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Toxic Televisions – a new approach to CRT recycling

Recycling is broadly defined as 'subjecting a material to a process so that it can be used again'. An internet search for companies 'recycling' TVs, monitors and cathode ray tubes will bring up a list of over 100 companies in the UK alone so it is clear that the UK has no problem in recycling the 105,000 tonnes of cathode ray tube (CRT) glass that WRAP studies predict will become waste during 2008?

"Not so" says Laurie Wood – Technical Director of Nulife Glass limited. "We are not aware of any true CRT recycling being conducted in the UK at the present time. There are many companies that claim to recycle CRTs but in reality we have found they are simply dismantling the equipment, splitting the CRT and then exporting the glass to developing nations where it is intended to be used in the production of new CRTs, a rapidly declining market, which is likely to end completely within a few years. The technology developed by Nulife Glass enables recyclers to process CRT glass in their own country at the point it is generated rather than having to ship it half way round the world to one of the few remaining manufacturers of new CRTs. This avoids the cost and hassle of trans-frontier waste shipments, transport costs and unnecessary carbon emissions from transport".

In July 2007 the Waste Electrical and Electronic Equipment (WEEE) Regulations came into force in the UK meaning that producers are now obliged to ensure that end-of-life equipment is collected and recycled rather than going to landfill. This has stimulated an explosion in the number of WEEE recycling companies many of who have introduced innovative processes for recycling the ferrous, non-ferrous and plastic components of discarded TVs and computer monitors. However, until now people seem to have been content to send the glass overseas rather than trying to process it in the country in which it is generated.

Research carried out by the Basel Action Network (www.BAN.org) has found that all too frequently equipment dispatched from Europe and the US for recycling in Africa and China is being treated in a manner that causes significant harm to operators, their families and the environment. In the case of TVs and monitors, the copper components are removed from the CRT to be smelted down but the remaining glass is thrown into irrigation ditches where the lead slowly leaches out contaminating drinking water. BAN found that up to 75% of the electronic equipment sent to countries in Africa for 're-use' was actually faulty and not capable of being re-used. This equipment is subsequently broken up to recover the valuable metals whilst the remainder is burned or simply dumped causing significant environmental damage.

CRTs are made from two different types of glass, which have different chemical compositions and characteristics, which makes recycling them a difficult task. The front part of the CRT (the panel) is made from a silica/barium glass and the rear part

(the funnel) is made from silica/lead glass, which contains up to 20% lead in the form of lead oxide. Whilst this is essential to cut down the amount of radiation emitted by the TV or monitor, it means that scrap CRTs are classified as hazardous waste.

In the UK CRT 'recycling' has so far been limited to splitting the CRT to separate the panel and funnel glass, removing the phosphor coating from the panel glass and then exporting both types of glass to CRT manufacturing companies that are typically located in non-OECD countries.

A study by industry analysts Tekrati in September 2007 put the global market for new TVs at 245.5 million by 2011. Only 38% of these will contain a cathode ray tube which means 93 million CRT based TVs will be sold in 3 years time. Assuming 5Kg of leaded glass per unit, 466,450 tonnes of leaded glass will be required to produce these units. However, currently the maximum percentage of recycled glass that can be used in new CRTs is 10% meaning the global market for "glass to glass" recycling of leaded CRT glass is only 46,450 tonnes. Even allowing for improvements in the manufacturing process for new CRTs it is unlikely the maximum percentage of recycled glass in new units will exceed 20% putting the upper limit on glass to glass recycling at less than 100,000 tonnes pa for the whole world. As more and more countries implement restrictions on disposal of TVs to landfill this recycling route will quickly become swamped leaving a mountain of leaded glass that can't be recycled.

Nulife Glass has been working on the issue of recycling CRT glass for over 10 years and has just released the first commercially available recycling system that removes the lead from CRT glass to produce solid lead ingots with a purity in excess of 99.7% and a de-leaded glass sand suitable for use as an aggregate replacement, a feedstock material in the ceramics industry or sandblasting media.

The Nulife Glass CRT recycling process utilises a specially designed electrolytic converter where the CRT glass and process chemicals are melted under strictly controlled conditions to free metallic lead from the glass which is tapped off to form lead ingots. The treated glass flows into a water bath where it is quenched to produce a glass sand. This is then dried, sieved to remove any oversized material and then packed into bulk bags ready for re-use. The level of lead in the CRT glass is reduced by more than 90% and any residual lead is tied up in the glass matrix making it very resistant to leaching and suitable for many new applications.

The Nulife Glass electrolytic converter has been designed with energy efficiency in mind to minimise the environmental impact of the recycling process. Super-efficient insulation means that while the temperature inside the main melting unit is in excess of 1000c, the outside never exceeds 60c. In addition to being energy efficient, the converter has negligible emissions due to the innovative design so there is no requirement for expensive extraction and filtration systems.

Nulife Glass has been working with designers, architects and construction companies to develop a range of products that contain de-leaded glass. For the construction market, the sand produced by Nulife Glass is a carbon neutral product

as no additional energy input is required once it has been through the decontamination process. In addition to being carbon neutral, the nature of CRT glass means it performs better in some applications than virgin sand and does not have the intrinsic problem seen with recycled container glass, which can contain sugar residues from the original contents. Sugar can react with cement to produce weak spots in the finished product, which shortens its lifespan making glass sand from container glass unsuitable for some applications. "As the Nulife Glass process becomes more wide spread, we aim to develop higher value products that are manufactured directly from the hot glass rather than cooling it and losing the heat energy it contains." Says Simon Greer, Managing Director of Nulife Glass. "We are currently working with designers from the glass art movement and have already produced tiles, vases, bowls and other decorative products in addition to developing bulk applications for the treated glass".

The launch of the Nulife Glass CRT recycling system makes it possible for companies to truly 'recycle' CRT glass at their own site rather than having to export it halfway round the world and trust that it is being managed to the same standards that are required in the UK. "The computer industry has been accused of turning a blind eye to the wholesale dumping of redundant equipment in developing countries under the guise of export for re-use" Says Laurie Wood, "We are starting to see a shift in sentiment with organisations such as BAN and the Silicon Valley Toxics Coalition putting manufacturers under real pressure to deal with electronic waste at the point of generation, a case of the polluter pays principle in action".

So far Nulife Glass have been approached by over 50 recycling companies in the UK, USA, Europe and as far away as Australia and Mexico to discuss installation of a recycling system at their plant. "This level of interest has been amazing as up until this point we have been developing the electrolytic converter and haven't done any marketing or advertising" says Simon Greer. "This clearly shows the level of interest in the issue of CRT recycling and the lack of other competing recycling technology across the world". In the UK discussions are underway with several large recycling companies to install systems capable of processing from 2 to over 10 tonnes of leaded glass per day, which equates to around 5,000 average sized monitors or 3,000 widescreen televisions. This technology is also suitable for removing the lead from glass waste from the lead crystal industry and redundant x-ray shielding, two problematic waste streams which have until now also had to go to hazardous landfill for disposal. Interest has been particularly strong from recyclers in the US where it is predicted up to 63 million analogue television sets will enter the waste stream when the country converts to digital transmission in February 2009.

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