

Lead

The PVC Industry has pledged to phase out lead stabilisers by 2015 as part of the Vinyl 2010 Voluntary Commitment, updated in October 2001. Again this is part of a long-term sustainability strategy and is not prompted by any major risk to the environment or human health. Elemental lead is not used as a PVC additive. Special compounds known as salts and soaps have been used in PVC applications to give very good processing and weatherability characteristics.

In the past, the safety of lead stabilisers in PVC has been confirmed by the UK Drinking Water Inspectorate, the Swedish Environmental Protection Agency, the Swedish Water and Waste Waterworks Association, the World Health Organisation and the OECD, which had all approved the use of lead stabilisers in PVC pipes intended to carry potable (drinking) water. In fact, an official Swedish test institute conducted tests to see how lead migration from PVC pipe would compare to the limits set down in the EU Ceramics Directive (which covers migration limits for food contact ceramics[38]. Their results showed that it is just as safe to eat meals off a lead stabilised PVC pipe as it is to eat them off a ceramic plate[39].

However, in line with the Voluntary Commitment, the pipes industry has phased out lead stabilisers in potable water pipes from 2003 onwards, and it also seems likely that the windows industry will phase out lead stabilisers well before the 2015 target date.

Organotin Stabilisers

These stabiliser systems are now well established for use in PVC items, though their use in PVC-U window profile applications is limited. As with lead and cadmium based stabilisers, they remain firmly bound within the polymer matrix. The organotin compounds used as PVC stabilisers are safe to use[40]. Indeed, certain organotin stabilisers have been approved for use in food contact packaging under EU regulations[41].

Referring back to the OSPAR Convention, a special Workshop on Plastic Additives was held in Paris in May 1997. The workshop concluded that there are several different, significant sources of certain organotin compounds found in the environment. (e.g. anti-fouling paints, biocidal applications and the use of tributyl-tin) and also that natural processes acting on inorganic tin (methylation) also contributed to environmental levels[42]. Octyl-tin, being only used as a plastic stabiliser is not found significantly in the environment. The environmental concentrations of organotin compounds used as stabilisers are therefore estimated as very low and should not pose an environmental risk[43].

How can PVC be disposed of in an environmentally responsible way?

There is a range of alternative methods available for deriving residual value from used plastics products. The optimal route for a particular product will be determined by assessing a combination of environmental, logistical, economic and market considerations. Therefore, the whole range of waste management options should be considered when deciding on the treatment of plastic waste, including PVC-U windows.

Recycling

It is claimed that PVC is not recyclable. This is simply not true. PVC, like all other thermoplastic materials, can be recycled relatively straightforwardly. The PVC-U window industry has been criticised for an apparent lack of post-use recycling. At this point it should be noted that the primary aim of recycling is to elicit a net environmental benefit through reducing the use of primary resources and / or diverting resources from landfill. The European PVC industry has most definitely achieved real successes in this regard. It is now common practice to recover and recycle factory wastes and / or off-cuts after the window has been fabricated. These materials are then incorporated with virgin polymer to produce further long life products including window profiles.

Now the European PVC Industry is pledging to recycle increasing quantities of post-consumer PVC window waste as part of the Vinyl 2010 Voluntary Commitment. The Industry has committed to recycle 50% of the collectable available quantities of post-consumer PVC window waste by 2005. One of the barriers to cost-effective recycling of post use products – regardless of the materials involved – is the ability to retrieve economically meaningful quantities of used products to supply a recycling scheme with its feedstock. In Germany, PVC-U windows were commercially introduced some fifteen years before they were in the UK. Hence German companies have now developed proven technologies to recycle post-use PVC windows, which may arise as demolition wastes, for example. In the UK, however, tonnages have been traditionally modest because PVC-U products last so long and there simply hasn't been enough feedstock yet to input effectively into the recovery and recycling processes. As post-use PVC-windows are slowly becoming more available in sufficient quantities, then the European Industry can apply the appropriate technology to recycle them in commercially viable and environmentally beneficial schemes, as part of the Vinyl 2010 Voluntary Commitment.

Incineration

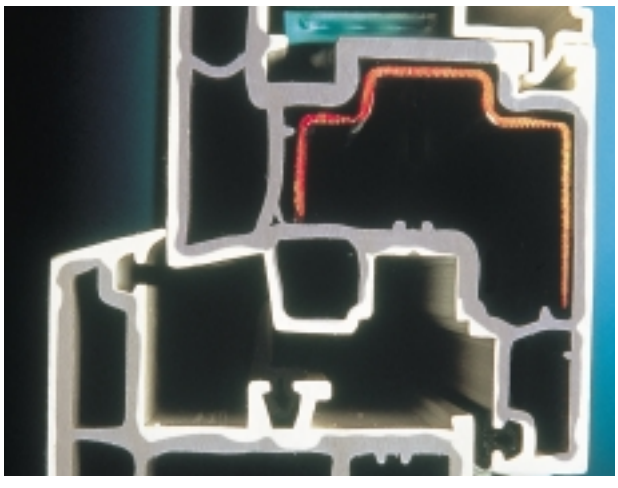
As discussed above the incineration of PVC need not present any special problems relating to emissions of dioxins. Modern incinerators in Europe are designed to meet stringent EU limits on emissions of a number of substances including dioxins and hydrogen chloride. It should be noted, however, that both of these substances are formed by other materials and not just PVC.

Municipal Solid Wastes (MSW). Organic materials such as, wood, card, paper, textiles and waste foodstuffs, for example, are also capable of forming hydrogen chloride (HCl), as well as other acidic precursors such as oxides of sulphur and nitrogen (SOx and NOx). The flue gas wastes must be treated as hazardous due to the presence of heavy metal components - the vast majority of which come from non-PVC sources. Therefore, the scrubbing and purifying facilities would be required whether PVC was incinerated or not, and so there are no additional capital fixed costs associated with the controlled incineration of PVC, as part of the municipal solid waste stream. However, it is true that the operating costs can vary according to the amount of PVC in the waste stream, but this also depends upon the conditions of incineration and the rate of utilisation on the incineration facility. Based upon studies made and the average content of PVC in MSW, the incremental cost of PVC in the waste stream may amount to 1 - 2% of the total cost of incineration[44]. It should be noted, however, that other component materials present in the waste stream also have associated costs.

Landfill

A study by the Chalmers University of Technology in Sweden, concluded that rigid PVC does not degrade in landfill[45]. PVC-U will remain inert in landfill, and there is no evidence to suggest that PVC-U would be a source of any toxic substances under landfill conditions.

Although PVC does not pose a specific problem in landfill, it is the PVC Industry's strategy to divert more PVC waste from landfill and recycle more, for example, as part of the Voluntary Commitment.



Cross section of a PVC-U window frame using 70% recyclate

PVC-U Windows - Technical Performance

Life Expectancy and Maintenance of Window Profiles

PVC-U windows have an expected service life of over 40 years. UK National standards (under the auspices of the British Standards Institution- BSI) are available governing various aspects of the technical performance of PVC-U window frames. One of the most recent of these is BS-7413, where annex L sums up the maintenance requirements of such profiles, and includes the possibility of recycling end-of-life profiles[46]. The key points of annex L are:

- "PVC-U profiles manufactured in accordance with this standard only require an occasional wipe down for appearance purposes"
- "A gradual loss of gloss and slight change of colour may occur over time which has no effect on the functional performance of the profiles"
- "As PVC-U profiles have been successfully used for windows for the last 40 years, PVC-U profiles manufactured in accordance with this standard are expected to last in excess of 40 years"
- "Used PVC-U profiles manufactured in accordance with this standard can be recycled, for instance into the core of a co-extrusion as specified in this standard"

One important factor leading to the now well established position of PVC-U in construction applications is its durability. This has led to its use in long-life applications such as pipes and window profiles - the two biggest applications for PVC-U in Western Europe, accounting for over a third of total consumption.

The first commercially available windows were installed in Germany in 1959. While the technology for producing these windows has naturally advanced over the years with, for example, the introduction of better performing acrylic-based impact modifiers, some of these earlier PVC-U windows are actually still in use. The main reasons why PVC-U windows would be replaced over time are:

1 Renovation / redesign / demolition of the whole building.

2. Upgrading from single to double-glazing

3. Upgrading to improve insulation properties (e.g. increasing the internal webbing which improves heat insulation and energy conservation properties).

Modern stabiliser systems allow a service life of over 40 years to be given to the PVC-U material component of replacement and new-build window systems. As windows are intended to be exposed to the elements, including wind, rain and UV light, some limited, superficial changes can occur. However, the only effect this could have would be a loss of gloss on the surface finish of the frame. There would be minimal loss of impact strength not affecting the performance of the window, and the colour would also remain white. In short the window system will remain an extremely useful building component.

PVC-U - the ideal choice for building refurbishment

In the BPF's own guidelines[47], we identify low maintenance as being a major benefit of PVC-U windows. We recommend regular cleaning with appropriate detergents and warm water, and the checking of certain hardware components such as gaskets and hinges, which may need lubrication from time to time. *This would hold true for all materials, however, and is not unique to PVC-U.*

In a report undertaken by the German Institute for Construction with Plastics on behalf of the German Federal Ministry for Environmental Planning, Construction and Urban Development, the long-term characteristics of PVC-U were identified as follows:

"Faults on windows using PVC-U profiles occur usually in the operating mechanism or the seals, i.e. the components that are not made of PVC. Hence the long term characteristics are determined by the durability, low maintenance and wear characteristics of the components installed into the PVC window frames, and not by those of the frame itself. Since the PVC window frames do not have to be painted with fungicides or protective coatings, no maintenance of the frame is required apart from cleaning"[48].

PVC-U can be successfully maintained by following the guidance provided by the British Plastics Federation's Windows Group. It is important to remember that timber window frames are also subject to weathering, and they will require cleaning just the same as PVC-U. PVC-U windows, however, do not rot, warp, peel or chip.

Cost Comparisons

While it is very difficult to generalise about costs which will vary for all materials in terms of product quality and market conditions, the Northern Consortium of Housing Authorities in the UK has carried out a regular survey of costs of window systems. The Consortium has accumulated a considerable amount of data for the in-use cost of window frames made from different materials. Their data shows that over a 30-year period, the total capital and maintenance costs for a softwood window will be 33% more than for a window in PVC-U, assuming a 10% bank interest rate in a scheme involving 30 windows[49].

An industry study compiled in Germany by AgPU (PVC industry organisation in Germany) has shown that the total investment and maintenance costs for hardwood systems over a 25-year period were 23% more than PVC-U, and aluminium systems were 57% more expensive[50]. It is difficult to transfer the results of cost comparisons in one region to the situation in another. However, the marked success that PVC-U windows have enjoyed in the UK market clearly demonstrates their cost-effectiveness in relation to competing materials.

Minimum maintenance PVC-U windows for every home

Aesthetics

The use of PVC-U windows in modern dwellings is subject to few if any planning regulations, and over the last 20 years the consumer has overwhelmingly chosen to fit replacement windows made from PVC-U. In fact, PVC-U now accounts for some 90% of the replacement window market in the UK. Windows obviously play an important part in the expression of period, image and regional building traditions. The BPF does not support the installation of PVC-U windows where this is against the relevant Planning Laws, as it could well result in a loss of common architectural heritage and may incur costs for homeowners and installers. The BPF would urge installers and homeowners to check that their dwelling or area is not subject to such planning regulations[51].

PVC-U for improved security

Aesthetically pleasing, energy-saving PVC-U double glazing

Is timber really the environmentally preferable material?

All too often the premise that timber is necessarily an environmentally superior material is simply accepted as part of the "natural is better than synthetic" assumption.

Life Cycle Analyses of PVC and timber in window profiles were recently conducted by Entec UK Ltd for the DETR (now DEFRA) in early 2001 and also for Manchester City Council in September 2001. In analysing the various impacts across the lifecycle, they compared data from other LCA studies. Entec found that, " the difference found by the German Federal Environmental Agency between the environmental performance of wood and PVC-U profiles, are consistent with the findings of the DETR 2000 study such that, there are only marginal differences in the environmental performance. This will particularly be the case where recycled PVC-U is used in the profiles and lead and cadmium based stabilisers are avoided"[52].

In fact, the timber industry itself has not been without its own environmental critics. Historically, it was the environmental campaigns against the timber industry which helped give a high profile and an increasing momentum to the emerging environmental movement around the world. Leading environmental organisations claim, for example, that some 10% of the world's varieties of trees are threatened with extinction, and nearly 80% of ancient forests have been destroyed.

Naturally the plastics and other industries would challenge the premises and assumptions that claim environmental superiority for timber, but you may be surprised to learn that leading environmental NGOs, including Friends of the Earth (FoE)[53], Greenpeace[54] and the World Wildlife Fund (WWF)[55], have severely criticised the timber industry on its environmental performance. While such organisations have also criticised the petrochemicals industry, their commentary on the timber industry serves to balance the environmental debate on PVC-U window materials.

In its report, "Seeing the Wood for the Trees - What the UK Timber Industry Doesn't Tell You About the World's Forests"[56], Friends of the Earth portray a quite different picture of the timber industry, and associated forestry issues, to the one commonly perceived by the public and specifiers. In this report, FoE claim that[57]:

- The [timber] industry does not have adequate evidence to substantiate its claims that timber is, overall, better for the environment than any other material;
- The timber industry's forest management practices (including tree planting) can damage the environment;
- The temperate and boreal forests of the world are far from being sustainably managed;
- Logging for timber is causing deforestation;
- The timber industry does not have adequate evidence to show that it is helping to meet the threat of climate change, and it may even be adding to the problem

The FoE discuss a number of common perceptions relating to timber[58]:

Timber is not necessarily best

FoE challenge the assertion that timber is environmentally preferred by pointing out that, while the environmental problems associated with the timber industry tend to be of a different nature to the issues facing other competing industries, these problems should not be ranked below them in terms of importance.

Quantity of trees is not the real issue

While the FoE acknowledge that trees are not a scarce resource *per se*, they argue that the real environmental danger lies in the logging of ancient or old-growth forests. The logging of these forests can lead to a decrease in biodiversity, as habitats are destroyed in the logging process. Tree plantations are grown, in their place, for the intense farming of timber and wood products. This itself, claim the FoE, can lead to soil erosion and nutrient degradation, vulnerability to pest attack, reduction in water supply, over use of fertilisers and social impacts.

The FoE urge caution in accepting claims of an increase in forested areas. Scandinavia presents an interesting example relating to the misconceptions surrounding so-called 'sustainable forestry'. FoE comment: "More trees are not a good thing when they are replacing valuable wildlife habitats. Scandinavia has now just 5% of its original old-growth forest remaining, yet this is still being logged. Also almost 50% of Finland's peat bogs have been drained, mostly for planting managed forests"[59].

The FoE report catalogues similar environmental problems associated with logging in other major producer countries. The FoE looks at the association of timber with global warming and questions more assumptions about the environmental credentials of timber. They accuse the timber industry of oversimplifying the global warming issue in their favour, and assert that, "using timber is also likely to contribute to the growing threat of global warming, especially if it is from old-growth forests"[60].

PVC-U windows are tough, durable, cost-effective building components with excellent weathering resistance and very good insulation properties.

PVC-U windows have an established consumer and public acceptance.

The vast majority of the global PVC markets, are continuing to use PVC products and applications where appropriate.

When the scientific evidence is assessed, and the claims made against PVC are scrutinised, the conclusion that so many independent authorities have reached is that PVC is safe in manufacture, use and disposal.

When PVC is raised as an issue, the scientific dimension to any debate must take on the highest priority. Any move away from PVC for anything other than commercial or technical reasons is unjust and misleading.

There would be no tangible environmental or safety benefit in abandoning PVC.

Notes and References

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