



Kuusakoski Recycling

Peoria Disposal Company



ADDRESSING THE CRT GLASS MANAGEMENT CHALLENGE

Presented to SWANA Land of Lincoln Chapter
February 5, 2014

About Kuusakoski Recycling

- Family-owned company in operation for 100 years
- Worldwide leader in metals and e-waste recycling
- Expanded operations to U.S. in 2009
- Operations currently span 12 countries, 3 continents, and 48 states
- Create, develop and manufacture recycling technologies
- e-Stewards, R2, and ISO 14001 certified



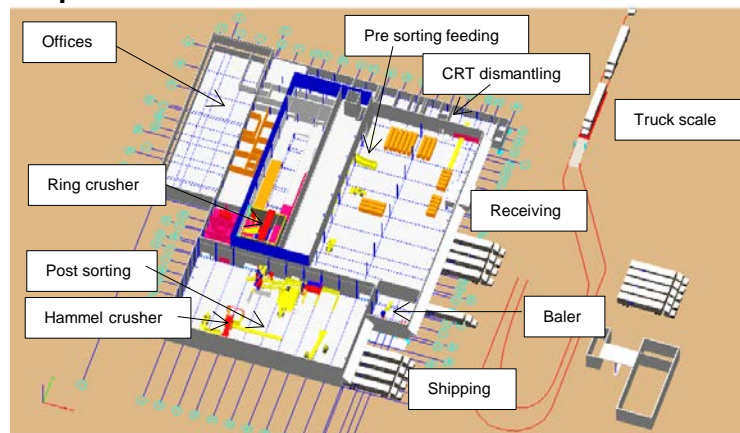
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Peoria Disposal Company



Kuusakoski Recycling's Illinois Facilities

- U.S. headquarters located in Plainfield
 - Operations commenced in 2012
 - Primary collection and dismantling facility - 160,000 sq. ft.
- Kuusakoski Glass Recycling Facility located in Peoria
 - Operations commenced November 2013
 - In addition to CRT glass management, facility provides collection and dismantling of all e-wastes - 50,000 sq. ft.



Plainfield Headquarters



Peoria Glass Recycling Facility



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About Peoria Disposal Company

- Peoria Disposal Company (PDC) and its affiliate Area Disposal Service, Inc. (AREA) are family-owned companies, serving customers throughout the Midwest since 1928
- The PDC/AREA family includes 15 companies/operations located across Central Illinois, Eastern Missouri and Southern Iowa, employing 600 people
- Operations include 3 active solid waste landfills, 1 hazardous waste treatment and disposal facility, 1 wastewater treatment facility, 3 transfer stations and recycling facilities, 3 environmental testing laboratories, and 1 landfill gas-to-energy plant
- Services include: hazardous and non-hazardous waste collection and disposal, waste and wastewater treatment, waste transportation and brokerage, consulting and engineering services, laboratory analysis and equipment rental



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PDC & Affiliated Landfills

PDC #1 Landfill



Hickory Ridge Landfill



Indian Creek Landfill



Clinton Landfill



PDC & Affiliated Landfills

Peoria City/County Landfill #3



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PDC Waste Treatment & Recycling Facilities

PDC Waste Treatment Facility



PDC WWTP Facility



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PDC & Affiliated Transportation Companies

PDC Transportation



W.W. Sanitation



C&S Waste Services



Buster Sanitation



Area Clinton



Grimm Bros. Trucking



Area Lincoln



Wigand Disposal



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PDC Laboratories - 3 Locations

Peoria, IL



St. Louis, MO



Springfield, MO



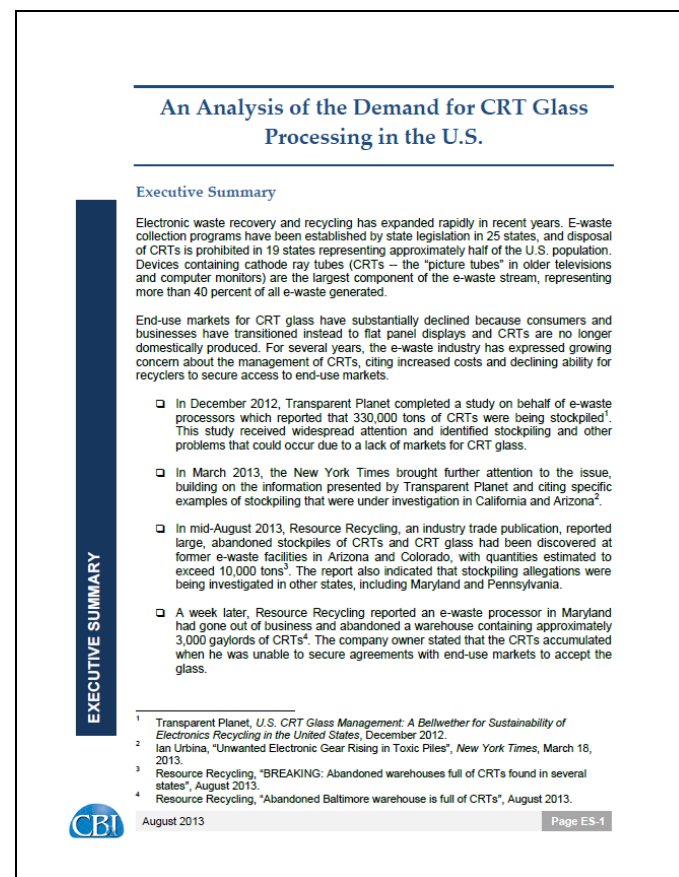
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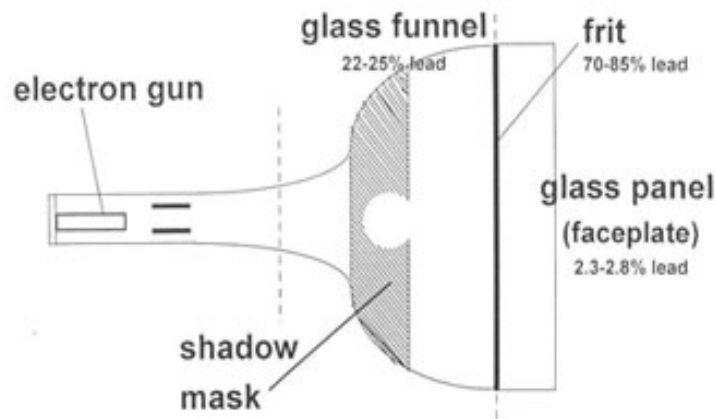
CRT Glass White Paper

- Kuusakoski Recycling retained Shaw Environmental, Inc. (Shaw), a CB&I Company, to evaluate the CRT glass market in the U.S.
- “An Analysis of the Demand for CRT Glass Processing in the U.S.” was released to the public on September 9, 2013
 - Available to download at <http://kuusakoski.us/white-paper/>



What is a CRT?

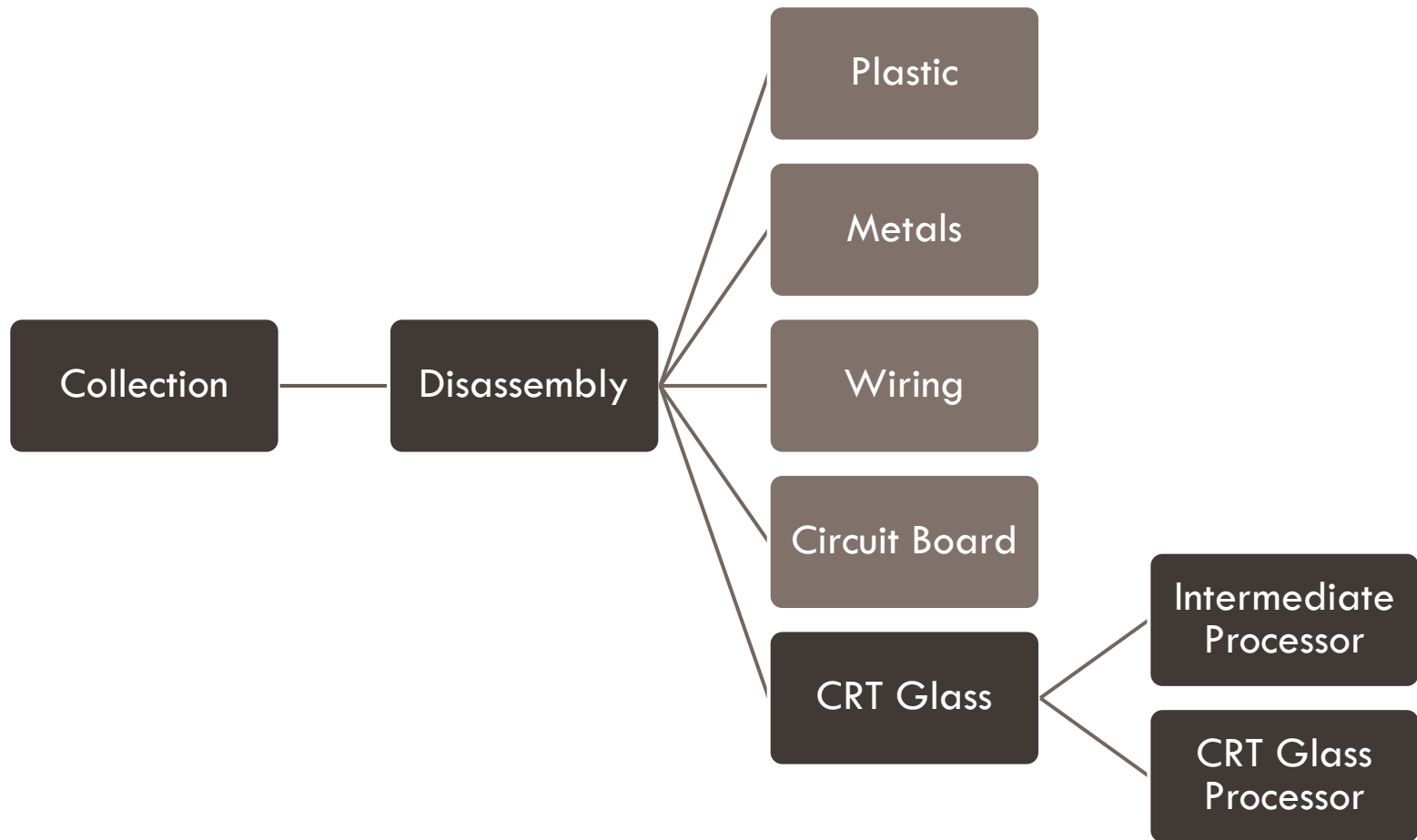
- Cathode ray tubes (CRTs) are the “picture tube” in older televisions and computer monitors



- CRT devices represent nearly one-half of the e-waste stream
- The CRT is mostly glass, comprising 60-70% of the weight of the TV or monitor
 - 30% of the glass (i.e. funnel & frit portion) contains high levels of lead, resulting in the glass being characterized as hazardous waste



CRT Recovery Process Flow



Concerns About CRT Glass Management

- E-waste processors have grown increasingly concerned about:
 - Costs of managing CRT glass
 - Availability of markets to manage CRT glass

- Large quantities of CRT glass are reportedly being stored or abandoned:

New York Times cites facilities in Arizona under investigation for stockpiling

Resource Recycling reports on an estimated 10,000+ tons of abandoned CRTs in AZ, CO, and more expected in MD, PA

E-Scrap News reports that Basel Action Network alleges 9 million pounds of CRT glass abandoned in AZ

Dec '12

Jan '13

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Transparent Planet issues report estimating 330,000 tons of CRTs are being stockpiled

Resource Recycling reports 3,000 gaylords of CRTs found at abandoned facility in Baltimore



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Factors Influencing CRT Glass Management

- Changes in display technologies from CRTs to flat panels
- Laws mandating recovery of e-wastes
- Laws banning disposal of e-wastes



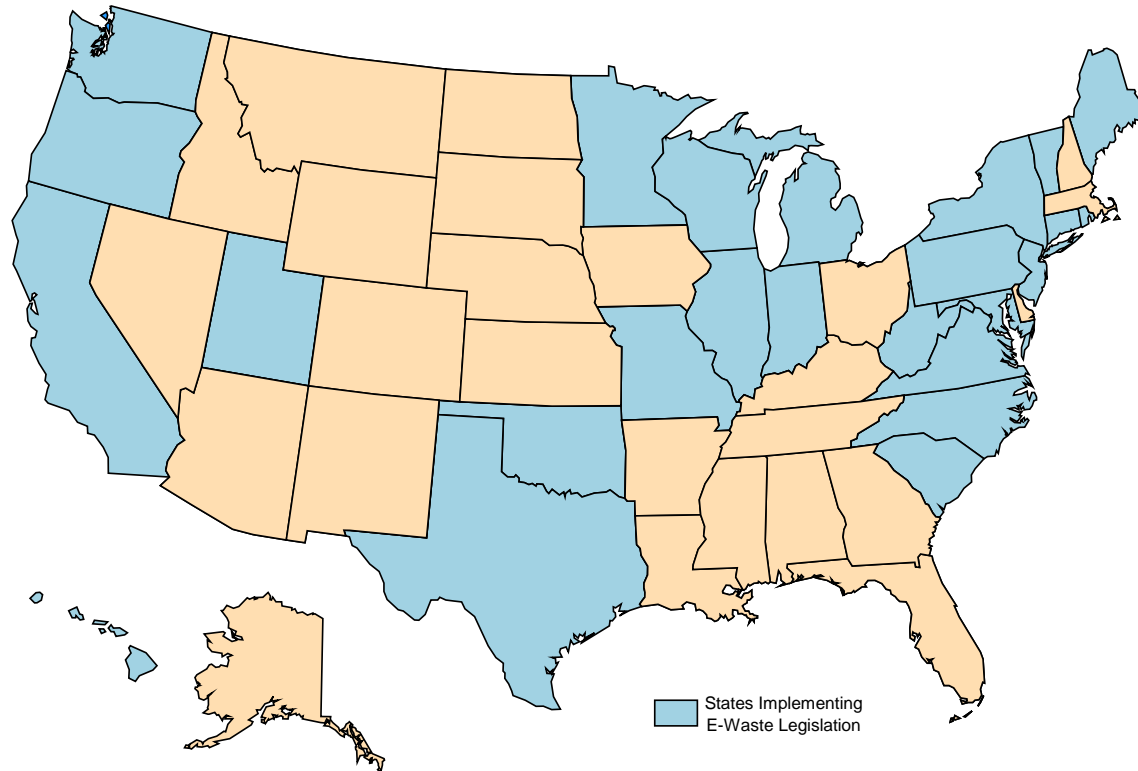
Impact of Technology Shift from CRTs to Flat Panels

- Sales of CRT devices in the U.S. dropped significantly beginning in 2000
- Historically, recovered CRT glass was principally used to make new CRTs
- With the shift to flat panels in the U.S. and other countries, CRT glass is no longer in demand



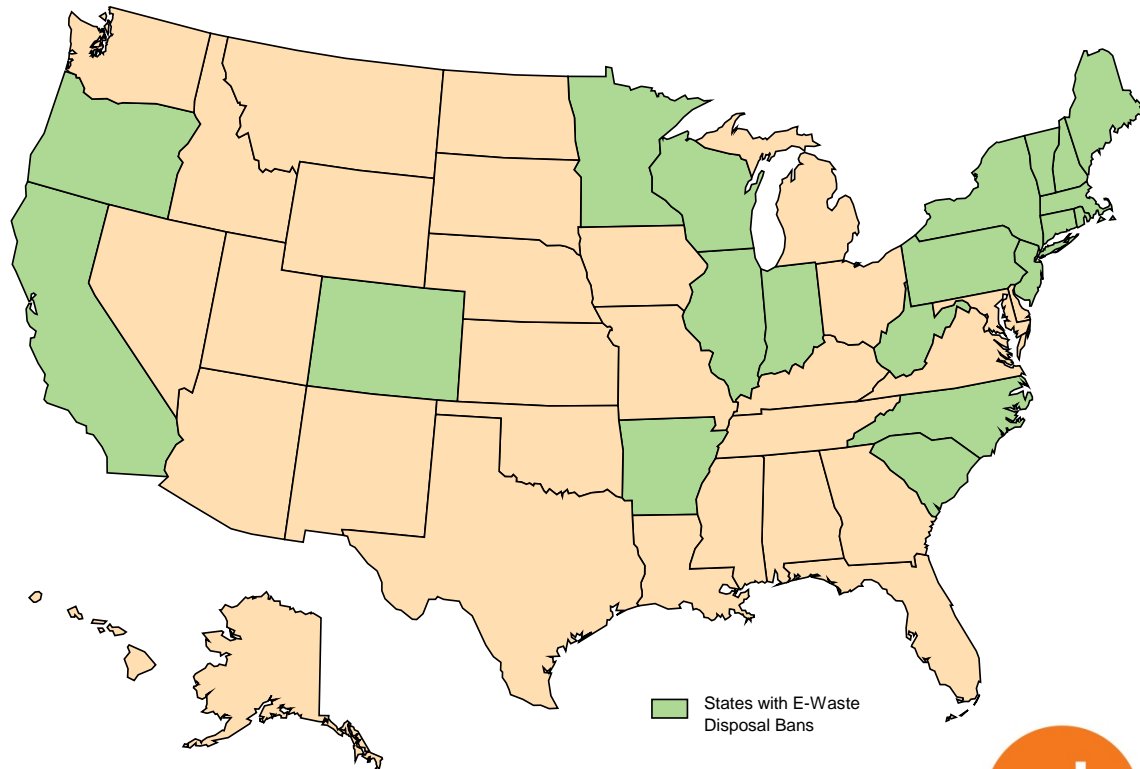
E-Waste Recovery Laws

- 25 states have passed legislation requiring recovery and recycling of e-waste, including CRT devices



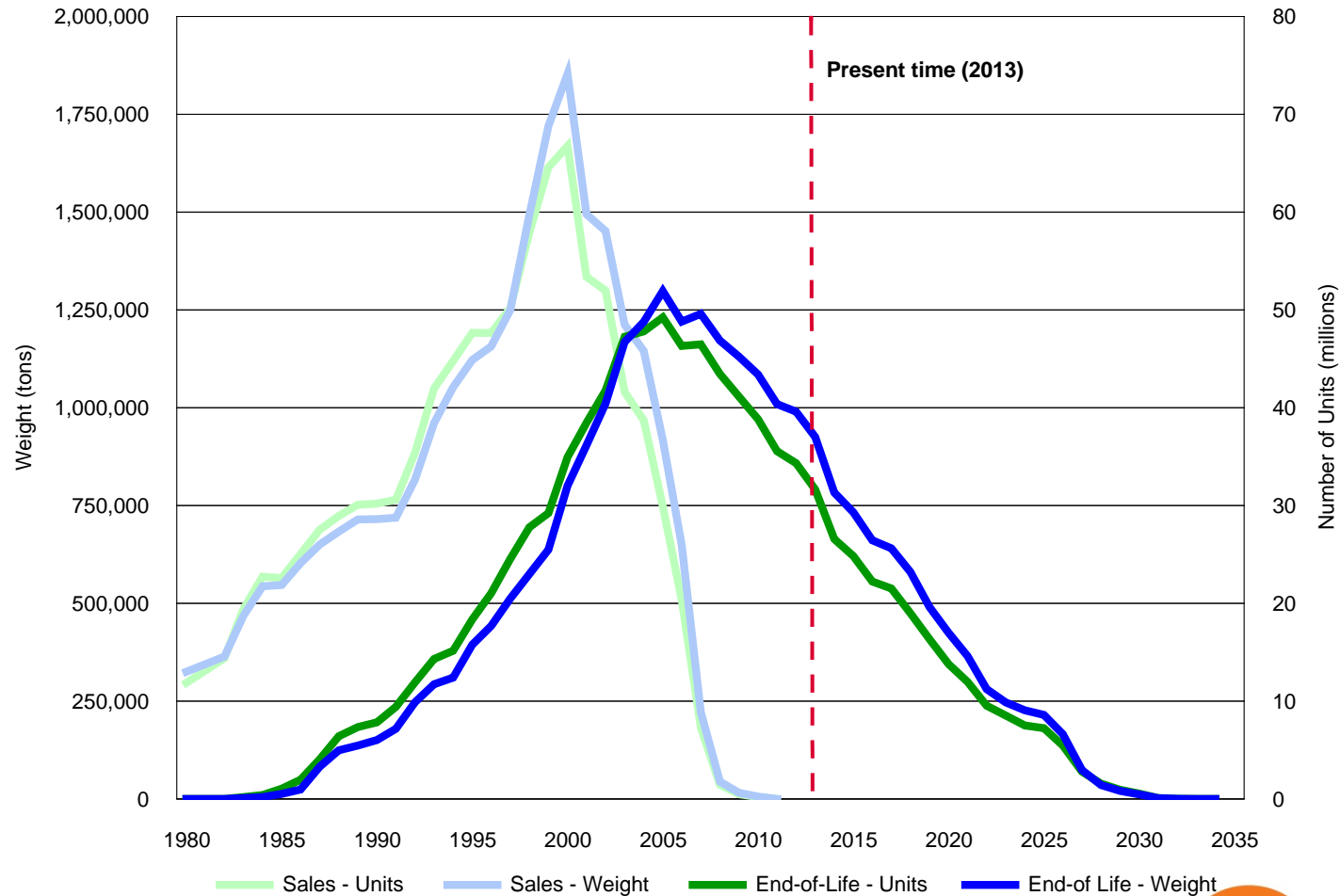
E-Waste Disposal Bans

- 19 states have implemented bans on disposal of e-waste in landfills
 - These states represent about half of the U.S. population



CRT Sales and End-of-Life Projections

- Between 1980 and 2010, more than 979 million CRT devices were sold
- With a life of up to 23 years, all CRTs are projected to be discarded by 2033

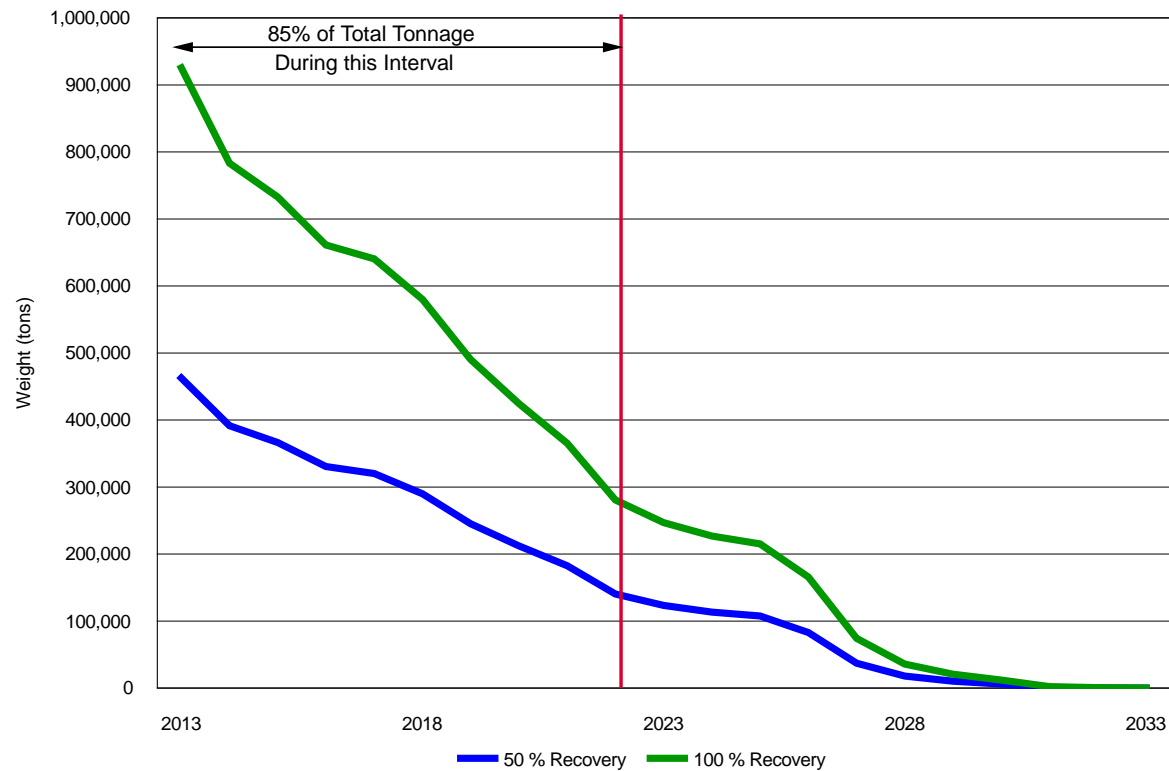


Source: U.S. EPA, Electronics Waste Management in the United States Through 2009, May 2011.

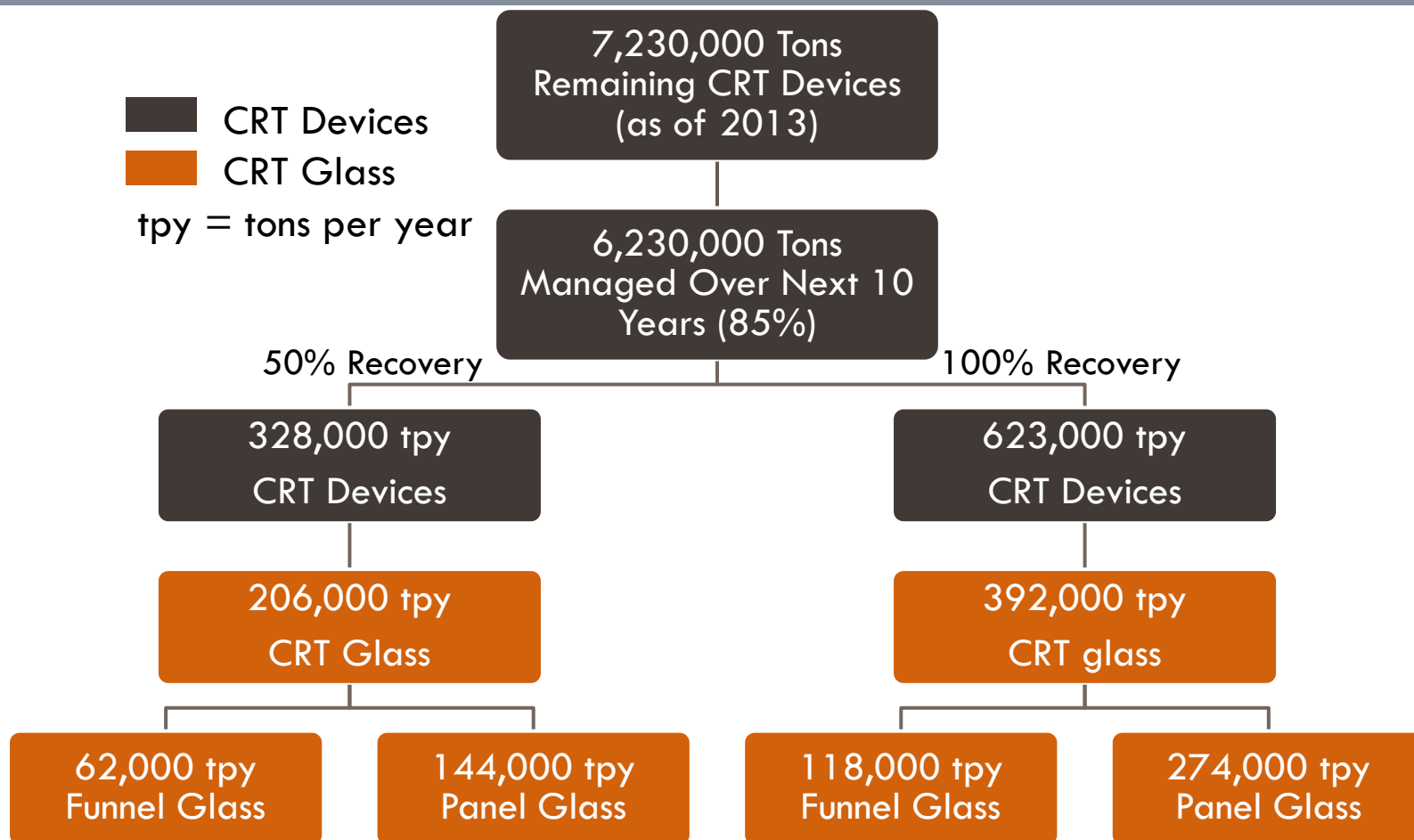
CRT Devices Reaching End-of-Life (2013-2033)

- 85% of remaining CRTs are expected to require management by 2022
 - This is an immediate, short-term concern

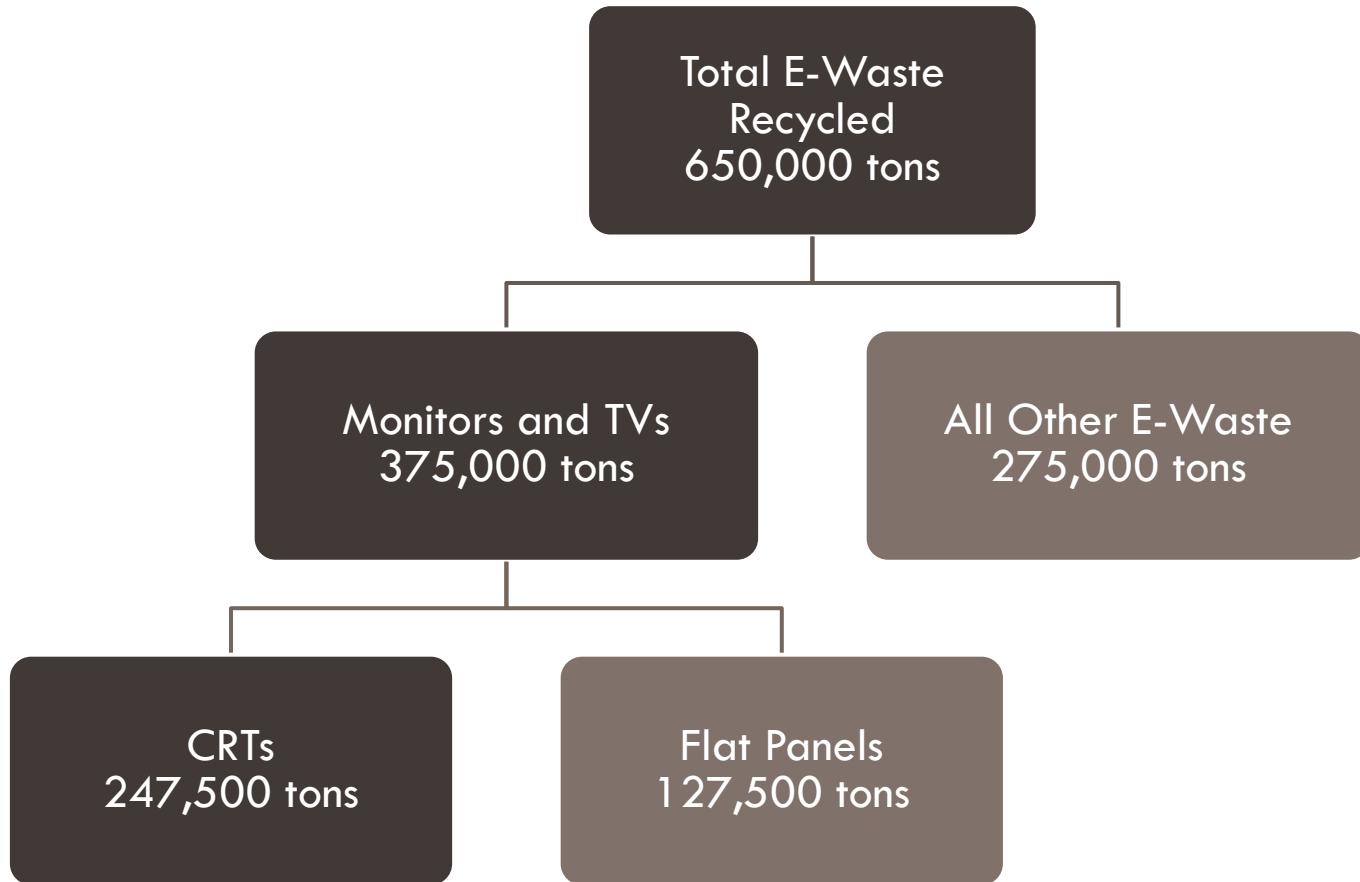
- At a minimum, half of these devices are projected to be in states with disposal bans in place
 - More than half are likely to be recovered for recycling, since e-waste recovery is occurring in other states as well



CRT Projections: 2013-2022

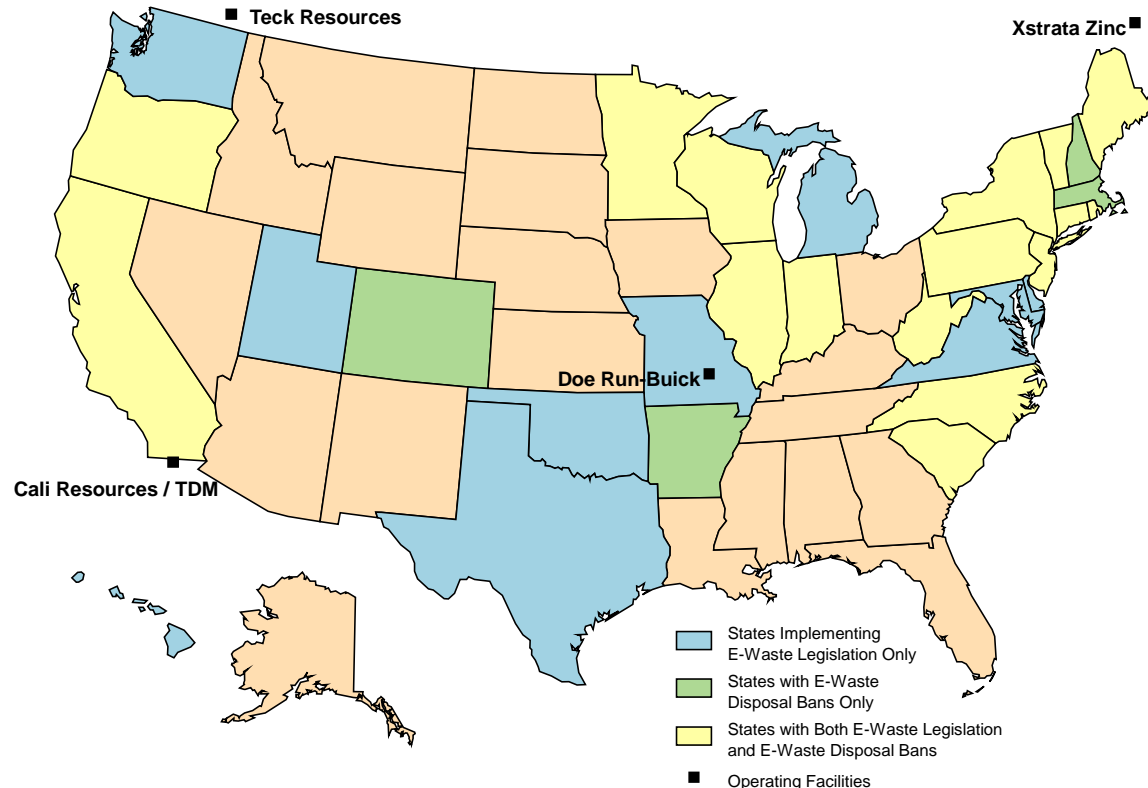


E-Waste Recycling: 2010

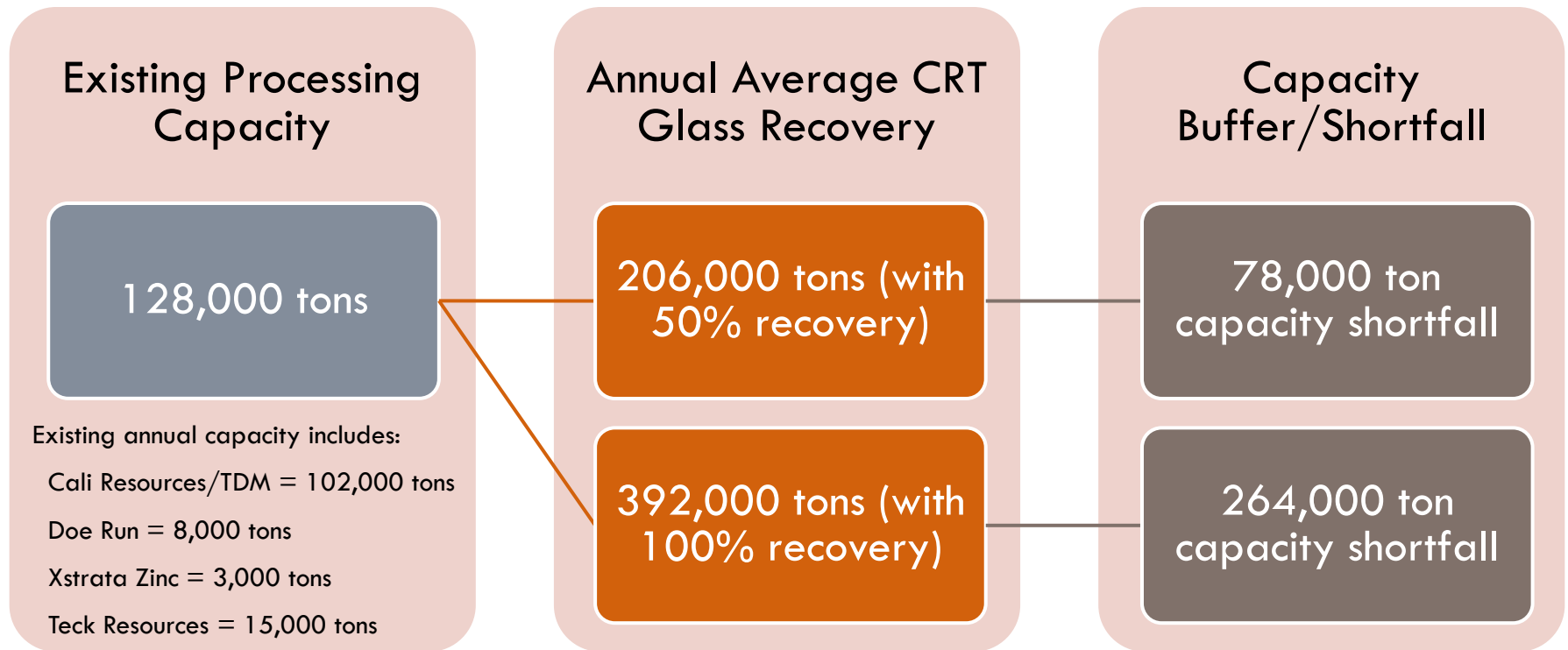


Existing CRT Glass Processing Capacity

- There are 4 existing facilities processing CRT glass
 - 80% of capacity is at one facility, a glass-to-glass processor
 - Only one facility in the U.S.



Existing CRT Glass Processing Capacity



Average recovery is calculated over 10 years; projected annual recovery is much greater in the near term than shown above



Concerns About Capacity Shortfalls

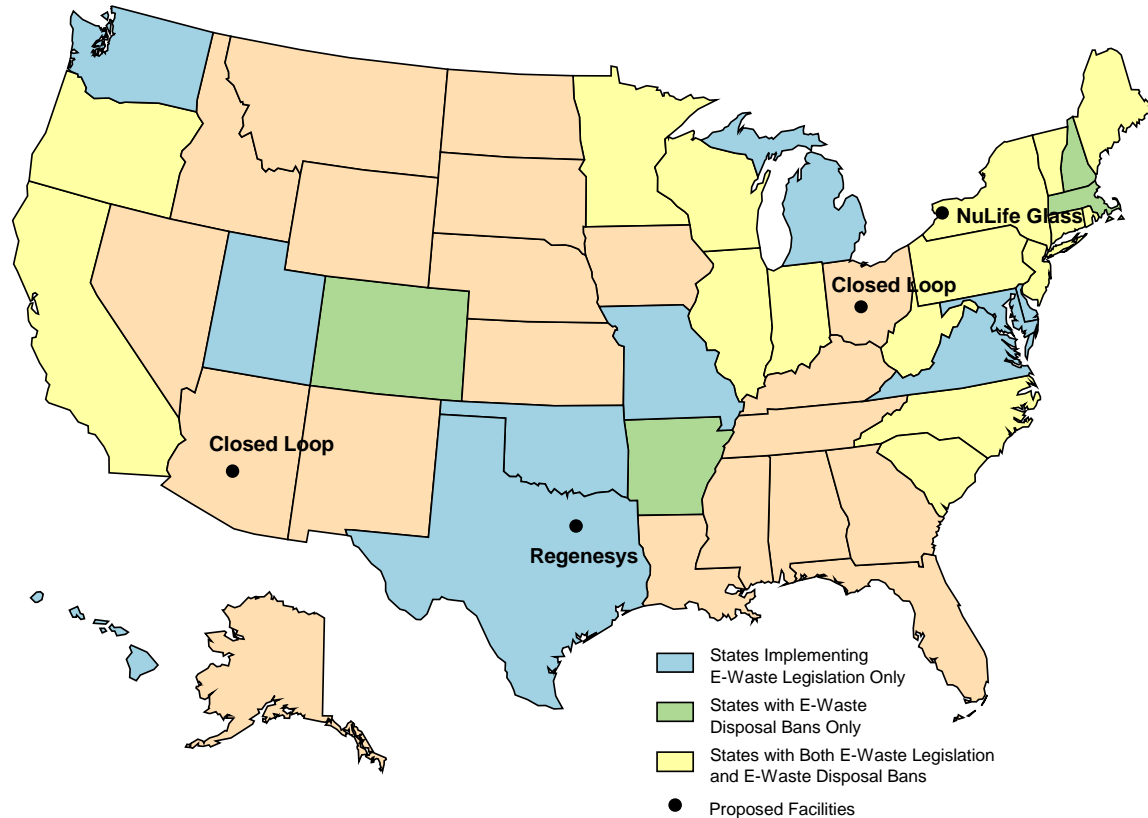
- A number of agencies have cited concerns about outlets for CRT glass:
 - CalRecycle (California)
 - Wisconsin DNR
 - United Nations Environment Programme
 - U.S. International Trade Commission

- Industry trade associations and publications have also identified concerns:
 - Institute of Scrap Recycling Industries
 - Waste Management World
 - Waste & Recycling News

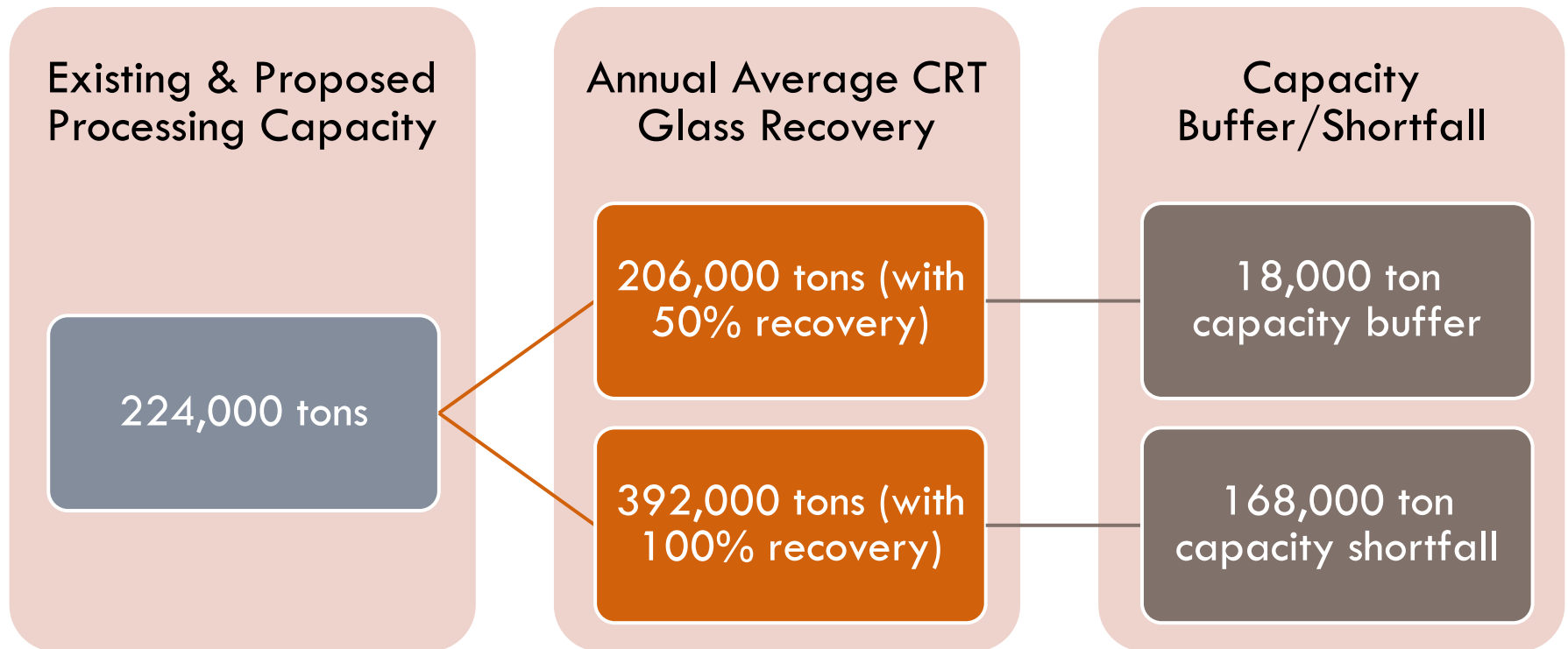


Proposed CRT Glass Processing Capacity

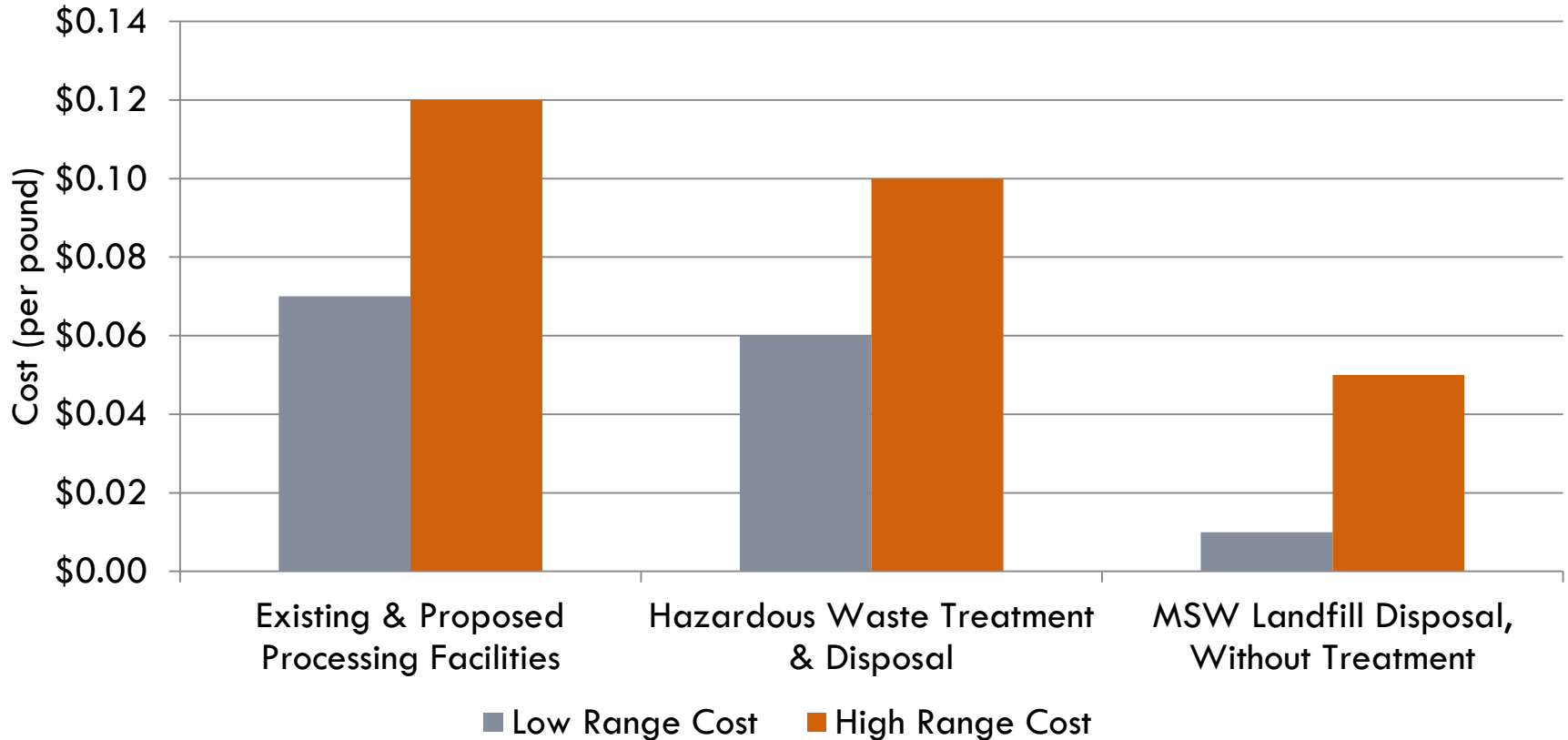
- Four new leaded glass smelting facilities have been proposed in the U.S.
- None of them are operating



CRT Glass Processing Capacity Review



CRT Glass Processing Costs



Transportation costs are not included above and generally add \$0.03-0.04 per pound within 400 miles and \$0.05-0.06 per pound or more at greater distances



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KleanKover Recycling Solution

- Kuusakoski and PDC have developed a comprehensive solution for CRT glass
 - Options analysis began in April 2012
 - Contract finalized in May 2013
 - Fully operational in November 2013

- Kuusakoski generates crushed CRT glass at its Peoria Glass Recycling Facility from:
 - Dismantling of whole CRT devices
 - Bare CRTs from e-waste processors
 - Broken or crushed CRT glass from e-waste processors



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KleanKover Recycling Solution

- Why does CRT funnel glass have to be managed differently as compared to other e-waste materials?
 - CRT funnel glass typically exhibits toxicity for lead (D008)
 - Toxicity characteristics are found in 40 CFR 261.24, Table 1
 - Lead-bearing CRT funnel glass is prohibited from being disposed in a Subtitle D (i.e. nonhazardous) landfill because of its toxicity characteristics (i.e. ≥ 5 ppm TCLP lead)



KleanKover Recycling Solution

40 CFR 261.24 Table 1

TABLE 1—MAXIMUM CONCENTRATION OF CONTAMINANTS FOR THE TOXICITY CHARACTERISTIC

EPA HW No. ¹	Contaminant	CAS No. ²	Regulatory Level (mg/L)
D004	Arsenic	7440-38-2	5.0
D005	Barium	7440-39-3	100.0
D018	Benzene	71-43-2	0.5
D006	Cadmium	7440-43-9	1.0
D019	Carbon tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100.0
D022	Chloroform	67-66-3	6.0
D007	Chromium	7440-47-3	5.0
D023	o-Cresol	95-48-7	⁴ 200.0
D024	m-Cresol	108-39-4	⁴ 200.0
D025	p-Cresol	106-44-5	⁴ 200.0
D026	Cresol	⁴ 200.0
D016	2,4-D	94-75-7	10.0
D027	1,4-Dichlorobenzene	106-46-7	7.5
D028	1,2-Dichloroethane	107-06-2	0.5
D029	1,1-Dichloroethylene	75-35-4	0.7
D030	2,4-Dinitrotoluene	121-14-2	³ 0.13
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its epoxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	³ 0.13
D033	Hexachlorobutadiene	87-68-3	0.5
D034	Hexachloroethane	67-72-1	0.0
D008	Lead	7439-92-1	5.0



KleanKover Recycling Solution

- How can PDC dispose of CRT funnel glass in a Subtitle D Landfill?
 - 40 CFR Part 268 subpart D establishes Treatment Standards for hazardous waste
 - A prohibited waste identified in the table may be land disposed only if it meets the requirements found in the table
 - Compliance with treatment standards is measured by an analysis of grab samples, unless otherwise noted



KleanKover Recycling Solution

Treatment Standards Table
40 CFR 268.48 Universal Treatment Standards (UTS) Metals

Regulated Constituent common name	CAS Number	Concentration in mg/l	Concentration in mg/kg unless noted as "mg/l TCLP"
Antimony	7440-36-0	1.9	1.15 mg/l TCLP
Arsenic	7440-38-2	1.4	5.0 mg/l TCLP
Barium	7440-39-3	1.2	21 mg/l TCLP
Beryllium	7440-41-7	0.82	1.22 mg/l TCLP
Cadmium	7440-43-9	0.69	0.11 mg/l TCLP
Chromium (Total)	7440-47-3	2.77	0.60 mg/l TCLP
Lead	7439-92-1	0.69	0.75 mg/l TCLP
Mercury - All Others	7439-97-6	0.15	0.025 mg/l TCLP
Nickel	7440-02-0	3.98	11 mg/l TCLP
Selenium	7782-49-2	0.82	5.7 mg/l TCLP
Silver	7440-22-4	0.43	0.14 mg/l TCLP
Thallium	7440-28-0	1.4	0.20 mg/l TCLP
Vanadium	7440-62-2	4.3	1.6 mg/l TCLP
Zinc	7440-66-6	2.61	4.3 mg/l TCLP

Note: PDC must also meet 40 CFR 268.48 standards for Underlying Hazardous Constituents (UHCs) as well. Vanadium and Zinc are not UHCs.



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KleanKover Recycling Solution

- What is PDC's treatment process for CRT glass?
 - Hazardous stabilization process whereby the CRT funnel glass is physically and chemically changed so that the leachability of the lead content in the glass is virtually immobilized
 - PDC accepted crushed CRT glass from Zenith's manufacturing facility in Melrose Park, IL for treatment and disposal from 1989 to 1998
 - PDC is now using the same treatment technology it has developed for the delisting of K061 Electric Arc Furnace (EAF) dusts generated by steel mills, the largest hazardous waste stream generated by volume in the U.S. today, on crushed CRT funnel glass generated by e-waste collectors/processors



KleanKover Recycling Solution

- The treatment process was approved for the delisting of K061 EAF dust by the Illinois Pollution Control Board (IPCB) in January 2009
- The K061 delisting order issued by the IPCB requires PDC to meet the UTS standards for antimony, arsenic, barium, beryllium, cadmium, total chromium, lead, mercury, nickel, selenium, silver, thallium, vanadium and zinc
- Since PDC is using the same treatment technology for CRT glass as it is using for K061 EAF dust, this means that PDC is voluntarily analyzing for many more metals, **not just lead**
- PDC typically achieves treatment results for CRT funnel glass at or below laboratory instrumentation detection levels for lead (i.e. <0.02 ppm)



KleanKover Recycling Solutions

□ Important Note:

- Based on the EPA regulations, CRT panel glass (i.e. non Focus Material) can be disposed of in a Subtitle D landfill at a lead concentration level of **4.99 ppm or less**
- CRT funnel glass (i.e. Focus Material) can only be disposed of in a Subtitle D landfill post-treatment at a lead concentration level meeting UTS of **0.75 ppm or less**
- Based on PDC's experience, the treated CRT glass is being disposed at its Indian Creek Landfill at lead concentrations well below the UTS, i.e. **0.02 ppm**



KleanKover Recycling Solution

- PDC transports crushed glass to its Waste Stabilization Facility (WSF)
 - PDC is a licensed hazardous waste hauler; leaded CRT glass is managed as a hazardous waste prior to treatment
 - WSF has not received an environmental violation since 1991; during this time, over 500 unannounced inspections have been performed by IEPA
- Crushed glass is treated, rendering it non-hazardous and the lead relatively non-leachable
 - Delivered glass is <6"; PDC further crushes it to <2"
 - Proprietary chemical treatment reagent blend, and water, is added in mixing unit
 - Samples of treated CRT glass are collected for TCLP analyses to verify compliance with EPA Universal Treatment Standards



Crushed CRT Glass



Waste Stabilization Facility



Treated CRT Glass



KleanKover Recycling Solution

- PDC transports treated CRT glass to Indian Creek Landfill for use as alternative daily cover (ADC)
 - Permitted for use by IEPA in November 2012
 - All treated CRT glass is used as ADC at Indian Creek Landfill, and is tracked and recorded accordingly
 - Non-hazardous CRT panel glass is also permitted by IEPA for use as ADC, if Kuusakoski does not have a viable market for panel glass
 - Indian Creek Landfill has 30 or more years of disposal capacity, with room to expand
 - Since opening in July 2004, Indian Creek Landfill has not received a single environmental violation from IEPA or the Tazewell County Health Dept.
- PDC applied for a provisional patent and service mark for KleanKover with the U.S Patent and Trademark Office in July 2013



Indian Creek Landfill



KleanKover Placed as ADC

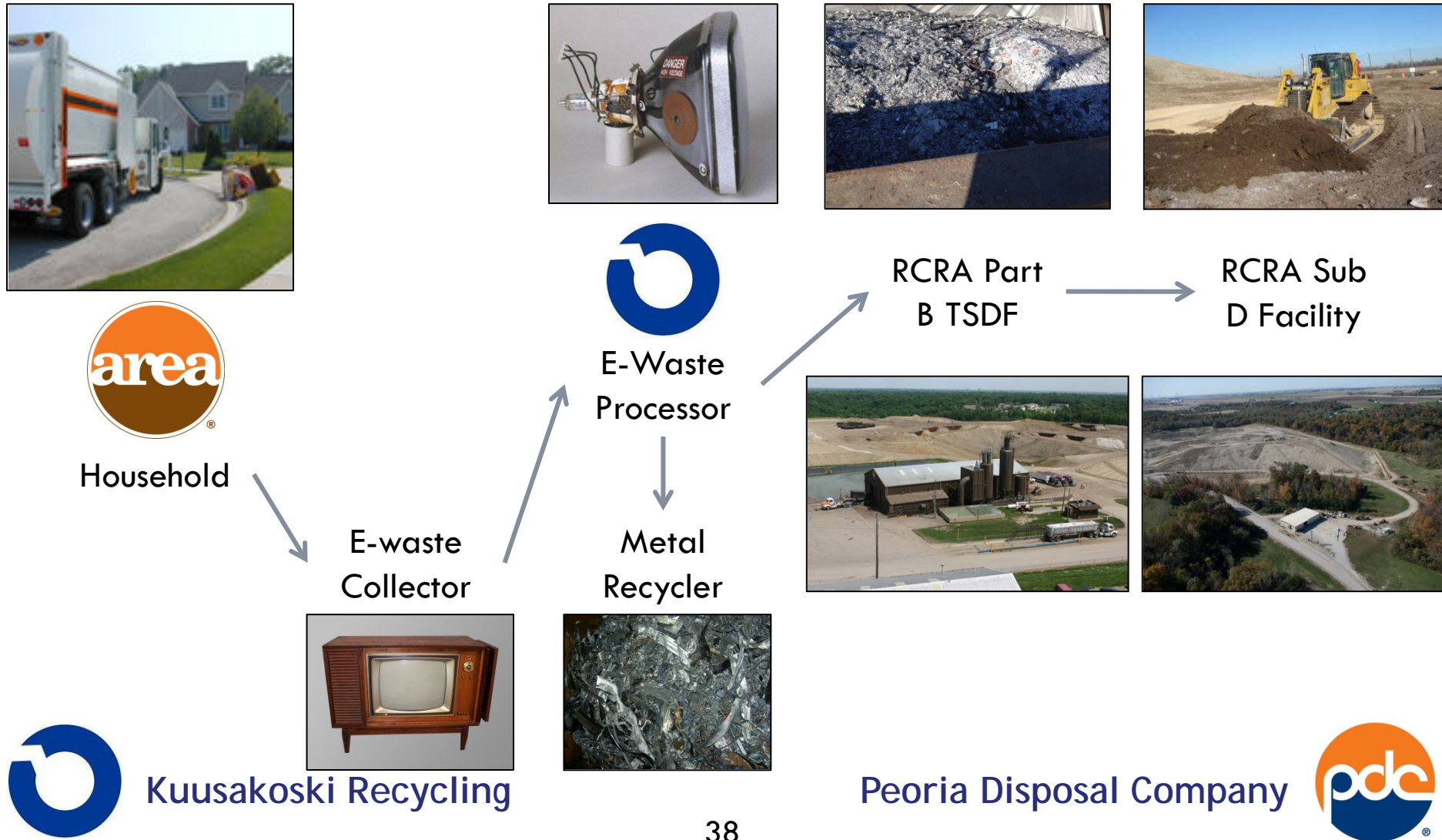


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Process Flow: From CRT Device to KleanKover



Benefits of the KleanKover Recycling Solution

- All processing, treatment, and end use facilities are fully permitted and operational
- Current capacity to manage leaded CRT glass is 50,000 tons per year, with potential to increase to 100,000 tons per year
- Cost is at the lower end of the range of current and proposed processing options, with upper end of cost to deliver to Kuusakoski of \$0.075 per pound (\$150 per ton)
- In addition to its 30 year post closure fund, Indian Creek Landfill has an established Perpetual Care Fund to provide monitoring and maintenance of the landfill into perpetuity, exceeding federal and state requirements for post-closure care
- Indian Creek Landfill currently has over \$4,900,000 and \$500,000 of cash assets in its post-closure and perpetual care funds, respectively; these funds cannot be withdrawn without the approval of the IEPA and County of Tazewell, Illinois



Compliance with Illinois E-Waste Law

Illinois Electronic Products Recycling and Reuse Act (EPRRA) says the following:

Section 10

“Recycler” means a person who engages in the recycling of CEDs or EEDs...

“Recycling” means any method, technique, or process by which CEDs or EEDs that would otherwise be disposed of or discarded are instead collected, separated, or processed and are returned to the economic mainstream in the form of raw materials or products. “Recycling” includes the collection, transportation, dismantling and shredding of CEDs or EEDs.



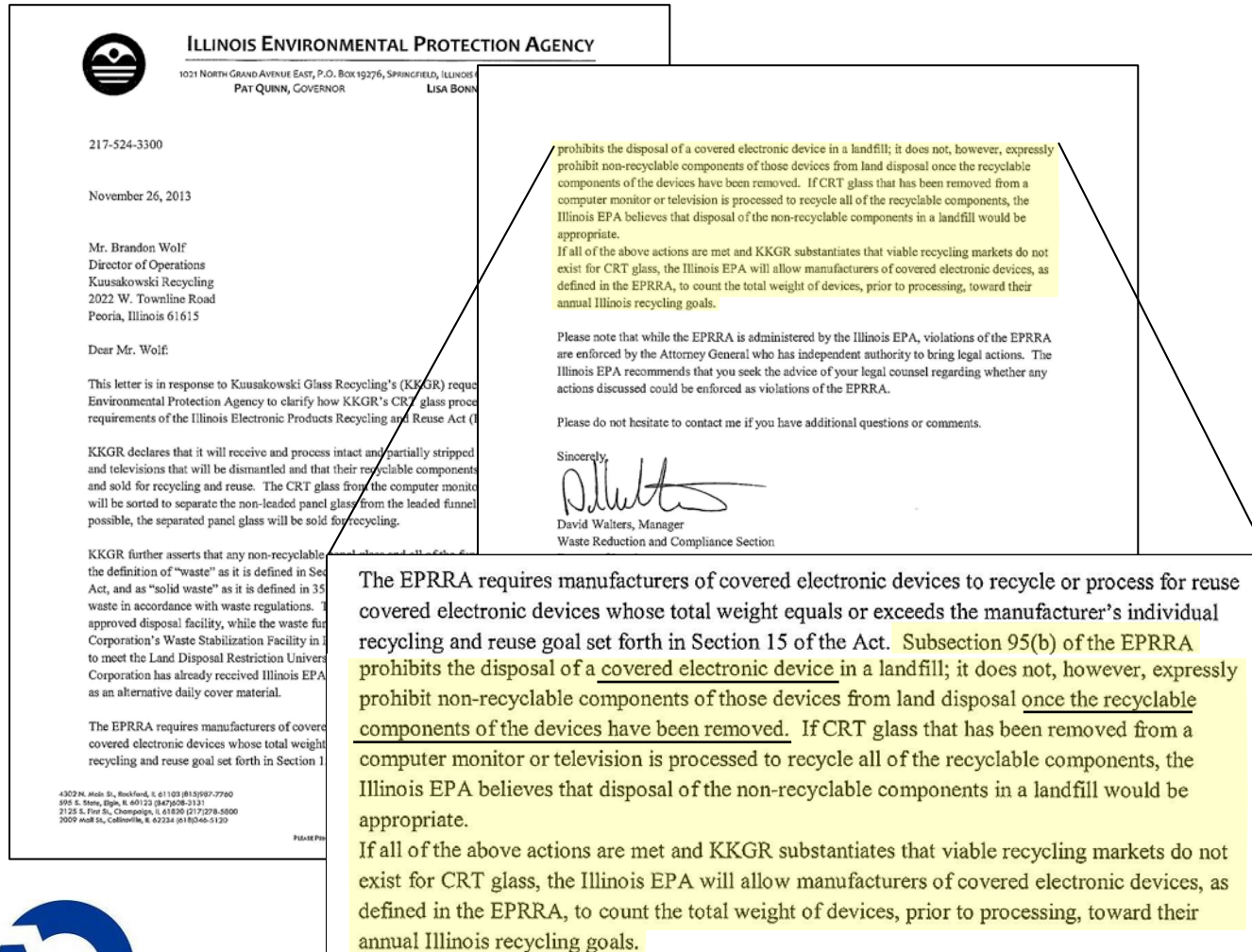
Compliance with Illinois E-Waste Law

Section 15 (C-5)

For program year 2013 and thereafter and for each of the following categories of electronic devices, each manufacturer shall recycle or reuse at least 50% of the total weight of the electronic devices that the manufacturer sold in that category in Illinois during the calendar year 2 years before the applicable program year: computers, monitors, televisions.....



Compliance with Illinois E-Waste Law



- IEPA also confirms that covered electronic device manufacturers may include the total weight of electronic devices, including intact and partially stripped TVs and computer monitors managed at Kuusakoski's Peoria Glass Recycling Facility, toward the manufacturer's goals under section 15



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Kuusakoski/PDC Partnership Terms

- Exclusive contractual agreement between Kuusakoski and PDC:
 - Kuusakoski delivers all crushed CRT funnel glass to PDC's Waste Stabilization Facility
 - Kuusakoski does not have to deliver all crushed CRT panel glass to PDC's Indian Creek Landfill
 - PDC only accepts crushed CRT glass from Kuusakoski, unless other mutually agreeable arrangements are made
 - PDC commits to provide at least 50,000 tons per year of capacity for CRT glass; even if Kuusakoski delivers 50,000 tons per year of CRT glass to PDC for treatment, this still will not take care of the daily cover needs for Indian Creek Landfill on an annual basis
 - Treated CRT funnel glass has to be used as ADC at Indian Creek Landfill



Kuusakoski/PDC Partnership

- Please schedule a tour to see our Peoria, Illinois recycling and disposal facilities



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