

Glass Briefing Paper

This paper summarises the Glass opportunities in Hampshire required to meet the Vision of the MRS.

This is based upon the best information that we have available. Following discussion with industry experts and detailed research into the topic, an initial paper was prepared for the MRS Workshop on 31 March 2004. The paper was refined following input from a group of sector experts and volunteers at a glass sector workshop on 16 June 2004. Details of these volunteers and experts are set out at the end of this paper.

The Opportunities outlined below are the results of discussion with industry experts and detailed research into the topic. This research is summarised in the following pages.

The Information contained within this briefing paper will develop following this consultation into one section of the Material Resources Strategy.

This paper also links to the follow papers:

- **Construction & Demolition Waste**
- **WEEE**
- **ELVs**

The main opportunities to meet the MRS Vision

Within Hampshire:

- Improve awareness and participation of the public and licensed trade
- Develop combined collection systems for household and commercial packaging glass under a common and co-ordinated strategy for Hampshire.
- Develop infrastructure within Hampshire to process glass to provide high value end uses.
- Increase awareness of glass-based products in procurement.

Within the Southeast Region:

- Develop infrastructure to recover and recycle flat glass from construction and demolition, particularly the replacement window sector.
- Develop infrastructure to recover and recycle glass from automotive and waste electrical goods.

Nationally:

- Break down barriers to artificial classification of packaging waste as household or commercial.
- Work with Waste Management Industry to move away from charging by per bin lift to a more rational system that gives incentives to SMEs and other Commercial organisations to segregate waste.

- Pressure should be placed on traditional industries such as brick manufacture to use energy saving techniques such as glass powder flux.

<p>What is the current Glass resource situation?</p>

Current Trends

1. Glass Arisings

- **Packaging (Container) Glass** Around 2.4m tonnes of packaging glassare consumed in the UK (source DEFRA website equating to around 64KT in Hampshire (based on proportion of Hampshire population to the whole UK), although this is likely to be locally higher linked to relative economic prosperity. The 1999 Project Integra waste composition analysis suggested that 4.2% of household waste collected at the kerbside was glass. Most UK studies put the total between 6-8% of the overall household waste stream. (source WRAP *Recycled Glass Market Study and Standards Review - 2004 Update*, May 2004). If Hampshire falls broadly in line with the DEFRA estimate, then 7.5% of the household waste stream equates to 64KT. SEEDA's* estimation is higher at 87KT, based on 10% of the waste stream being glass. This is high compared to most observations. In the UK, 36% of packaging glass is recycled, equating to 875KT pa.

*Estimated waste arisings in SE England, January 2003.

- **Glass Banks** Currently around 23KT a year is being deposited in glass banks in Hampshire (source Midland Glass Processing Company (MGPC)). These are administered by Waste Collection Authorities who have a 10 year contract with Midland Glass. Glass banks are generally efficient and cost effective but can give rise to local complaints of nuisance and local authorities consequently struggle to find additional sites. Household bottle banks are undoubtedly used by some commercial businesses illegally. Most local authorities turn a blind eye to this practice unless it causes capacity or other local problems.
- **Kerbside glass collection.** A pilot scheme serving 9,300 households has been underway since January 2004 in Hart and Rushmoor Boroughs on behalf of the Project Integra partnership and is being closely monitored. Early indications suggest that a high yield (equating to 56kg per household per year) is being obtained from participants although early participation rates are disappointing at around 53%. Resident attitudes have been surveyed as part of the trial (May 2004) and found to be favourable. If this level of kerbside recycling could be reproduced across the county, assuming 1/3 of material still comes thorough banks (WRAP suggests this is typical but yet to be evaluated in Hampshire), total tonnage recovered could be increased to around 50KTpa based on a 60% participation rate in the kerbside scheme.

- **Commercial Container Glass Collection:** Midland Glass are also offering a commercial glass collection service and have an agreement with one of the Hampshire Brewery chains to service some 26 premises. WRAP estimate there are around 600KTpa of container glass in the commercial waste stream, equating to around 16-20KT in Hampshire. SEEDA's estimate is 15KT (*Estimated Waste Arisings in the South East Region*, Viridis Report for SEEDA, January 2003).
- **Flat Glass** 1.15MT of flat glass is used annually in the UK. Most of this is architectural. Around 80KT of this total is used in other commercial applications, such as the automotive industry. Of the architectural glass, 67% is used in domestic dwellings and 33% in commercial projects. The split in use between new properties and repair/renovations is 50:50. In the UK an estimated 500KT of flat glass is disposed of annually, mainly to landfill. This would equate to around 13,000T in Hampshire, although the actual is likely to be larger due to relative economic prosperity. Very little post consumer flat glass recycling is undertaken in the UK, due to lack of economic drivers and infrastructure. That which is used is largely internal process scrap.
- **Current Glass Recycling Rates** 23KT (or approximately a third, based on estimated arisings) of Hampshire's household packaging glass is currently recycled via bottle banks, representing 34kg per household per year. Household bottle banks are undoubtedly used by some commercial businesses illegally. This is not discouraged by most local authorities unless it causes capacity problems.
- **Processing Capacity** The Midland Glass Company estimate that their facility at Southampton Docks (with whom the Hampshire local authorities have a 10 year exclusive supply contract) would potentially be able to handle over 100,000 tonnes of glass a year. This exceeds the total arisings in Hampshire, although some glass is already "imported" from Buckinghamshire. This plant can either colour-sort glass from a mixed glass stream or improve quality by removing impurities from a single colour batch. The facility is equipped to move processed glass to the dockside. To date, several thousand tonnes of clear glass has been shipped to Humberside from the Southampton facility.

Current Legislation

- Waste Glass is not regulated by any specific regulations/legislation but comes into the general classification of waste as outlined in the Environmental Protection Act 1990.
- **The Landfill Directive (1999/31/EC)** seeks to reduce the volumes of waste going to landfill and imposes controls on the nature and types of wastes disposed of and the manner in which they can be disposed.
- **Best Value Performance Indicator (BVPI)** recycling targets are set by the ODPM for local authorities. For Hampshire as a whole the target

equates to 40% by 2005/6. Glass which is collected and sent for recycling contributes to the overall recycling performance.

- **The Producer Responsibility Obligations (Packaging Waste) Regulations 1997**, are intended to increase the level of packaging (including glass) recycling and help to establish a more stable market for 'cullet'. By 2008 the UK will be obliged by European law to recycle at least 70% of glass in the packaging waste stream. The UK specific target for glass was revised from 19% to 49% from January 2004. The system is underpinned by Packaging Recovery Notes (PRNs), which are purchased by obligated companies to prove they have met their own quota. The importance of PRNs in driving up recycling rates was highlighted in 2003 after the target was not increased and volumes levelled off. The new target for 2004, which will increase year on year to 2008 is expected to reverse stagnation in the total volume of glass recycling.

Current Environmental Issues

- Glass particulates are an inhalation hazard and appropriate personal protective equipment (PPE) local exhaust ventilation (LEV) and environmental controls should be in place to manage risk of exposure to workers and the public. Glass does not contain free silicates and therefore has advantages over sand based products.

Current Fiscal Policies

- **Landfill Tax** was introduced in 1996 and currently stands at £14 per tonne for active waste and £2 per tonne for inert waste. From 1st April 2004 active waste will be charged £15 per tonne. Annual escalator £3.
- **Recycling Credits** are paid by the Waste Disposal Authorities to Waste Collection Authorities or third parties for each tonne of material diverted from landfill. The present rate in Hampshire is around £32 per tonne for glass. This payment represents the avoided cost in landfilling the material, although actual costs of landfill in Hampshire are currently around £49 per tonne.
- **Climate Change Levy** will continue to be a significant driver as glass manufacturers derive energy savings by using cullet. – container manufacturers have energy reduction targets to meet.
- **Aggregates Tax** Imposes a fixed charge of £1.60 per tonne on aggregate extracted as an incentive to substitute secondary and recycled materials which includes glass.

What is being recovered now and what infrastructure is in place?

Current Opportunities for Avoidance

- Returning bottles to the retailer and receiving the deposit in return used to be common practice. However as plants became larger and decreased in number, bottles had to be carried further for refilling. This removed much

of the financial and environmental advantages associated with returnable bottles. In addition, to this consumer preference turned to the convenience of non-returnable bottles. Milk bottles are one of the few types of glass packaging still reused (an average of 20 times). Despite the extra weight required to withstand wear and tear and the costs of cleaning, returning bottles can still be the best option when they are recovered and refilled locally. There is however no new investment in reuse plant anywhere in the UK and the dairy products sector for glass packaging is in decline. There is also the option of reusing bottles and jars as storage containers for home made products although modern lifestyles make this much less significant.

- Improved design of homes and buildings will enable flat glass to be more readily recoverable. The benefits of this are long term, as buildings or glass fittings designed in this way now may not be replaced for decades.

Current Disposal Options

- **Glass waste** arises in several forms including packaging (bottles and jars), flat glass, usually from demolition and construction activity and the automotive industry, and electrical applications including TVs and PC monitors, fluorescent tubes and bulbs.
- **Landfill and energy recovery systems** Container and flat glass is stable in landfill but has a negative benefit in energy recovery systems as it has no calorific value and some energy is lost melting the glass which becomes part of the bottom ash.
- **Remelting** Options for glass recycling include re-melting – provided the feedstock is relatively pure and the end product does not have critical specifications regarding impurities. It is theoretically possible for container glass furnaces to use up to 60-70% recycled glass cullet for clear and amber glass production, and 90% for green glass. At present on average container glass furnaces use about 30% recycled glass but there are wide variations depending on the colour. This is due to the fact that green is the predominant colour in glass recycling collections, whereas the UK glass container production is biased towards clear. Unless alternative uses are found, this will create a 'surplus' of green glass as glass collection rates increase. The container sector has the capacity to consume 900,000 tonnes leaving some 400,000 tonnes of green glass for alternative uses.
- **Aggregate Substitute** Glass, and particularly excess green glass, is increasingly used as an aggregate substitute. It has benefits but industry standards have yet to be properly developed. Incorporating glass as a road stone substitute is, however, a very low value end use, entirely supported by PRN revenue. Use within concrete blocks and paving has higher value.
- **Glass Powders, Grits and Foam** WRAP have been working with industry to evaluate high value end uses for glass. There are promising prospects for use in rapid filter systems for high volume water treatment and as a flux in firing ceramics and bricks. Foam glass provides a lightweight material with high insulation properties. Grinding glass to fine powders of "flour" is energy intensive but there are energy benefits in end uses such as flux in brick manufacture.

Current Standards

- **BSI PAS 101: Recovered container glass - Specification for quality and guidance for good practice in collection.** The BRI, in consultation with WRAP, have prepared Publicly Available Specification PAS 101. It includes a guide to good practice in collection and delivery of recovered container glass. It aims to help collectors achieve the higher grades laid down in the specification.
- **BSI PAS 102:** WRAP is collaborating with the BSI to develop a Publicly Available Specification (PAS) for processed glass (GLA0021) to be used in a variety of high value, alternative markets.

Current Specification

Container manufacturers buy in ready processed cullet. Many of the common impurities can cause major problems in the manufacturing process so the recycled glass has to be processed to remove metals, ceramics and other impurities. It is also important to keep the glass colours separate as the food and drink companies that purchase containers have tight specifications regarding consistency of colour. In common with many glass manufacturers and cullet suppliers, the Midland Glass Processing Company has invested in colorsort technology to provide an increased quality product and ensure the lowest possible levels of contamination. Separation and removal of ceramics and 'Pyrex' impurities is now possible and impurity levels as low as 2.5g/tonne are possible. For processed cullet most glass manufacturers operate with a maximum contamination level of around 50g/tonne and less than 2% colour contamination.

Examples:

National – WRAP fund schemes throughout the UK (www.wrap.org.uk)

Hampshire - MGPC plant, Southampton Docks

- MGPC partnership with Project Integra – long term exclusive supply contract with profit share including sale of PRNs.
- MGPC commercial glass recycling collection service
- Project Integra kerbside glass collection trial

Current Costs

Although recycled glass costs less than virgin raw materials there are the reprocessing costs to take into account. These additional costs may be offset by the sale of PRNs, therefore, depending on the PRN price, using recycled glass may represent a cost saving to the glass maker.

WRAP calculate that the average cost of kerbside collection schemes in the UK which include glass is £105 per tonne, although this is based on mixed collection. Project Integra is piloting separate kerbside collection of glass,. Early indications are that this has a net cost of £45-50 per tonne, subject to income remaining buoyant. Unit costs should reduce if the system is scaled up.

Energy Consumption - Glass manufacture is very energy intensive with furnaces operating at around 1550°C. For every 10% of recycled glass in furnace feedstock, energy consumption decreases by about 2%. The energy

savings from increased use of recycled glass has an important part to play in the glass manufacturing sector's Energy efficiency strategy and meeting Climate Change Levy targets.

Current Benefits

Recycling glass back into bottles and containers is of greater environmental benefit than any other recycling option, including container manufacture, water filtration, fluxing agents, fibreglass and aggregates (source WRAP). This is based on the amount of carbon dioxide used by all the options. Recycling one tonne of glass into new bottles and jars saves 315 kg of carbon dioxide compared to using 1 tonne of glass in aggregate manufacture - which in most cases resulted in increased carbon dioxide emissions. From the reduced energy consumption comes the associated reduction in nitrogen oxides, particulates and carbon dioxide emissions. In addition, every tonne of recycled glass replaces 1.2 tonnes of quarried materials. Additional benefits include diversion of glass from landfill and conservation of raw material resources. Increasing the quantity of recycled glass in the raw material mix can extend the furnace life.

Current Key players

Local:

- Project Integra (suppliers of 23,000T of recycled glass pa)
- Midland Glass Processing Company
- Glass Recycling Group Ltd
- Krysteline

Regional: - Foster Yeoman, Tarmac,

National: - WRAP, Glass manufacturers, compliance schemes such as Valpak, other glass recyclers inc Berryman UK, retailers, Industry Council for Packaging and the Environment.

Glass sector support

- **Waste & Resources Action Programme** - is a not-for-profit company supported by funding from DEFRA, the DTI and the devolved administrations of Scotland, Wales and Northern Ireland. It is working to promote sustainable waste management by creating stable and efficient markets for recycled materials and products.
- **TIGRA** (The Independent Glass Recyclers Association) Represents glass industry's interests to local authorities, manufacturers and distributors. Provides an alternative viewpoint from that of the glass container manufacturers.

How is this likely to change by 2020?
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Future legislation

There is no specific legislation expected in relation to container or flat glass, however the WEEE and ELV Regulations (see relevant sector papers) will also require glass components to be recycled.

Future trends

- **Container Glass**– The volume of container glass manufactured in the UK is generally stable, although glass is under pressure on a number of fronts, particularly from improved and multi layered or “barrier” plastics. Most soft drinks and bottled water is now in plastic. The trend for designer beers and alco-pops plus a stable beers and spirits sector maintains a high demand for glass in the alcoholic sector. The food sector is relatively stable although barrier plastics are increasingly being used for products such as ketchup and honey. Glass is also in decline in the toiletries and cosmetics sector as quality and appearance of plastics continues to improve.
- Despite relatively stable consumption, more cullet is becoming available as local authority recycling rates increase and for clear and brown glass this is being absorbed by the glass container industry. There is unlikely to be a significant growth in new foundry capacity in the UK and not in Hampshire. Most foundries are located in North of England due to availability of skilled labour pool. There are energy benefits in using recycled glass and therefore incentives for manufacturers to reduce contamination of the feedstock to maximize the ratio of recycled to raw material.
- **Flat Glass** The tonnage of waste flat glass coming into the waste stream is expected to reduce from 500KTpa to around 300KTpa as a direct result of the trend toward frames with longer life expectancy and as the market for replacement windows consequently declines. Re-melting of flat glass is even more quality sensitive and the process chain does not benefit from PRNs. There is currently no re-melting of post consumer flat glass into flat glass manufacturing in the UK.
- **Aggregate** Currently around 50,000 tonnes per year of recycled glass is used in aggregate applications in the UK with a potential of several million tonnes. However, there are a number of current barriers to achieving this growth:
 - Many standards are material specific and will need to be amended to include glass. There are currently no accepted standards for glass in terms of its physical and chemical properties. Larger sized recycled glass (>5mm) has a plate like shape with a ‘high flakiness index’ that may limit the applications. The best prospects may be for smaller size fractions replacing sand and gravel. There is evidence that additions of very fine glass (<600µm) can actually increase concrete strength.
- **Fibreglass Insulation** Fibreglass manufacturers in the UK already consume around 50,000T pa of glass cullet. There is potential to increase this significantly. At present there is a preference for plate glass cullet but if quality issues can be overcome (e.g. removal of ceramics) then greater quantities of container glass could be used.

Future Disposal Options

- **Filtration Media** In this application green or amber glass grits in a specific size range is used as a replacement for natural sand for the filtration of water. The product “Active Filtration Media” (known as AFM®) has been

developed by Dryden Aqua Ltd over the last 5 years and can be used in a wide range of applications including industrial water treatment, sewage treatment, drinking water treatment and swimming pools. Hampshire based Glass Recycling Group Ltd has been working closely with Dryden Aqua Ltd and can supply product ideally suited to the AFM application. Potential for this product could exceed 200,000 tonne/annum. Dryden Aqua Ltd is currently commissioning a 20,000 tonne/annum process at their site in Scotland, which will ultimately be operated as a pilot plant for further product development. Franchise opportunities for AFM production could occur throughout the UK.

- **Grit Blast Media** In this application mixed coloured glass grits in a specific size range are used to prepare and clean a wide range of materials. This is achieved by firing the granular glass at the material using high-pressured air or water. Glass offers a cost effective alternative to traditional abrasives such as copper slag, olivine, garnet or sand, many of which are imported. Extensive trials have shown that glass grit can match or exceed performance of established abrasive media but with the added benefit of being inert and non-toxic. It is particularly appropriate for use in environmentally sensitive locations, for example, near watercourses. Copper slag has been identified as the main market into which glass grit could provide a competitive alternative. The market for copper slag in the UK is estimated at 40,000 tonne/annum (all of which is imported).
- **Brick Making** WRAP have developed a programme to demonstrate, at production scale, the viability of incorporating ground glass in bricks as a flux. Laboratory trials have demonstrated reduced emissions and energy savings while maintaining or enhancing product quality. Local company Glass Recycling Group Ltd are a partner on this project, managed by CERAM Building Technology. The 2-year project is scheduled to complete in March 2004 and results to date are extremely encouraging. The clay facing brick industry manufactures in the order of 3 billion bricks/annum, which equates to around 7 million tonnes/annum of clay (dry basis). With an addition rate of only 5% the potential for finely ground glass for brick manufacture in the UK could therefore be 350,000 tonne/annum.
- **Ceramics (Sanitary ware)** Glass Recycling Group Ltd is also a project partner on the WRAP R&D programme to demonstrate that recycled bottle glass can be used as a consistent, cheaper alternative flux in sanitary ware ceramic bodies. Ceramic Sanitary ware bodies currently comprise approximately 50% clay, 25% quartz and 25% mineral flux. These powdered minerals are cast as an aqueous suspension and after drying and glaze application, the ware is fired to ~1200 C. Mineral fluxes such as nepheline syenite and feldspar are imported and relatively expensive. Finely ground recycled glass powder can provide a cost-effective alternative. Recycled glass has proved to be a more powerful fluxing agent than the traditional minerals, offering the potential for energy savings through the use of lower peak temperatures in the firing process. The project, which is managed by CERAM Research Ltd, reaches completion in May 2004 and larger scale factory trials are now in progress.
- **Sports Areas** WRAP have also commissioned an R&D programme to determine whether sands derived from recycled glass can give

comparable (or better) performance to good quality sands already used in the sports turf industry. The key objectives of the project are assess whether glass-derived sands can be incorporated in root zone mixtures, golf bunkers and to improve drainage on fairways. In addition, their abrasive and more angular nature may discourage earthworm casting which is now a major problem on golf courses. If successful, this would reduce the current reliance on pesticides for earthworm suppression.

- **Industrial Mineral Fillers.** There are established markets for inert mineral fillers such as silica sand and calcium carbonate. Where the use is not colour sensitive, finely ground glass powder can be substituted. The greatest potential market may be where there are health and safety concerns about free silica – ground glass powder contains practically no free silica.

Future Option 1 - Status Quo

- Packaging Targets under the Packaging Directive are unlikely to stimulate additional collections in Hampshire without continued subsidy of and development of collection systems by Local Authorities.
- Without a countywide strategy, glass collection is likely to be introduced slowly and in a piecemeal fashion over the next 5 years by some WCAs. This would mirror the situation already seen with kerbside co-mingled collections and garden waste.
- There is some scope to offer a commercial service to improve capture from pubs, clubs etc. Entry costs and very low margins would preclude all but established glass processors such as Midland Glass from being able to offer this service. Some local authorities are starting to consider joint collection.
- **New Infrastructure Required:**
 - Collection – collection vehicles
 - Handling – bulking bays, probably located within existing depots and transfer stations. The Midland Glass Company will be able to absorb additional tonnages collected.
 - Reprocessing – .
- **Impact on recycling rate** – locally up to 3% per WCA if whole district is included.

Option 2 - Stretching Best Practice

- Trials in Hart & Rushmoor show that Kerbside glass collection, backed by a suitable awareness and communications campaign, can yield average capture rates of 56kg per household per year. This would boost overall tonnage by over 20KT per year. This system would result in some diversion from bottle banks and the glass would be mixed, although Midland glass can colour-sort. This level of capture would boost the overall domestic recycling rate in Hampshire by 2.5%.
- The household recycling rate could be increased by 5.5% if ALL household glass were diverted from the residual waste stream. This could only be achieved if placing glass in the residual stream was actively discouraged through legislation or changes in social attitudes.

- Combining collection from licensed premises with domestic kerbside collection could yield up to 9KT of additional packaging glass in Hampshire per year.
- The net cost of collection needs to be kept low through efficient systems and a countywide strategy.
- Facilities for separate storage of flat glass at HWRCs from household and trade sources could yield an estimated 6.5KT per annum at a 50% capture rate.
- There is potential to link the increased volume of materials to a new plant for high value end uses at Southampton Docks alongside the Midland Glass Plant. The glass sector strategy could therefore have the potential to be linked throughout the whole process chain.
 - **New Infrastructure Required:**
 - Collection – collection vehicle, one vehicle (driver plus 2 crew) per 20-25,000 households collecting fortnightly.
 - Handling – bulking bays, probably located within existing depots and transfer stations. The Midland Glass Company will be able to absorb additional tonnages collected.
 - Reprocessing – glass reprocessing facility (grinding / powdering) adjacent to Midland Glass Co. (Southampton Docks).
 - **Impact on recycling rate** – 2.5% on countywide basis (over 3% for each WCA).
 - **Impact on Residual waste stream -**

Further Information

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