

Residual CRT Glass Management and the CEW Recycling Payment System

Purpose:

This issue paper proposes adjustments to regulations to allow for all legal ultimate disposition of residual cathode ray tube (CRT) glass derived from California’s covered electronic waste (CEW) program. The below discussion will revisit assumptions, examine market realities, and assess existing policies. It is marked as “draft” to indicate that it is not a formally adopted position of CalRecycle.

Summary:

In 2001, when the Department of Toxic Substances Control (DTSC) clarified that cathode ray tube (CRT) devices were in fact considered hazardous when disposed, recycling markets existed for recovered residual CRT glass. Although the cost of device recovery and processing typically exceeded the combined value of the glass and other residuals (resulting in a “net cost” to recycle this technology), there were readily available options to send CRT glass either toward new CRT manufacturing or toward lead smelting. While never a cheap material to handle, properly sorted and cleaned residual CRT glass reportedly could be sold for between \$100 and \$200 per ton to CRT manufacturers, and smelters would accept leaded glass at a nominal cost for use as a flux.

Just over a decade later, CRT devices are no longer being consumed in any appreciable amount in the developed world. The sole manufacturer of new CRTs accepting processed CRT glass from the West is located in India and is charging between \$100 and \$200 per ton to do so, with ever-increasing quality specifications. Reportedly only three large metal smelters in North America will accept CRT glass in quantity and at a comparable price, though new lead extraction technologies for high-lead content funnel glass are allegedly being developed. A viable alternative large-scale application for low-leaded residual panel glass, which contains barium oxide for optical properties and radiation shielding, that conforms to California’s stringent hazardous waste management rules continues to be elusive.

California’s covered electronic waste (CEW) recycling program has generated approximately 100 million pounds of residual CRT glass annually in recent years, though volumes appear to be flat and beginning to decline. A key component of the CEW recycling program has been a requirement that the derived residual CRTs and/or CRT glass be “shipped” to a destination authorized to further treat that material, under the assumption (and hazardous waste management requirement) that the material would eventually find an appropriate recycling application.

Background:

Soon after the enactment of the Electronic Waste Recycling Act of 2003 (Act) via the passage of SB 20, CalRecycle’s predecessor, the California Integrated Waste Management Board (CIWMB), proposed

draft regulations to implement the covered electronic waste (CEW) recovery and recycling payment system. The proposed regulations established claim eligibility requirements that included criteria for the management of treatment residuals derived from processed CEW. In order for a recycler to submit a payment claim for recycling CEW that contained cathode ray tubes (CRTs), derived residual CRTs or CRT glass must have been shipped to a destination authorized to receive and further treat that material. In fact, for administrative documentation reasons, the initial proposed regulations based the recycling payment claim on the weight of the shipped glass multiplied by a payment rate factor that depended on the degree of residual glass processing.

SB 50 amended the Act in 2004, prior to the promulgation of the original proposed regulations, and required the CIWMB to pay on the full weight of CEW recovered and cancelled (see PRC 42478(b)), establishing a clear distinction between CEW recycling and residual CRT glass management. However, regulations continued to condition submittal of recycling payment claims on the shipment of residual CRT glass and, in part due to a 2006 market disruption involving a major lead smelter, were soon amended to clarify that all CRT glass derived from the processing (cancellation) of CEW must be shipped prior to submitting a recycling payment claim for that CEW.

There were several reasons for establishing residual CRT glass management criteria within the CEW recycling system rules. Residual CRTs and CRT glass, while no longer CEW, remain a regulated hazardous waste. While the ultimate disposition of the residual CRTs and CRT glass would occur in a timeframe and location far beyond the necessary scale of recycling claim cycles, this shipping requirement was deemed prudent to ensure that the CRT material was in fact moving toward a disposition allowable under California universal waste rules, the regulatory framework within which all of the program participants currently operate. Furthermore, the shipment of glass provided certified weight documentation that could act as an additional proxy measure for the original amount of CEW being claimed for recycling payment.

In addition to the CRT shipping criteria, CEW recycling claimants are also required by regulation to submit as part of a claim “... a discussion of the ultimate disposition of the (CRT) material shipped demonstrating that the disposition is not disposal to land, water or air.” This requirement was again intended to be supportive of the foundational hazardous waste regulatory framework, specifically universal waste rules, under which material collection, transportation, and treatment typically occurred. Any and all “ultimate dispositions”, it must be noted, have not “ultimately” been in California.

Program Experience:

Universal waste management rules applicable to residual CRT glass handling and treatment have generally recognized new CRT manufacturing and lead smelting as the only appropriate ultimate recycling dispositions for CRT glass. However, neither of these end-uses currently occurs within the

state of California. Early program participants generally shipped glass to North American smelters or to glass processors for beneficiation prior to its subsequent marketing to overseas CRT manufacturers. As more volume of CEW was recovered and processed, a larger proportion of derived CRT glass was ostensibly sent toward the so-called “glass-to-glass” market (e.g. CRT manufacturing), either directly or through processors. This practice was influenced by accessibility and price, even as the global production and sale of CRT devices rapidly declined.

By mid-2009, approximately 75% of residual CRTs and/or CRT glass was being shipped to Mexican processors. However, in the 4th quarter of 2009, access to Mexican CRT glass processors was interrupted for nearly a year. Because CEW recyclers are required to ship CRT glass to a destination “authorized to receive and further treat” the glass prior to filing CEW recycling claims, this interruption caused the volume of claimed CEW to decrease dramatically while recyclers searched for alternative outlets for CRT glass. A couple of recyclers pursued establishing their own in-state CRT processing capabilities, while other enterprises started or offered capacities out-of-state.

The requirement to “ship” CRT glass has been interpreted by CalRecycle, as well as its predecessor (CIWMB), as meaning that the glass be moved off-site from the facility where the CEW was cancelled and the treatment residual generated. This interpretation has been supportive of universal waste accumulation time limits by discouraging onsite storage. As ready access to ultimate disposition options became more uncertain, and as the price charged by out-of-state processors increased, more recyclers pursued interest in establishing their own in-state, off-site processing capabilities (or at least authorizations) to fulfill treatment residual shipping criteria. While this would allow CEW recycling payment claims to be submitted with regularity, it did not create new end markets for CRT glass.

Current Situation:

CalRecycle understands that current markets for residual CRTs and CRT glass are limited. Access to traditional lead smelting is reportedly difficult, with only one facility in the U.S. (Doe Run, Missouri) and two in Canada (Teck Cominco and Xstrata) known to accept CRT glass in volume. Furthermore, traditional smelting results in hazardous slag wastes that must be subsequently managed. There remains one known CRT manufacturer available to receive residual glass generated by California recyclers (Videocon Industries, located in India). Access to Videocon is typically through an intermediate processor and/or broker, such as Glassico (aka TDA/TDM) located in Mexicali. However, given that the residual CRT glass derived from many states’ and nations’ recycling efforts are also competing for the same outlet, reliable access to and the longevity of this market for California recyclers is uncertain.

With the exception of Doe Run (smelter) and Videocon Industries (the CRT manufacturer in India), all out-of-state destinations that received residual CRT shipments in 2013 are not ultimate endpoints; instead, they are portrayed as intermediate facilities that ostensibly perform some degree of CRT

processing before presumably shipping the glass onto a subsequent destination or ultimate disposition. One such operation, Dow Management in Yuma, AZ, unfortunately abandoned its facilities in June 2013, leaving behind substantial volumes of CRT in various stages of processing, including approximately 9 million pounds of CRT received from California recyclers. These recyclers have since spent several months and considerable expense retrieving and redirecting the CRT for which they are responsible.

As of the drafting of this paper, approximately five California CEW recyclers are affiliated with in-state operations authorized to further treat (e.g., break, cut, sort, separate, clean, etc.) residual CRT and/or CRT glass. These facilities are ostensibly authorized to treat CRTs under 22 CCR 66273.73 and may accumulate CRTs and/or CRT glass for up to one year under universal waste rules before presumably being shipped onto another appropriate destination. Meanwhile, with the demise of Dow Management, all intact residual CRT shipped directly out-of-state within the past several months has been sent to either Closed Loop Refining & Recovery in Phoenix, AZ, or to Glassico in Mexicali.

New CRT Management Regulations

On October 15, 2012, DTSC issued emergency regulations governing the management of CRTs and CRT glass. The new rules established stricter specificity on how in-state handlers are regulated depending on the ultimate disposition of this material. The rules preserve the ability of handlers who simply collect and dismantle CRT devices to operate under the universal waste framework. The rules also maintained pathways for CRTs and CRT glass to be shipped and ultimately recycled through traditional markets (smelting and CRT manufacturing) under the universal waste framework.

Perhaps the most significant changes in the rules created the allowance for CRTs and CRT glass to be ultimately managed via alternative recycling applications, if such applications exist, without necessarily jeopardizing the upstream handling and treatment of CRT devices and CRTs under the universal waste concept. These changes even opened up the possibility of, and specified the standards for, regulated disposal for residual CRT glass should feasible markets be unavailable.

It must be noted again that the CEW recycling program regulations are separate from, though constructed with deference to, the rules that govern the physical management of residual CRTs and CRT glass. However, although now afforded the possibility of residual CRT disposal under DTSC's new CRT rules, the current CEW program rules require recyclers to "ship" residual CRTs and CRT glass for purposes other than disposal to land, air, or water. Unless and until that changes, CEW recyclers must continue to search for what appear to be elusive and diminishing residual CRT glass recycling options.

Looking Ahead:

CRT glass can be loosely categorized into leaded glass and non-leaded glass. Sometimes this is referred to as "funnel glass" and "panel glass" respectively, but such classification can be misleading since the

panel glass of some CRTs also contains lead. And even so-called non-lead glass contains other toxic metals, such as barium, at levels that create environmental and regulatory concern, particularly under current California hazardous waste law. The ability to effectively identify, separate, characterize, process, and test residual CRT glass will be critical to future management options.

New lead extraction technologies reportedly are emerging that may be more efficient than traditional smelting, including facilities in AZ, OH, TX, and NY utilizing new technologies that are in differing stages of development but not in production-scale operation. Alternative applications also have been reported for non-lead CRT glass, such as in building materials, tile, insulation, aggregate, proppant, industrial abrasives, reflective coatings, and fill. However CalRecycle is not aware of any alternative production-scale applications in the United States that have been demonstrated to and evaluated by DTSC and found to constitute an ultimate disposition that would warrant inclusion in the list of uses allowed under universal waste rules. Nor is CalRecycle aware of any proposed use for non-lead CRT glass that has secured concurrence from DTSC as an excluded recyclable material.

As the CEW recycling system moves forward, consideration should be given to the availability of viable CRT glass markets and alternatives, the anticipated lifespan of those markets and the available supply of feedstock, and the environmental impacts associated with moving the glass to those markets versus other management options. The fact that the ultimate disposition of essentially all residual CRT glass currently occurs beyond California's borders, and in a timeframe that makes the effective monitoring of that disposition problematic, suggests policies that ensure more certain fates closer to home should be considered.

Proposed Next Steps

CalRecycle's CEW recycling program is proposing to amend existing regulation in a manner that would eliminate restrictions on the ultimate disposition of residual CRT glass beyond compliance with applicable rules for material management administered by DTSC. Doing so would afford California recyclers the opportunity to explore the viability of all legal residual CRT disposition options available under the emergency regulations promulgated by DTSC in October 2012, giving both the CEW recycling industry and the regulators an opportunity to gain experience with such practices, should they be pursued. It would also create an alternative to an essentially monopolistic downstream market, which could better illuminate industry economics and reveal the actual costs and value associated with the management of this waste stream.

While broader revisions to the current CEW program regulations are needed in the coming months, this specific proposal focuses on amending only those sections that affect the disposition of residual CRT glass derived from CEW processing within the CEW recycling program, along with associated documentation requirements to demonstrate compliant dispositions. The amendments would be made under the emergency rulemaking authority granted by PRC 42475.2.

For reference and discussion, an associated workshop attachment shows draft regulatory revisions via underline and ~~striketrough~~ in the following sections of Title 14 of the California Code of Regulations:

- 18660.5(a)(46) -- Definitions
- 18660.6(h)(2) -- Applicability and Limitations
- 18660.21(l)(4) -- Requirements for an Approved Recycler
- 18660.22(a) and (c) -- General Requirements for Recycling Payment Claims
- 18660.23(e) and (g) -- Additional Requirements for Recycling Payment Claims to Demonstrate Cancellation of CRTs or CRT-Containing CEWs through Crushing or Shredding
- 18660.24 (e) and (g) -- Additional Requirements for Recycling Payment Claims to Demonstrate Cancellation of CRTs or CRT-Containing CEWs through Dismantling to a Bare CRT After Relieving the Vacuum

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