

IT'S COMPLICATED



How have we ended up with warehouses full of CRT glass and millions of tons still on the way? A rapid technological shift and the fickle economics of electronics recycling spawned a capacity catastrophe that will be playing out over the next 20 years. **BY BOBBY ELLIOTT**

Between 2013 and 2022 an estimated 6.2 million tons of devices containing cathode ray tube (CRT) displays will find their way from our basements, closets and guest bedrooms into the U.S. e-scrap stream. An additional 330,000 tons of CRT glass are already out there, much of it stockpiled in warehouses across the country by CRT tube processors and intermediaries who've either abandoned ship or found there simply isn't a market for the items. And that's only a conservative estimate.

Ten or 20 years ago, with "glass-to-glass" facilities running in the U.S. and abroad, taking old CRTs and making them into new ones was a fairly straightforward and profitable business. According to research by Lauren Roman, managing director at consulting firm Transparent Planet, there were a total of 14 global CRT manufacturers using recycled CRT glass in 1999, with facilities in 12 U.S. states.

Today, the only facility in the world that still takes old U.S. CRTs to manufacture new ones – India's Videocon – probably won't within five years. Furthermore, Videocon is, by far, the largest processor of U.S. CRT glass at a time when the rising volume of CRTs in need of processing already outweighs American capacity to take the lead-heavy components.

So how did we get here? Let's take a look.

Oh, so obsolete

In part, the story of the CRT monitor is the story of every electronic device: here today and gone tomorrow. Just as we've seen with the fall of the VHS and cassette tapes, CRT televisions and monitors were simply eclipsed by the next big thing.

EPA sales estimates suggest between 1980 and 2010 more than 979 million televisions and computers equipped with CRTs, the component responsible for generating and displaying video images, were sold in the U.S. After a sharp ascent in annual sales between 1980 and the late 1990s, sales of CRT monitors began to free-fall as the public turned to lead-free, but mercury-rich, flat panel display (FPD) televisions for a sleeker, leaner design and a better picture.

By 2010, annual sales of CRT devices in the U.S. had all but disappeared while U.S. sales of FPD devices totaled more than 61 million units. In less than a decade the end of CRTs had been signaled and a monumental project to clean them up began.

Kicking the CRT down the road

The trouble with cleaning them up, as the industry knew well before the technology obsolesced, derives, in part, from the high lead content of CRTs. CRTs, which constitute 60 to 70 percent of the overall weight of the products they are housed in, contain an average of four



Courtesy of Jim Puckett, Basel Action Network, 2013.

pounds of lead. The panel glass portion of CRTs, with typically low lead levels, can be processed as a non-hazardous waste in numerous recycling applications, while the funnel glass, under EPA's CRT exclusion rule, is treated as a hazardous waste because it contains dangerously high lead levels once broken down (when lead is released into the environment, it is potentially toxic to human health). A 2013 white paper released by Kuusakoski U.S. estimated 3.9 million tons of the 6.2 million tons of CRT devices entering the e-scrap stream between 2013 and 2022 would be panel and funnel glass.

Once CRT devices are collected for recycling, they make their way to an intermediary processor, or sometimes a host of them, for de-manufacturing. Several de-manufacturing methods exist, but typically once the CRT is removed from the housing of the product, the funnel glass, panel glass and the lead solder that binds them together – the frit – are separated using tumblers or cutters. Separated glass then gets sent to a CRT glass processor for final recovery.

In keeping with EPA guidelines sanctioning the proper end-of-life treatment of CRTs, CRT glass processors have traditionally relied upon two processing methods: First is the "glass-to-glass" option, where panel and funnel glass is broken down into

small pieces and treated, with primarily leaded glass sent to be used in the manufacture of new CRTs. The second method is lead smelting, where the glass can be used as a fluxing agent and the lead is recovered via the smelting process and re-sold as a commodity grade good to battery makers and other buyers.

U.S. processors can export CRT glass, intact or crushed, with an EPA Acknowledgement of Consent letter verifying the glass will be "used for CRT glass making or lead smelting and not disposed in the receiving country."

As U.S. and global sales of CRT devices evaporated during the last decade, so, too, did the glass-to-glass market and recycling option. Closures of major U.S. glass operations run by Corning Asahi (in 2003) and Techneglass (in 2004) were signs of trouble ahead. "We knew that demand for post-consumer glass was going to have to come from overseas plants where they still needed it," says Jason Linnell of the National Center for Electronics Recycling. By the late 2000s, however, overseas markets also dried up, limiting exports and shuttering global CRT manufacturers who had readily welcomed the recycled feedstock just years before.

State laws enter picture

At the same time recycling options were dwindling, numerous states moved in earnest to pass aggressive e-scrap legislation, leading, among other things, to a flood of CRTs suddenly collected for recycling. Today, a total of 25 states have passed laws concerning the collection and recycling of used electronics. Under 23 of the 25 state-level laws in place, original equipment manufacturers (OEMs) are required to pay for the recycling of a number of covered electronic products, including CRT televisions and monitors, which make up 43 percent of the U.S. e-scrap stream by weight. In addition, a total of 20 states have specifically banned the disposal of CRTs in landfills.

Over the years, however, OEMs have increasingly sought the lowest bids from recyclers pledging to ensure the safe treatment of electronics. Increased competition among bidders, who often agree to pay for the cost of collecting, transporting, de-manufacturing, treating and recycling electronics, has left many recyclers stuck with large amounts of CRTs they simply don't have the funds – or the interest – to move to final recovery facilities. "With the costs the way they are, there's only so much a

company can do while remaining cost effective,” Illinois’ Solid Waste Agency of Lake County recycling director Peter Adrian told *Resource Recycling*. “And some cut corners.”

Cutting corners by stockpiling or abandoning CRTs has become a national storyline. In the last year alone, reporting by *Resource Recycling* uncovered more than 13,000 tons of stockpiled CRTs in Arizona, Baltimore and Denver. In the largest of the stockpiles, Luminous Recycling left behind a reported 8,000 tons of CRT glass after its Denver plant closed in May of 2013.

Despite a recent push by the EPA to encourage recyclers facing downstream challenges to apply for state-granted speculative accumulation variances, temporarily relieving yearly requirements that mandate the recycling of at least 75 percent of inventory, several collectors and processors told *Resource Recycling* stockpiling continues throughout the country. Regulators too are well aware of the problem, and they’re struggling to determine the best way to proceed. One state official, speaking on the condition of anonymity, said, “There is a glut of CRT glass in the U.S.,” and he acknowledged his state “was not immune to the CRT glass issue.”

Given the current climate, existing and up-and-coming operations attempting to handle the glass properly – and in an economically viable manner – can only do so much. “The fact of the matter is the amount of glass that’s being generated cannot be consumed by the glass furnaces today, even if [all prospective operations] go on-line,” said David Cauchi from Closed Loop Refining and Recovery, a new CRT venture hoping to use treated glass in the production of various products. “There’s a five-year backlog on the ground.”

Three times more than we can handle

Today, just four established processors of U.S. CRT glass remain in operation and only one, India’s Videocon, is a glass-to-glass operation. All told, the combined annual capacity of



Courtesy of Jim Puckett, Basel Action Network, 2013.

Solution through innovation?

Here’s a look at how two companies aim to use technology to process – and profit on – the nation’s growing glut of CRT glass.

NuLife Glass, with a lead smelting operation already live in the U.K., is “still doing the permit paperwork” for a secondary lead smelting furnace in Dunkirk, New York, the company’s Simon Greer explained. While the goal is to get the operation running as soon as possible, Greer acknowledged the permitting and building process can take many months, if not years. According to the company’s website, the plant will be able to process up to 100,000 tons of CRT glass per year. Greer confirmed NuLife’s New York operation was already “building feedstock according to plans.”

Closed Loop’s CEO, David Cauchi,

says his company has lead smelting plants planned in Arizona and Ohio, and the company expects annual tonnages of as much as 72,000 tons. Installation, air and operating permits are in place for the Ohio smelter, and the company is seeking similar permits in Arizona, where Cauchi says there is as much as 45,000 tons of CRT glass awaiting processing. The company plans to turn both funnel and panel glass into new glass products. In a nod to speculative accumulation limitations, requiring that 75 percent of inventory is recycled during a calendar year, Cauchi ceded the pressure was on: “We have to build that furnace [in Arizona] now, because we can’t hold that inventory for much longer.” According to Cauchi, a truck load of CRTs is being delivered every hour at both the Arizona and Ohio operations.

existing processors taking on U.S. glass hovers between 131,000 and 140,000 tons. EPA life cycle models, however, show 392,000 tons of CRT glass will enter the U.S. e-scrap stream every year until 2023, nearly tripling current capacity.

In interviews, top executives of the existing processing companies indicated they have little room for more glass. Missouri’s

Doe Run, the only remaining secondary lead smelter of CRTs in the U.S., confirmed processing between 10,000 tons to 20,000 tons of glass each year, which puts it near its capacity. Canadian smelters Teck Resources and Glencore (formerly Xstrata), which receive a mix of Canadian and U.S. glass, indicated operating at reported capacities of 10,000 tons and 3,000 tons, respectively.

Glencore's Tom Schnull told *Resource Recycling*, "We continue to take CRT [crushed funnel] glass. ... If we can charge for processing the material and we get a little bit of lead for free, then we can be a viable outlet for CRT glass." Schnull said Glencore could process CRT glass "indefinitely" as long as supply remains.

Videocon suggested an annual capacity of 108,000 tons was being met and could increase, though North America partners are finding shipping the material to India to be a cost challenge.

Videocon's Albino Bessa also contended India's demand for recycled CRT glass was "still very high," adding, "I think I keep answering the same question every year. So far, there's been no change ... I say [demand will be] strong until 2016 or 2017." Asked what the company would do when the CRT market in India does disappear, Bessa said Videocon, with a "huge investment" in its current glass furnace, would attempt to use recycled CRT glass "for other things," including solar panels, while selling the recovered lead.

North American processing capacity may get a much-needed increase from a slew of emerging enterprises eager to get into the U.S. CRT processing landscape. Three told *Resource Recycling* about their operations and reported a combined annual tonnage capacity of 222,000 tons (see sidebars).

Significant questions remain, however. Even if emerging operations manage to

An answer too good to be true?

One unique CRT processing venture has achieved the unlikely feat of gaining permits and beginning operations. Many in the e-scrap industry have questioned the effort, however.

Kuusakoski U.S., through a unique 10-year, 500,000-ton agreement with Illinois' Peoria Disposal Company (PDC), has officially begun operations to turn treated CRT glass into alternative daily cover at landfills. According to Anssi Takala – the company's president of sourcing, sales and logistics – Kuusakoski is just several months into the project and is "still ramping up volume." He adds the firm has "collected and treated several million pounds of CRTs," with quantities "increasing steadily."

David Walters of the Illinois EPA

explained the process, while approved by the state, should not be considered recycling because "we do not believe that anything that goes into the footprint of a landfill can be considered recycled."

The state's e-scrap law, however, "never intended that 100 percent of the items collected would actually be sent for recycling," Walters said. "If manufacturers pay for the collection and get it fully processed, they can count those pounds toward manufacturers' goals."

In addition, critics of Kuusakoski contend that due to the alternative process, the company is able to outbid competing processors, including those still standing in the U.S.

process glass at ambitious capacity levels, the U.S. will face a processing shortfall of about 50,000 tons per year until 2023. Additional ventures – and there are some in the works – will also need to gain necessary permits and funding in order to match our annual supply.

Like so many other challenges in recycling, solving the CRT conundrum seems to lead to the industry's favorite phrase: There is no silver bullet. A patchwork of smelting operations and innovative solutions will

have to slowly take on the tonnages heading into the waste stream. In the immediate future, stockpiling seems destined to continue – and regulators and the industry will keep on facing an uphill processing battle. **RR**

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