

Quarterly Progress Report – Second Quarter ending February 28, 2009
 Submitted February 25, 2009

Project Title: Analysis of Discarded CRTs in Florida: Volume Projections and Disposal Management Options

Principal Investigator: Amy B. Chan-Hilton (Email: abchan@eng.fsu.edu; Phone: 850.410.6121)

Co-Principal Investigator: Gang Chen (Email: gchen@eng.fsu.edu)

Institution: Florida State University, FAMU-FSU College of Engineering, Civil and Environmental Engineering, 2525 Pottsdamer Street, Tallahassee, FL 32310

Contract Period: September 25, 2008 – August 31, 2009

Note: The subcontract between FSU and the HCSHWM was signed in October 2008, and a project budget number was activated by FSU on November 4, 2008.

Steady and noteworthy progress has been made since the submission of the first quarterly report. According to the project timeline (Table 1), four tasks, including the submission of second quarterly report, are expected to commence or be in progress during Quarter 2 of the project period. The progress of these tasks is detailed below.

Table 1: Timeline of project milestones (from original proposal, April 2008), where xx = completed; x = in progress.

Task	Q 1	Q 2	Q 3	Q 4
Task 1: Collect CRT volume and disposal data	x	x		
Task 2: Model future volume and disposal		x		
Task 3: Develop tool; analyze management options				
Task 4: Develop recommendations				
Establish project web site	xx			
Maintain project web site	x	x		
Establish TAG and hold TAG meetings	x			
Submit quarterly progress reports	xx	xx		
Submit draft and final reports				

Task 1: Collect CRT volume and disposal data.

This task will provide answers to the questions: 1) What are the current trends in the volume of CRTs discarded in Florida; 2) what are the current practices in Florida for CRT disposal management; 3) what is the currently available infrastructure for handling disposed CRTs from Florida; and 4) what are the current capacities of existing disposal and recycling facilities for CRT components? To date, efforts have been made to answer all four of these questions. In ongoing efforts, the research team is collecting current data on the volume of CRTs disposed and management practices and identifying past and recent trends in Florida. This information will help provide a snapshot of the current conditions in Florida and will form the basis for predicting future trends (Task 2).

Estimates on the existing number of CRT television sets and computer monitors

will be made based on recent data from the U.S. census, consumer electronics industry, and other Florida-specific sources. We have conducted an extensive literature review and gathered historic data on numbers of CRTs in Florida, other states such as California, and throughout the U.S. Historical data on the production of CRT products has been obtained from manufacturers and the consumer electronics industry through the literature.

In addition, we have completed an extensive literature review of current management practices, regulations, and policies for discarded CRTs used in other states and countries. The practices used in other states and countries, and the results of their implementation, will provide potential alternative management approaches for Florida. Through the surveys (see below) we continue to investigate existing CRT demanufacturing (in which the CRT may be separated from the rest of the monitor), recycling, and disposal practices existing in Florida or are used by municipalities and facilities in Florida.

US EPA (2007a) estimated disposal rates of electronics in the U.S. using data from two sources, market research data for sales and government statistics for sales, and found that resulting estimates are similar. We have estimated the duration the product is used; this also is known as the time for the product to reach end-of-life (EOL). The EOL estimates are based on data from the literature (including the EPA reports) and previous surveys. Efforts will be made to obtain data from both household and industry sectors.

The current volume of discarded CRTs in the waste stream in Florida (such as those at resellers, storage, demanufacturers, recycling facilities, and disposal facilities) also will be estimated. We currently are in the process of obtaining additional information from other existing facilities in Florida that demanufacture and recycle televisions, computers, and electronics and organizations in Florida that accept donations of electronic equipment. Information on the number, locations, capacities, and other limitations of facilities that handle CRTs will be collected. We also are obtaining information on the costs and fees related to each of these disposal options. This data and information currently is being collected using electronic surveys and telephone and personal interviews.

During Quarter 2, we worked closely with Jack Price and Raoul Clarke at FDEP to developing the surveys and interview questions so that a standard format may be used. See Appendix A for the three surveys circulated to 1) household hazardous waste (HHW) managers, 2) electronics recycling facilities, and 3) donation centers. The initial invitations to participate in the surveys were sent via email in February 2009. Mr. Price and Mr. Clarke at FDEP assisted with the distribution of the surveys to county HHW managers and electronics recycling facilities through listservs that they maintain. To date, we have received responses from 4 HHW managers, 1 electronics recycling facility, and 1 donation center. We will send reminder emails to solicit additional responses. We anticipated that one barrier to the data collection in this project is obtaining responses to the surveys. The resulting data will be aggregated to provide a snapshot of recent and current trends on the volume, and disposal rate of CRTs in Florida, as well as current management options.

Task 2: Estimate future volumes of discarded CRTs and required infrastructure.

This task will provide answers to the questions: “What are the trends in the volume of CRTs discarded in Florida expected in the near future; and will existing disposal and

recycling facilities for CRT components be able to handle projected future volumes?” Using the data collected in Task 1, estimates on the future CRT waste stream will be determined.

A spreadsheet-based model using materials balance and flow modeling and analysis currently is being developed to track the life cycle of CRTs. The methodology in this task will be based on Kang and Schoenung (2006) and US EPA (2007a). The approach is to track CRTs from when a consumer purchases a monitor or television (inflow) to when the consumer decides the item is no longer of use (outflow). Then the CRT may go into storage, to a second user (from donations or resellers), demanufacturing and recycling, and final disposal. This flow of CRTs will be modeled over a period of 3-7 years in order to make projections on the volumes of discarded CRTs and the infrastructure required to handle the waste stream. The resulting projections will form the base case for additional scenario analyses that will be conducted in Task 3.

The modeling and analysis in this task also will be used to identify critical infrastructure and areas that require enhanced public education in order for the state of Florida and municipalities to handle the CRT waste stream. Based on these CRT flow projections, an analysis of whether the existing handling, recycling, and disposal facilities would be able to handle the projected future volumes will be completed. Data collected in Task 1 will be used in this analysis. In addition, we will estimate the costs of CRT waste management based on these future projections.

Establish and maintain project web site.

A project web site has been established at <http://www.eng.fsu.edu/~abchan/CRTanalysis.html>.

The web site includes the project abstract, list of project participants, and Technical Awareness Group (TAG) members, TAG meeting minutes, and project reports. Additional information will be included in the project web site as they become available.

Hold TAG meeting.

The Technical Awareness Group (TAG) for this project has been established and confirmed. Members include a wide range of experts and represent organizations that have direct interest in the project. TAG members include (listed alphabetically by last name):

- Tarek Abichou, Associate Professor, FAMU-FSU College of Engineering
- Cynthia Brantley, Recycling Coordinator, Leon County Solid Waste Management
- Randy Jones, Executive Vice President, Goodwill Industries Big Bend Inc.
- Jack Price, Environmental Manager, FDEP
- Norman Thomas, Director, Leon County Solid Waste Management

The first TAG meeting was held on December 11, 2008. Minutes of the meeting as well as the presentation slides are available on the project web site. They are included in Appendix B.

Submit quarterly progress report.

This present report is the submission of the second quarterly progress report.

Appendix A – Surveys on CRT Recycling

The following cover letter and surveys were sent to county household hazardous waste managers, recycling center managers, and donation centers.

Cover Letter

Dear Household Hazardous Waste Manager/ Electronics Recycling Facility Manager/
Donation Center Manager,

We would appreciate your help in conducting a survey regarding cathode ray tube (CRT) recycling in the State of Florida. This work is part of a project funded by FDEP and the Hinkley Center for Solid and Hazardous Waste Management. One of the goals of this project is to capture a snapshot of the quantities of CRTs recycled and the current practices of CRT recycling. We define CRTs as both televisions and computer monitors. More information on this project may be found at <http://www.eng.fsu.edu/~abchan/CRTanalysis.html>

If you are not the person in your facility with the information requested, I would appreciate you forwarding this survey to the appropriate person.

Please find below the survey. Please send your responses to Amy Chan-Hilton via email at abchan@eng.fsu.edu or fax at 850.410.6142. We look forward to receiving your response by February 27, 2009.

If you prefer to respond to this survey over the phone, please let me know. We would be happy to schedule a time to speak with you.

Thank you in advance for your time.

Sincerely,
Amy B. Chan Hilton, Ph.D.

Survey to County Household Hazardous Waste Managers on CRT Recycling

Note: If you do not have actual data or percentages, please provide your best estimates and note this in your responses.

- 1) Method of CRT collection:
 - a) How are CRTs collected: Curbside pick-up? Drop-off centers? Collection events? Other (please explain)?
 - b) How many (or weight or percentage) from each collection source? What is the frequency of each collection source?
 - c) Do you collect from private citizens only or can small businesses participate?
 - d) What are the fees or incentives, if any, for participants?
- 2) Volume of CRTs received:
 - a) How many (quantity or weight) CRTs have you received annually during the last 2 years? If you have monthly data or data going back to previous years, please include.
 - b) How many (or %) are televisions vs. computer monitors?
 - c) How many (or %) are from households? From small businesses? From donation centers? Other sources?
- 3) Has there been any significant change in the amount of CRTs received in the recent months?
 - a) If yes, have you seen an increase or decrease? By how much?
 - b) In your opinion, what do you think the reasons are for this change? Analog to digital TV signal conversion on February 17, 2009? Seasonal/events such as Christmas and Super Bowl? Other? Do you expect this trend to continue?
- 4) Processing CRTs:
 - a) Please describe how the CRTs are processed (stored, sorted, recycled).
 - b) Are any CRTs disposed rather than recycled? If so, why and how many (or %)?
 - c) Where are they sent for recycling? What is the frequency of shipments (weekly, monthly, quarterly, upon request)? What volume (quantity or weight) is sent?
 - d) What is the cost of processing (handling, transportation, recycling fees, etc.)?
- 5) What is your collection capacity (i.e., limits on the number of CRTs that may be received and/or processed per week or month due to storage, handling, etc.)?
- 6) Although not directly related to CRT management, we are interested in other electronics that you may receive. How many (quantity or weight) computers have you received annually during the last 2 years? Please specify for desktop vs. laptops.

Survey to Electronics Recycling Centers on CRT Recycling

Note: If you do not have actual data or percentages, please provide your best estimates and note this in your responses.

- 1) How are CRTs collected - Personal drop-off? Collection events? Municipal agreements/contracts? Commercial business accounts?
- 2) Volume of CRTs received:
 - a) How many (quantity or weight) CRTs have you received annually during the last 2 years? If you have monthly data or data going back to previous years, please include.
 - b) How many (or %) are televisions vs. computer monitors?
 - c) How many (or %) are from households? Commercial? Donation centers? Other sources?
- 3) Has there been any significant change in the amount of CRTs received in the recent months?
 - a) If yes, have you seen an increase or decrease? By how much?
 - b) In your opinion, what do you think the reasons are for this change? Analog to digital TV signal conversion on February 17, 2009? Seasonal/events such as Christmas and Super Bowl? Other? Do you expect this trend to continue?
- 4) Requirements for incoming CRTs:
 - a) Must they be disassembled? Or do you demanufacture at your facility?
 - b) Are there minimum/maximum quantity requirements? If so, please describe.
- 5) What are your fees for receiving CRTs?
- 6) Process for recycling or demanufacturing CRTs at your facility:
 - a) Please describe how the CRTs are recycled or demanufactured. What components or materials are separated?
 - b) Are any items sent to landfills? If so, which items and how many?
- 7) Where are the following parts or materials sent? Please specify and to which state or country they are sent and to the type of facility (such as lead smelter; glass, metals, or plastics recycler; or electronics manufacturer).
 - a) Leaded glass
 - b) Cones
 - c) Electron guns
 - d) Circuit boards
 - e) Cables
 - f) Metals (steel, etc.)
 - g) Plastics

- 8) Capacity:
 - a) What is your collection capacity (i.e., limits on the number of CRTs that may be received per day, week, etc. due to storage availability)?
 - b) What is your processing capacity per day or week? Please specify the constraints.

- 9) Although not directly related to CRT management, we are interested in other electronics that you may receive. How many (quantity or weight) computers have you received annually during the last 2 years? Please specify for desktop vs. laptops.

Survey to Donation Centers on CRT Management

Note: If you do not have actual data or percentages, please provide your best estimates and note this in your responses.

- 1) How are CRTs collected?
- 2) Volume of CRTs received:
 - a) How many (quantity or weight) CRTs have you received annually during the last 2 years? If you have monthly data or data going back to previous years, please include.
 - b) How many (or %) are televisions vs. computer monitors?
 - a) Distribution (quantity or %) of CRTs collected - Residential? Commercial? Municipal?
- 3) Has there been any significant change in the amount of CRTs received in the recent months?
 - a) If yes, have you seen an increase or decrease? By how much?
 - b) In your opinion, what do you think are the reasons for this change? Analog to digital TV signal conversion on February 17, 2009? Seasonal/events such as Christmas and Super Bowl? Other? Do you expect this trend to continue?
- 4) Processing CRTs:
 - a) Please describe how the CRTs are processed (stored, sorted, recycled).
 - b) Are any CRTs disposed rather than recycled? If so, why and how many (or %)?
 - c) Where are they sent? What volume (quantity or weight) is sent?
 - d) What is the cost of processing (handling, transportation, recycling fees, etc.)?
- 5) What is your collection capacity (i.e., limits on the number of CRTs that may be received and/or processed per week or month due to storage, handling, etc.)?
- 6) Although not directly related to CRT management, we are interested in other electronics that you may receive. How many (quantity or weight) computers have you received annually during the last 2 years? Please specify for desktop

Appendix B – Minutes and Presentation from TAG Meeting 1 (December 11, 2008)

Minutes of TAG Meeting 1

In Attendance:

- Cynthia Brantley, Recycling Coordinator, Leon County Solid Waste Management (TAG member)
- Randy Jones, Executive Vice President, Goodwill Industries Big Bend Inc. (TAG member)
- Jack Price, Environmental Manager, FDEP (TAG Member)
- Norman Thomas, Director, Leon County Solid Waste Management (TAG member)
- Dinesha Kodituwakku, Researcher
- Dan Mathis, Undergraduate Researcher
- Amy Chan-Hilton, FAMU-FSU Civil and Environmental Engineering (PI)
- Gang Chen, FAMU-FSU Civil and Environmental Engineering (Co-PI)

1. Introductions

2. Project background and objectives

The goal of this research to answer questions about trends in volume of discarded CRTs in the future, current CRT waste management practices and trends, and capacity for handling increase in CRT disposal in Florida. These questions include:

- What are the trends in the volume of CRTs discarded in Florida – both currently and expected in the near future?
- What is the currently available infrastructure for handling disposed CRTs from Florida?
- What are the current capacities of existing disposal and recycling facilities for CRT components, and will they be able to handle future volumes?
- What are the current practices in Florida for CRT disposal management, and how can they be improved?

In order to provide insight on these topics and to help answer these questions, the research objectives of this project are to:

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.

Additionally, recommendations on management practices and policies will be made based on this research. The results of this research will be disseminated to stakeholders, including regulators, waste management facilities, and the public.

3. Project tasks

The project background, objectives, and tasks were described in the presentation given by Dr. Amy Chan-Hilton (included here and available from the project web site). The major project tasks are:

- Task 1: Consolidate past and current data trends on discarded CRT volume and disposal.
- Task 2: Estimate future volumes of discarded CRTs and required infrastructure.
- Task 3: Develop tool to analyze management options.
- Task 4: Develop recommendations for future management practices.

4. Discussion

Suggestions by TAG to the project team:

- Incorporate the collection component into our data gathering, modeling, and analysis (Cynthia Brantley, Norman Thomas, Jack Price)
- Include the cyclical nature of price/demand of recyclable scrap materials into our modeling/analysis (Jack Price)
- Try to gather data or estimate on how many units that are disposed come from Florida
- Use the term "e-scrap" rather than "e-waste" to reflect the value of the material (Jack Price)

Requests to TAG members by project team:

- Assist in distributing our surveys and requests for information, when ready, via the list serve (Jack Price)
- Send relevant papers from the 2008 E-Scrap Conference (Jack Price)
- Contact Unicor and USA Liquidators in Marianna and ask them to contact Dr. Chan-Hilton (Randy Jones)