



CASCADE

Asset Management, LLC

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**Occupational Risks Associated with
Electronics Demanufacturing and CRT
Glass Processing Operations and the
Impact of Mitigation Activities on
Employee Safety and Health**

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Presentation Overview

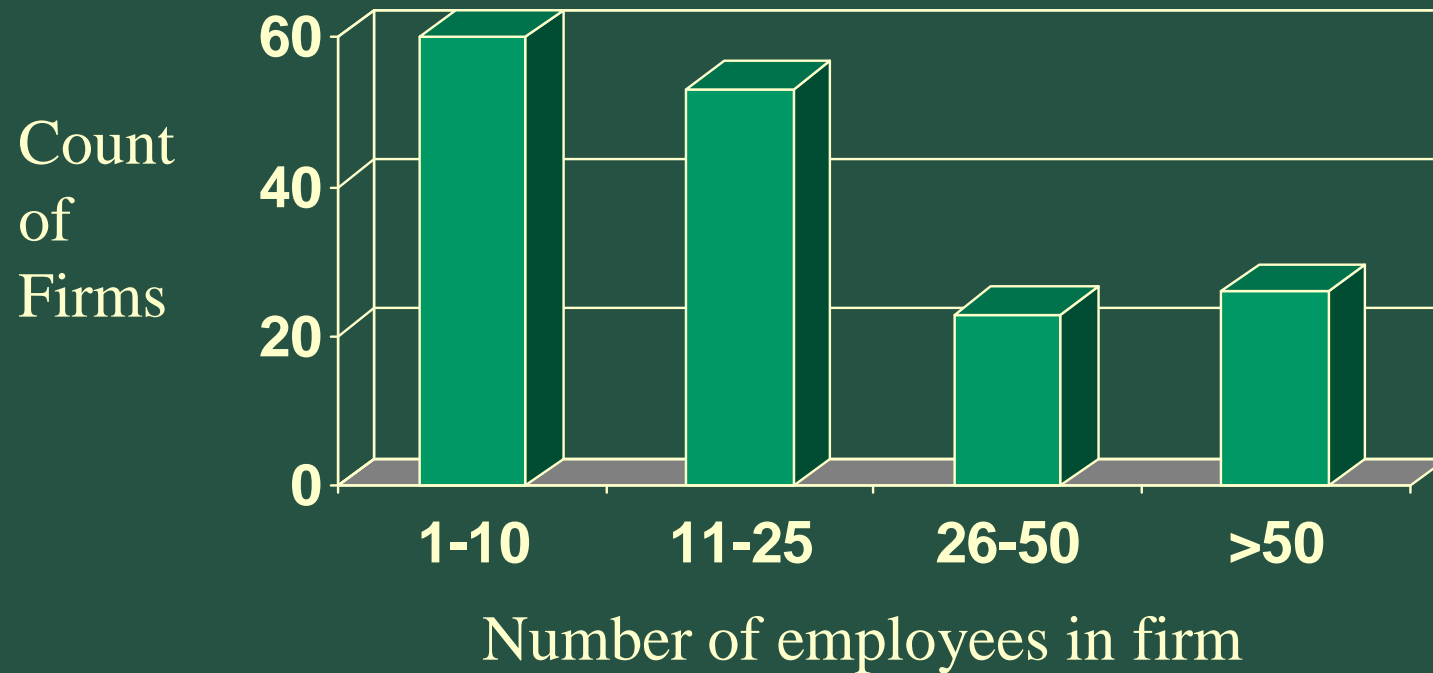
- n Description of Cascade and its industry
- n Testing Goals: Testing Procedures
 - Mitigation program
- n Results
- n Future Research
- n Resources for Recyclers

Industry Context

- n Focus on US demanufacturers and processors
- n Examine the working conditions of a typical small-scale demanufacturer or processor (50,000 - 400,000 lbs./month)
- n Little capabilities for environmental monitoring programs

Industry Context

Distribution of Electronics “Recyclers” in the USA - 2002



Profile of Cascade

- n Madison, Wisconsin base
- n Established 1999
- n January, 2003: 75 tpm - 14 employees
- n April, 2003: 175 tpm - 21 employees
- n 93% from business and institutions
- n 57% of equipment demanufactured
- n Separate CRT glass cutting operation



Testing, Data Scrubbing, Parts Harvesting, Reuse Markets



Manual Disassembly

- n Recover reusable components
- n Remove hazardous materials
- n Generate clean commodities for market (~25 grades)



Shredding Activities



Plastic Size
Reduction - also
use vertical baler

Electronic Media
Destruction



CRT Processing

Intact CRTs are pulled at demanufacturing facility and sent to CRT processing



CRT Processing

CRTs are prepped by cleaning contamination - removing implosion band



CRT Processing

Color CRTs are cut to separate panel glass from funnel/frit



Testing Goals

- n Develop baseline of worker exposure to occupational health hazards
- n Demonstrate compliance (or become compliant) with OSHA standards
- n Test impacts of mitigation activities on occupational health

Minimum Standards

n Lead

- EPA (waste) TCLP: 5.0 mg/L
- OSHA (air) PEL: 50 $\mu\text{/m}^3$ over 8 hours
- HUD (dust) 250 $\mu\text{/f}^2$ on interior window sills

n Cadmium

- EPA, TCLP: 1.0 mg/L
- OSHA, PEL: 5 $\mu\text{/m}^3$ over 8 hours

Air & Wipe Survey Methods

- n CRT Processing comparison study
 - Baseline conducted in 2001 at Milwaukee facility
 - Implemented mitigation activities
 - Follow-up in 2003 at Madison facility
- n Air study measuring lead and cadmium
- n Wipe samples throughout facilities

Mitigation Activities - CRT Processing

- n Clean all spills using wet methods before spills dry
- n Implement regular wet cleaning of all workstations (4 x day)
- n Increase worker hygiene
 - no eating/drinking at workstations
 - wash hands and face before breaks
 - wear protective clothing

Air Survey Results

CRT Area Sampling Results for **Lead**

Monitoring Device Location	4-26-01	1-23-03
CRT Operator	4.3	<10
Ambient air sample 1	0.42	<10
Ambient air sample 2	0.14	N/A
OSHA PEL	50.0	50.0

Data listed in micrograms of contaminant per cubic meter of air ($\mu\text{g}/\text{m}^3$) over an 8-hour time weighted period.

Air Survey Results

CRT Area Sampling Results for Cadmium

Monitoring Device Location	4-26-01	1-23-03
CRT Operator	<0.1	0.75
Ambient air sample 1	<0.1	1.5
Ambient air sample 2	<0.1	N/A
OSHA PEL	5.0	5.0

Data listed in micrograms of contaminant per cubic meter of air ($\mu\text{g}/\text{m}^3$) over an 8-hour time weighted period.

Wipe Sample Results

Surface **Lead** Concentrations in CRT Processing Areas

Wipe Sample Location	7-17-01	1-23-03
Floor behind CRT cutter	1510	430
Work table near CRT cutter	107	34
CRT prep table	1520	1100
Central tracking area	252	98
Break room/wash room	6	31
HUD hazard level on sills	250	250

Data listed in micrograms of contaminant per square foot (μf^2)

Wipe Sample Results

Surface Cadmium Concentrations in CRT Processing Areas

Wipe Sample Location	7-17-01	1-23-03
Floor behind CRT cutter	37.0	18.0
Work table near CRT cutter	7.7	1.2
CRT prep table	3.7	54.0
Central tracking area	15.0	27.0
Break room/wash room	<=0.6	12.0

Data listed in micrograms of contaminant per square foot (μf^2)

Possible Explanations

- n Overall, exposure levels decreased due to hygiene programs
- n Increase in cadmium exposure at prep table likely due to an increased number of color CRTs broken by hand in 2003 - phosphor powder not wet
- n increase in exposure at break room due to distances from processing area at locations

Other Studies

- n Demanufacturing area - shredding line

- Total particulate matter in air - 8 hours

- n Measured amount: Max reading - $322 \mu\text{/m}^3$

- n OSHA PEL: $15,000 \mu\text{/m}^3$

- Noise levels and exposure

- n Shredder operator: 83.4 dBA (8-hour reading)

- n OSHA PEL: 90.0 dBA - Action Limit: 85.0 dBA

Further Study

- n Lead and cadmium exposure at facilities employing manual breakage of CRT glass without containment
- n Concentration of flame retardants in particulate matter from shredders
- n Presence of VOCs from baling plastics
- n Noise studies at mechanized facilities

Recycler Resources

n OSHA Consultation Program

- designed for small- and medium-sized business (up to 250 employees at a site)
- Completely separate from OSHA enforcement
- Provides assessments, testing, written recommendations, training materials
- is free

Acknowledgements

n John Katers, UW-Green Bay

n Jim Barry, OSHA Consultation Program

Recycler Resources

- n OSHA Consultation Program:
 - administered through states:

www.osha.gov/oskdir/consult.html

- n Cascade Asset Management studies

www.cascade-assets.com