Collage of Engineering

Materials Department

Third Class

Lecture (9)

GLASS

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Recycling

Glass containers are wholly recyclable and the glass industries in many countries have a policy, sometimes required by government regulations, of maintaining a high price on cullet to ensure high return rates. Return rates of 95% are not uncommon in the Nordic countries (Sweden, Norway, Denmark and Finland). Return rates of less than 50% are usual in other countries. Of course glass containers can also be reused, and in developing countries this is common, however the environmental impact of washing containers as against remelting them is uncertain. Factors to consider here are the chemicals and fresh water used in the washing, and the fact that a single-use container can be made much lighter, using less than half the glass (and therefore energy content) of a multiuse container. Also, a significant factor in the developed world's consideration of reuse are producer concerns over the risk and consequential product liability of using a component (the reused container) of unknown and unqualified safety. How glass containers compare to other packaging types (plastic, cardboard, aluminium) is hard to say; conclusive lifecycle studies are yet to be produced.

Environmental impacts

Local impacts

As with all highly concentrated industries, glassworks suffer from moderately high local environmental impacts. Compounding this is that because they are mature market businesses, they often have been located on the same site for a long time and this has resulted in residential encroachment. The main impacts on residential housing and cities are noise, fresh water use, water pollution, NOx and SOx air pollution, and dust.

Noise is created by the forming machines. Operated by compressed air, they can produce noise levels of up to 106dBA. How this noise is carried into the local neighborhood depends heavily on the layout of the factory. Another factor in noise production is truck movements. A typical factory will process 600T of material a day. This means that some 600T of raw material has to come onto the site and the same off the site again as finished product.

Water is used to cool the furnace, compressor and unused molten glass. Water use in factories varies widely; it can be as little as one tonne water used per melted tonne of glass. Of the one tonne, roughly half is evaporated to provide cooling, the rest forms a wastewater stream.

Most factories use water containing an emulsified oil to cool and lubricate the *gob* cutting *shear blades*. This oil-laden water mixes with the water outflow stream, thus polluting it. Factories usually have some kind of water processing equipment that removes this emulsified oil to various degrees of effectiveness.

The oxides of nitrogen are a natural product of the burning of gas in air and are produced in large quantities by gas-fired furnaces. Some factories in cities with particular air pollution problems will mitigate this by using liquid oxygen, however the logic of this given the cost in carbon of (1) not using regenerators and (2) having to liquefy and transport oxygen is highly questionable. The oxides of sulfur are produced as a result of the glass melting process. Manipulating the batch formula can effect some limited mitigation of this; alternatively exhaust plume scrubbing can be used.

The raw materials for glass-making are all dusty material and are delivered either as a powder or as a fine-grained material. Systems for controlling dusty materials tend to be difficult to maintain, and given the large amounts of material moved each day, only a small amount has to escape for there to be a dust problem. *Cullet* is also

moved about in a glass factory and tends to produce fine glass particles when shovelled or broken.