Analysis of Discarded CRTs in Florida: Survey Results and Quantity Analysis Tool

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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 June 2009
- CRTs are a major component of electronic and hazardous waste stream

(www.nulifeglass.com)

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)

E-waste Stewardship

- Currently, no federal e-waste management legislation
  - US Congress Concept paper on e-recycling & the National Electronic Products Stewardship Act (NEPSA) (2.02.2008)
  - US House Science and Technology Committee e-waste hearings (2.11.09 and 4.30.08)
  - HR 1580: Electronic Waste Research and Development Act, passed in House (4.22.09).
  - H.Res. 938: to develop plan for management of Congress' e-waste, introduced 11.09
- So far, 21 states have e-waste legislation
  - 11 states have banned CRT disposal in municipal landfills
- Europe passed the Waste Electrical and Electronic Equipment (WEEE) Directive in 2003

We Need Answers

What are the:

- Trends in the volume of CRTs discarded in Florida – both recently 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?

Project Objectives

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

   Focus on discarded CRTs from both televisions and computer monitors

Task 1: Data Collection

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

Surveys on CRT Disposal

- Surveys to county household hazardous waste managers, recycling facilities, and donation centers in Florida (Spring 2009)
- Solicited information on:
  - Collection method, source of the CRTs
  - Amount of CRTs received in 2007 and 2008; distribution between TVs and computer monitors
  - Recent changes in quantities received
  - Fees charged to dispose of CRTs
  - CRT processing methods, capacity constraints, cost of recycling or processing

Survey Results

- Responses from:
  - 14 FL counties: 4 small populations (39,000-150,000), 6 mid-size populations (225,000-450,000), and 3 large populations (920,000-2 million)
  - 4 electronics recyclers & 1 donation center organization

Range of Survey Responses

Group	2007 CRTs Received	2008 CRTs Received	Distribution
Counties	3,500 - 25,000 units 117,000 - 750,000 lbs	6,000 - 25,000 units 155,000 - 660,000 lbs	20-70% monitors, 30-80% TVs
Electronics recyclers	6,500 - 365,000 units	7,500 - 174,000 units	60-99% monitors, 1-40% TVs
Donation centers	1.25 million lbs	1.75 million lbs	35% monitors, 65% TVs

Survey Results (cont.)

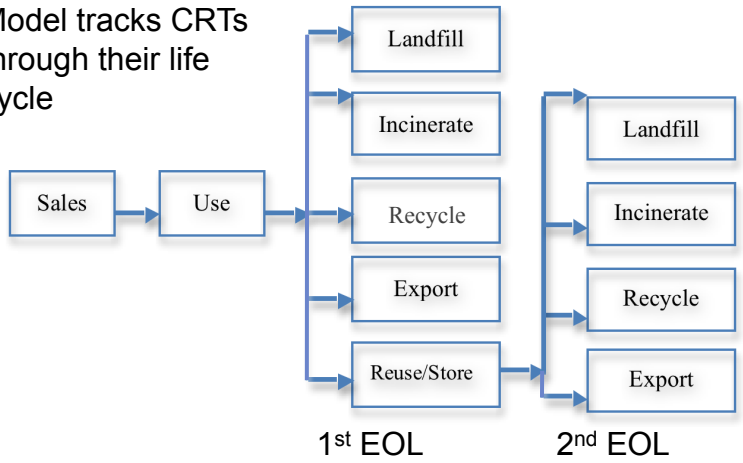
- Counties:
  - All have drop-off locations; some hold collection events
  - Two have regular curbside pickup of electronics
  - Do not charge residents for receiving
  - CRT Quantities: Most report little/no change, a few with up to 50% increase recently. More TVs than monitors.
  - Cost of CRT recycling: $1-10/unit, with TVs costlier
- Electronics recyclers:
  - Collect from business, governments, and municipalities
  - Receive more computer CRTs than TVs
  - Charge $3-7/unit or $0.15-0.50/lb to recycle

Task 2: Predicting CRT Quantities

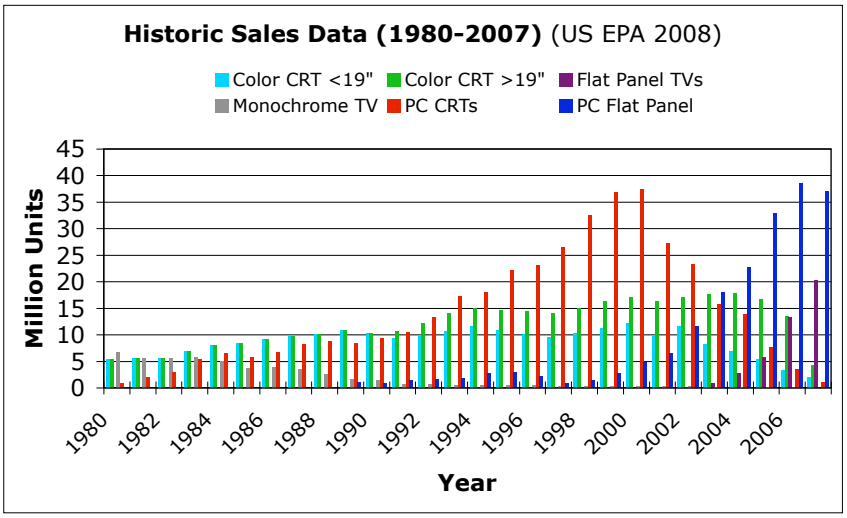
- Goal: Develop spreadsheet-based CRT waste analysis model to
  - Estimate future CRT waste stream
  - Identify critical infrastructure needs
- Approach:
  - Materials balance and flow modeling and analysis
  - Based on US EPA (2007)
  - Track CRTs from sales to end-of-life (EOL) disposal and recycling for 35 years (1985-2020)

CRT Life Cycle Flow Model

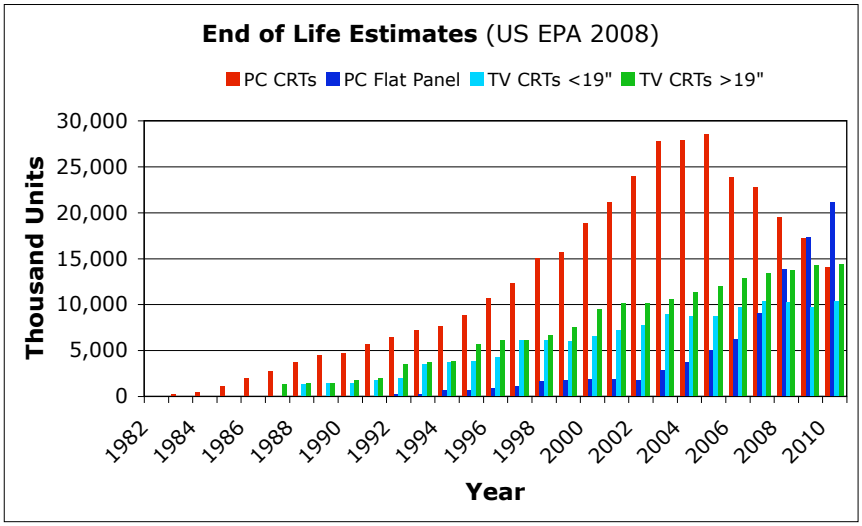
Model tracks CRTs through their life cycle



Historic Sales Data



Estimated Ready for EOL Mangt



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[1]

After Collection, Where do CRTs Go?

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

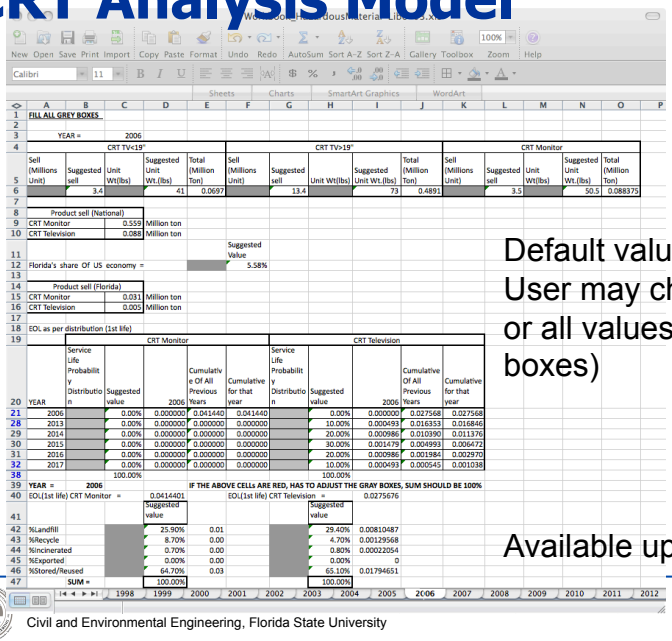
End Market	Tons/Year	% of Total
Resale "as is" or after some repair/upgrade in the U.S.	3,000	2%
Resale "as is" or after some repair/upgrade abroad	3,500	2%
Refurbishing or remanufacturing into specialty monitors in the U.S.	2,500	1%
Refurbishing or remanufacturing into new TVs or specialty monitors 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 Ingenthron 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.

CRT Spreadsheet Model

- Inputs (data):
  - Annual sales of computer monitors, TVs < 19", TVs > 19" and their average weights
  - State's share of US economy
  - Time to reach EOL distribution for 1st and 2nd EOL
  - Disposal option distribution for 1st and 2nd EOL
- Outputs (estimates):
  - Amount of CRT types at disposal options in future years
  - Use to analyze different mang't & policy scenarios

CRT Analysis Model



Default values provided
User may change any or all values (grey boxes)

Available upon request

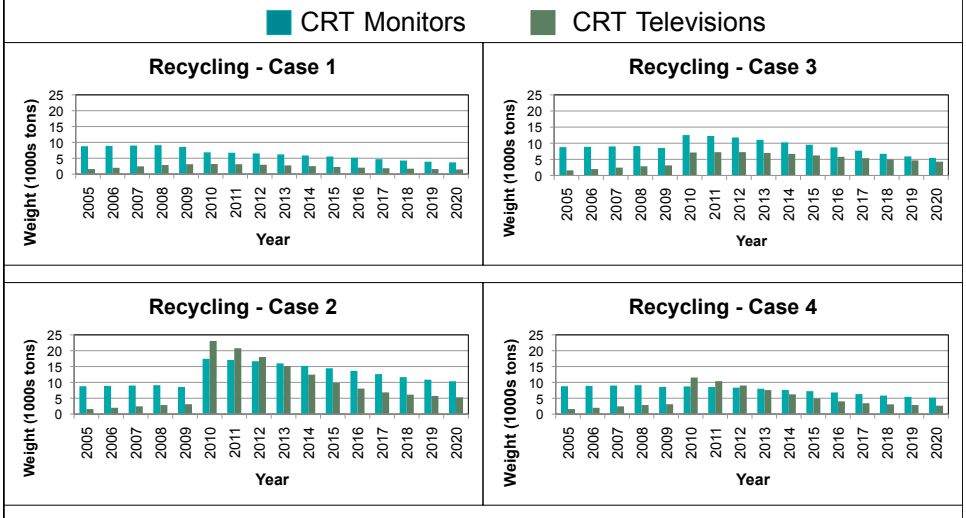
Task 3: Management Options

- Analyze & compare management scenarios
- Vary disposal distribution for TVs

Case	Landfill	Incinerate	Recycle	Export	Reuse/ storage
1 (Base)	29.4%	0.8%	4.7%	0%	65.1%
2	0%	0.8%	**50%**	0%	49.2%
3	0%	0.8%	4.7%	**50%**	44.5%
4	0%	0.8%	**25%**	**25%**	49.2%

- All use the same EOL duration distributions

Results: CRTs to Recycling



Summary

- Status of CRT disposal and recycling in Florida
  - Amount collected varied significantly
  - Collection methods varied; most common are drop-offs
  - A few saw up to 50% increases in quantities collected; most saw little/no change
  - Follow-up survey in Feb 2010
- CRT analysis tool
  - Spreadsheet model that can be used for any specific locale or region
  - Analyze potential effects of policy changes and rules on CRT flow
  - Users: municipalities, recycling and demanufacturing facility managers, regulators

Thank you!

Please send comments to:
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