

Analysis of Discarded CRTs in Florida: Volume Projections & Disposal Management Options

Technical Awareness Group (TAG)
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Problem

- Many CRTs are becoming obsolete
 - Advances in technology
 - Computer monitors: from CRTs to LCDs
 - Televisions: from CRTs to LCDs and plasma
 - Conversion to digital over-the-air television broadcast in Feb 2009
- CRTs are a major component of electronic and hazardous waste stream



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Background

- ~100 million TVs, computers, and monitors become obsolete each year
 - Lifespan of electronics is 18+ months
 - E-waste increases 16-28% each year
- 2 million tons of e-waste in landfills and incinerators, with 10-15% recycled
 - CRTs are 1/3 of this mass
 - Each CRT contains 4-8 lbs of lead



(www.crt-recycler.com)



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E-waste Stewardship

- Currently, no federal e-waste management strategy
 - US Senate hearing on e-waste (7.26.2005)
 - US Congress Concept paper on e-recycling & the National Electronic Products Stewardship Act (NEPSA) (2.02.2008)
 - US House Science and Technology Committee hearing on e-waste (4.30.08)
- So far, 13 states have e-waste legislation
 - MA, CA, ME, MN have banned CRT disposal in municipal landfills
- Europe passed the Waste Electrical and Electronic Equipment (WEEE) Directive in 2003



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States with E-waste Bans

State	Date Law passed	Effective date of ban	Ban on landfilling	Ban on incineration	Items that are banned
Massachusetts		4.11.00	Yes	Yes	CRTs; any intact, broken or processed glass tube used to provide the visual display
California	Aug. 2001	2002; 2006	Yes	No	CRTs since 2001. From Feb. 2006 universal waste (this includes electronic devices)
Minnesota	2003	7.01.06	Yes	No	Electronic items containing CRTs
Maine	2004	7.20.06	Yes	No	Electronic items containing CRTs (no size restriction)
Arkansas	3.18.05	1.01.08	Yes	No	Computer & electronic equipment (not clearly defined)
New Hampshire	5.24.06	7.01.07	Yes	Yes	Video display devices (CRTs, LCDs, gas plasmas, digital light processing or other image projection technology greater than 4' diagonally)
Rhode Island	July 2006	7.01.08	Yes	No	Desktop computers (including CPUs), Computer monitors (CRTs, flat panels), laptops; TVs (CRTs, LCDs, plasma); video display devices screen size greater 4" that contain circuit boards
Oregon	6.07.07	1.01.10	Yes	No	Desktop computers, laptops, TVs and monitors with diagonal screen size greater than 4"
Connecticut	July 2007	1.01.11	Yes	Yes	TVs, monitors, PCs, laptops
North Carolina	8.31.07	Jan. 2012	Yes	Yes	Computers, monitors, laptops, key boards, mice; Does not apply to TVs
New Jersey	1.15.08	1.01.10	Yes	Yes	TVs, monitors, computers, laptops
New York City	4.01.08	Manufacturer: 7.01.09 Others: 7.01.10	Yes	Yes	Computers, monitors, laptops, TVs, printers, key boards, mice

Source:

http://www.e-takeback.org/docs%20Open/Toolkit_Legislators/state%20legislation/States%20with%20Disposal%20Ban%20laws.pdf



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We Need Answers

What are the:

- Trends in the volume of CRTs discarded in Florida – both currently and expected in the near future?
- Currently available infrastructure for handling disposed CRTs from Florida?
- Current capacities of existing disposal and recycling facilities for CRT components? Will they be able to handle future volumes?
- Current practices in Florida for CRT disposal management? How can they be improved?



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Research Objectives

1. Consolidate data on CRT waste volume and current management practices in Florida.
2. Develop a model to predict future CRT quantities in Florida and analyze management options.
3. Analyze CRT disposal management options for Florida.



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Methodology

- Track CRTs throughout the life cycle - from production to use to recycling/reuse and disposal
- Focus on discarded CRTs from both televisions and computer monitors
- Expected outcomes:
 - Current trends and projections for CRT disposal
 - Analysis and comparison of management options for CRTs



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Task 1: Data Collection

- Goal: Obtain a snapshot of current and recent trends and practices in Florida
- Expected Outcome: Detailed data to form basis for predicting future trends
- Approach:
 - Data from FDEP and US EPA reports, previous surveys, and literature
 - Conduct surveys and interviews with recyclers, solid waste facilities, and donation centers



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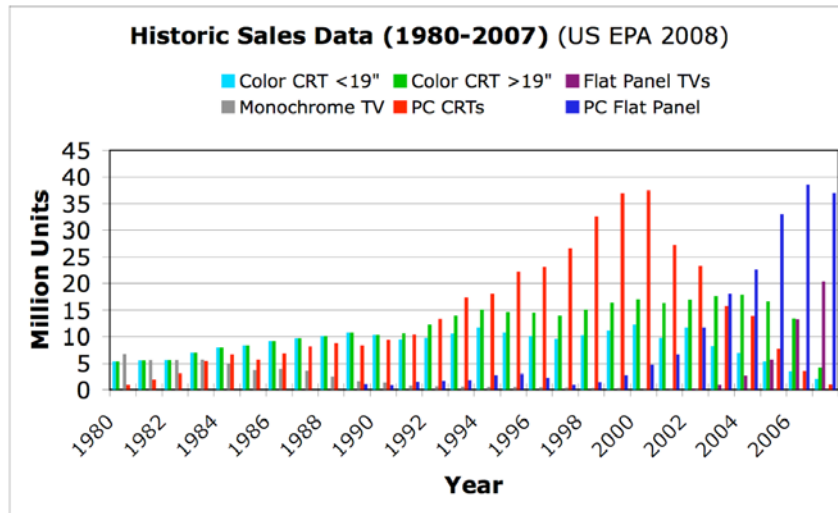
Task 1: Data Collection

- Data on CRT quantity and disposal estimates
 - Historical data on production and sales
 - Household and industrial statistics
 - Amount of CRTs in waste stream
- Data on reuse/disposal facilities & practices
 - Locations, capacities, limitations, fees, costs
 - Current practices used in Florida and elsewhere



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Historic Sales Data



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Task 2: Future Volumes and Infrastructure

- Goal: Develop spreadsheet-based CRT waste analysis model
- Expected Outcomes:
 - Estimate future CRT waste stream
 - Identify critical infrastructure needs
 - Estimate costs of CRT waste management
- Using data from Task 1, track life cycle of CRTs



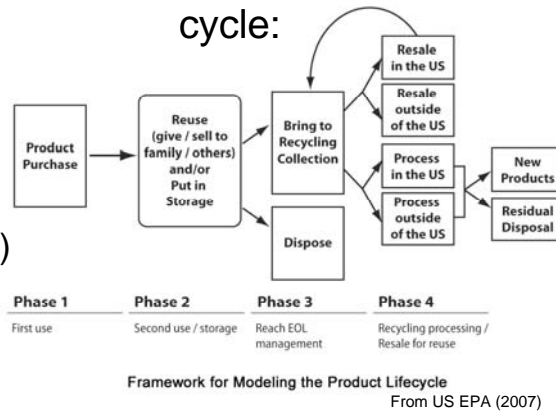
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Task 2: Future Volumes and Infrastructure

■ Approach:

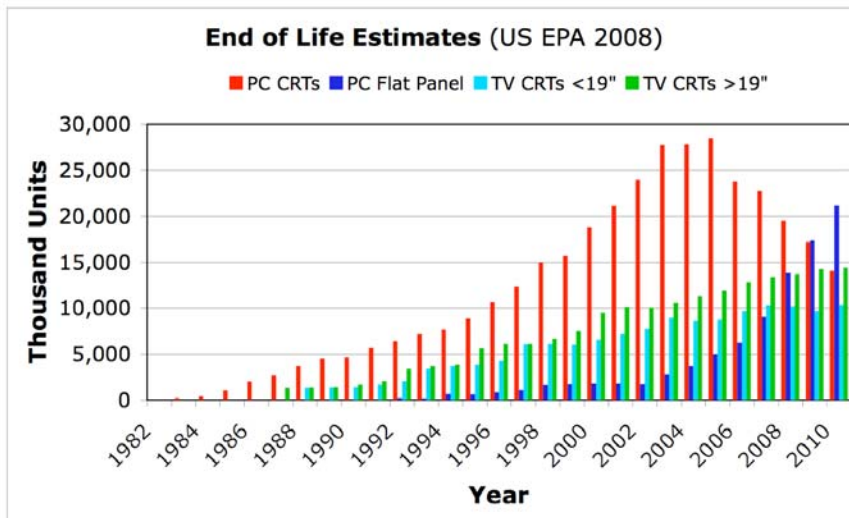
- Materials balance and flow modeling and analysis
- Based on US EPA (2007) and Kang and Schoenung (2006)

■ Example CRT life cycle:



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Estimated Ready for EOL Mangt



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Where Are the CRTs?

Electronics sold
1980-2007 in
storage as of
2007:

Desktop computers: 65.7 million
Desktop monitors: 42.4 million
Notebook computers: 2.1 million
Hard copy peripherals: 25.2 million (printers, copiers, faxes, multi's)
TOTAL: 234.6 million units in storage

E-Waste in 2007 – Was it Trashed or Recycled

For electronics
sold 1980-2007

Products	Total disposed** (million of units)	Trashed (million of units)	Recycled (million of units)	Recycling Rate (by weight)
Televisions	26.9	20.6	6.3	18%
Computer Products*	205.5	157.3	48.2	18%
Cell Phones	140.3	126.3	14	10%

*Computer products include CPUs, monitors, notebooks, keyboards, mice, and "hard copy peripherals", which are printers, copiers, multi's and faxes.

**These totals don't include products that are no longer used, but stored.

Source: EPA, 2008



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After Collection, Where do CRTs Go?

End Markets for EOL TVs and CRT Monitors Collected for Recycling in the U.S. in 2005

End Market	Tons/Year	% of Total
Resale "as is" or after some repair/upgrade in the U.S.	3,000	2%
Resale "as is" or after some repair/upgrade abroad	3,500	2%
Refurbishing or remanufacturing into specialty monitors in the U.S.	2,500	1%
Refurbishing or remanufacturing into new TVs or specialty monitors abroad*	107,500	61%
CRT glass-to-glass factories in the U.S.	4,000	2%
CRT glass-to-glass factories abroad	24,000	14%
CRT glass to smelters in North America for lead recovery **	10,000	6%
Plastic, metal, and other material recovery from demanufacturing***	20,500	12%
Total	175,000	100%

Source: World Reuse, Repair and Recycling Association, 2005. Figures for CRT glass-to-glass factories are based on EPA research.

*Industry experts interviewed by Robin Ingentron report that about 30% of material destined for remanufacturing abroad is not technically suitable for remanufacturing and has to be recycled or disposed. The recycling or disposal of unsuitable units occurs abroad.

**Includes units shipped to one smelter in each of the U.S. and Canada.

***End markets for these materials are both domestic and abroad.



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Task 3: Management Tool

- Goal: Develop spreadsheet management tool
- Expected Outcome: Provide end users ability to analyze management options and scenarios
- Management tool will incorporate:
 - Data from Task 1 and flow modeling from Task 2
 - Economic costs and facility and policy constraints



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Task 3: Management Options

Approach:

- Analyze & compare management scenarios:
 - Existing waste stream and infrastructure options based on current data (Task 1).
 - Existing waste stream and infrastructure options based on projections on future CRT waste stream (Task 2).
 - Disposal of CRTs in landfills is banned and 50% of CRTs must be recycled, based on future CRT projections.
 - Disposal of CRTs in landfills is banned and 50% of CRTs are sent overseas, based on future CRT projections.



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Tasks 3 & 4: Mang't Options

- Task 3 Approach (cont.):
 - Sensitivity analysis
 - Cost and fees
 - Number and capacity of facilities
- Task 4: Develop recommendations for future management practices and policies
 - Consider economic, environmental, and health impacts



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Timeline

	Q1	Q2	Q3	Q4
Task 1: Collect data				
Task 2: Model future disposal				
Task 3: Develop tool; analyze management options				
Task 4: Develop recommendations				
Maintain project web site				
Hold TAG meetings				
Submit reports				



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Benefits to End Users

- End Users include:
 - Municipalities; reuse, demanufacturing, & recycling facility managers; regulators; and public
- CRT projections and current status of CRT processing and disposal practices:
 - Align management practices, infrastructure options, and potential policies with future
- Management tool:
 - Analyze policy and management practices not specifically addressed in this research and/or use local-specific input data
 - Analyze issues such as user disposal fees or manufacturer fees and policy changes



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Deliverables

- Spreadsheet CRT disposal management tool
- Project web site
<<http://www.eng.fsu.edu/~abchan/CRTanalysis.html>>
- Conference presentations and manuscript submissions
- Quarterly Progress Reports, Final Report
- TAG meeting minutes



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Thank you for your time!

Discussion and Comments...



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