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## E-Scrap

- Fastest growing waste stream in the world
- Problem ignored for years
- Over 1 billion computers in the world today
- 200 million in the USA alone
- 100,000 computers scrapped every day

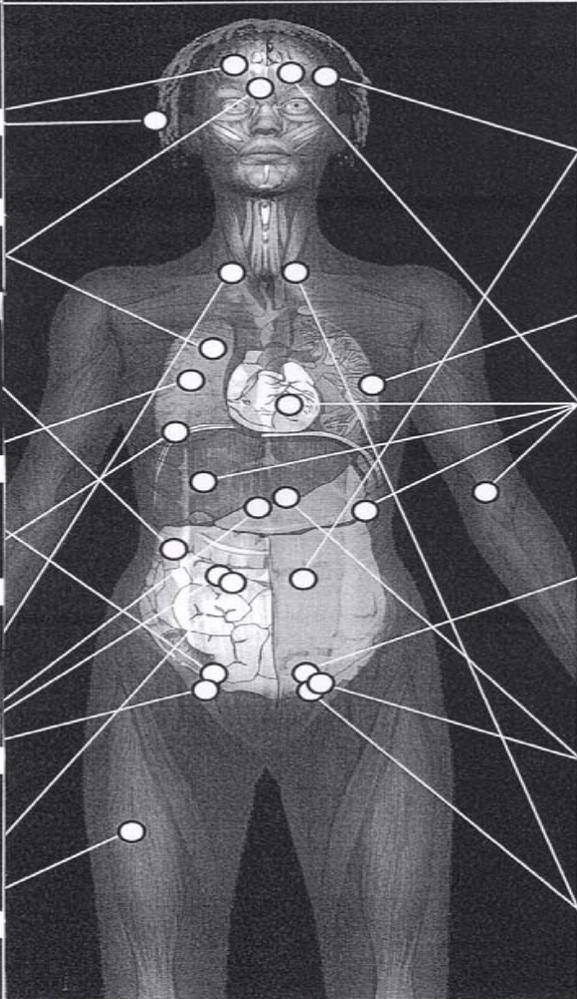
## E-Scrap (continued)

- Add to that:
  - Mobile Phones
  - CRT monitors (Cathode Ray Tube)
  - Printers
  - Photocopiers
  - Televisions
  - Brown & White goods

So why the worry?

## The Problem

- Full of valuable raw materials, but...
- Also contains a cocktail of various harmful materials

<p><b>Selenium</b> Exposure to high concentrations causes Selenosis, which can cause hair-loss, nail brittleness, and neurological abnormalities (i.e. numbness and other odd sensations in the extremities).<sup>1</sup></p>		<p><b>Lead</b> Exposure can cause brain damage, nervous damage, blood disorders, kidney damage and developmental damage to fetus. Children are especially vulnerable. Acute exposure can cause vomiting, diarrhea, convulsions, coma or death.<sup>1</sup></p>
<p><b>Beryllium</b> Exposure can cause lung cancer, and chronic beryllium disease (berylliosis) (affects lungs).<sup>2</sup></p>		<p><b>Polyvinyl chloride (PVC)</b> Most widely-used plastic, found in everyday electronics. When burned produces large quantities of hydrogen chloride gas, which combines with water to form hydrochloric acid (HCl). Inhaling HCl can cause respiratory problems. Production and incineration of PVC creates dioxins.<sup>11</sup></p>
<p><b>Mercury</b> Exposure through ingestion or inhalation can cause central nervous system damage and kidney damage.<sup>1</sup></p>		<p><b>Barium</b> Exposure may lead to brain swelling, muscle weakness, damage to heart, liver and spleen, or increased blood pressure.<sup>2</sup></p>
<p><b>Chromium (IV) - Hexavalent Chromium</b> Exposure can cause strong allergic reaction (linked to Asthmatic Bronchitis) and DNA damage to cells. Workers exposed at disposal stage and may be released into the environment from landfills and incineration.<sup>8</sup></p>		<p><b>Brominated flame retardants (BFR's)</b> Suspected of hormonal interference (damage to growth and sexual development), and reproductive harm. Used to make materials more flame resistant, but exposure studies reveal BFRs in breast milk, and blood of electronics workers, among others.<sup>4</sup></p>
<p><b>Arsenic</b> Long-term exposure may cause lung cancer, nerve damage and various skin diseases. Arsine gas (AsH3), used in tech manufacturing, is the most toxic form of arsenic.<sup>1</sup></p>		<p><b>Polychlorinated biphenyls (PCBs)</b> Toxic effects of PCBs include immune suppression, liver damage, cancer promotion, nervous damage, reproductive damage (both male and female) and behavioral changes. Widely used (prior to 1980) in transformers and capacitors. Though banned in many countries, still present in e-waste.<sup>12</sup></p>
<p><b>Trichloroethylene (TCE)</b> Exposure to TCE (depending on amount and route) can cause, liver and kidney damage, impaired immune system function, impaired fetal development or death. Manufacturing workers and communities where TCE leaches into drinking water are at greatest risk.<sup>5</sup></p>		<p><b>Dioxins and Furans</b> Exposure can cause hormonal disruptions, damage to fetus, reproductive harm, and impairment of immune system. These highly toxic compounds bio-accumulate (concentrate in the body) and persist in the environment.<sup>7</sup></p>
<p><b>Cadmium</b> Long-term exposure can cause kidney damage, and damage to bone structure, also a known carcinogen. Short term or acute exposure can cause weakness, fever, headache, chills, sweating and muscle pain.<sup>3</sup></p>		















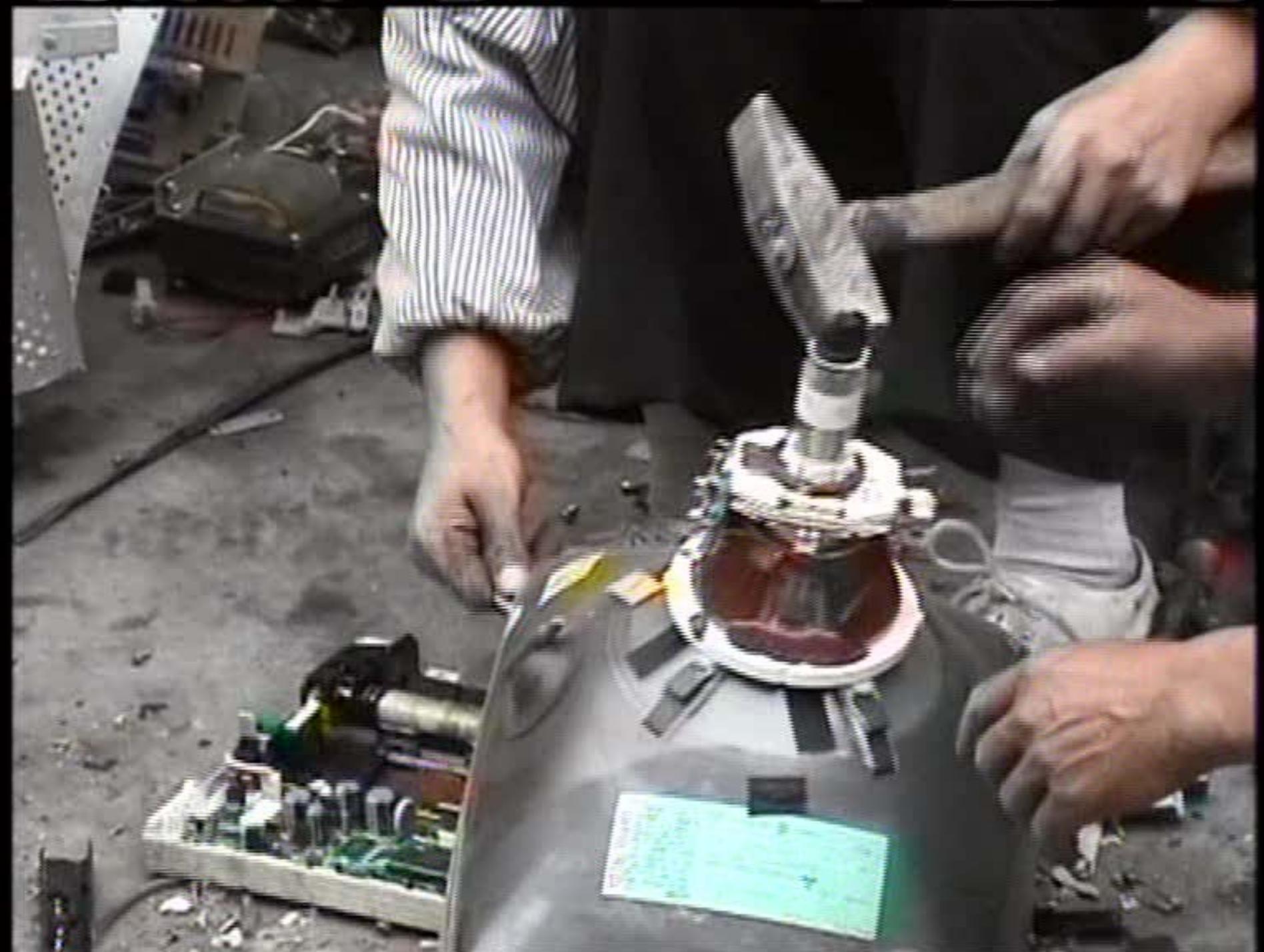












# Occupational Hazard:

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- \* Risk of violent implosion
- \* Possible Silicosis
- \* Inhalation of toxic phosphor compounds

# Environmental Hazard:

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- \* Lead and barium leachate
- \* Toxic phosphor releases

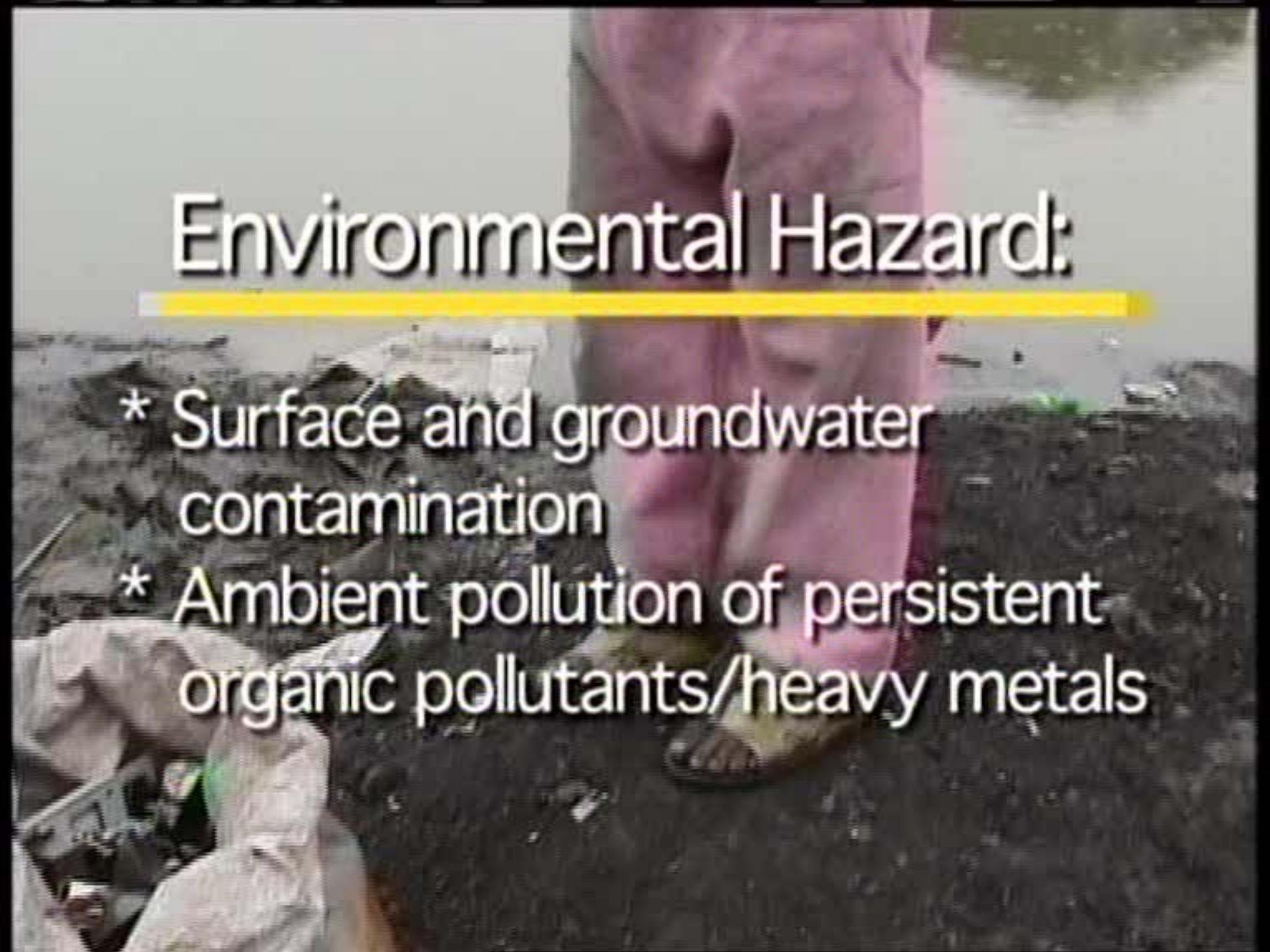




# Occupational Hazard:

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- \* Highly toxic dioxins and furan inhalation
- \* Cancer-causing polycyclic aromatic hydrocarbons
- \* Other smoke-borne pollutants

A person wearing a full-body pink protective suit and boots is walking through a dark, heavily contaminated area. The ground is covered in dark, granular material, possibly ash or soil, with some debris and white bags visible. The background shows a body of water under a grey sky.

# Environmental Hazard:

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- \* Surface and groundwater contamination
- \* Ambient pollution of persistent organic pollutants/heavy metals

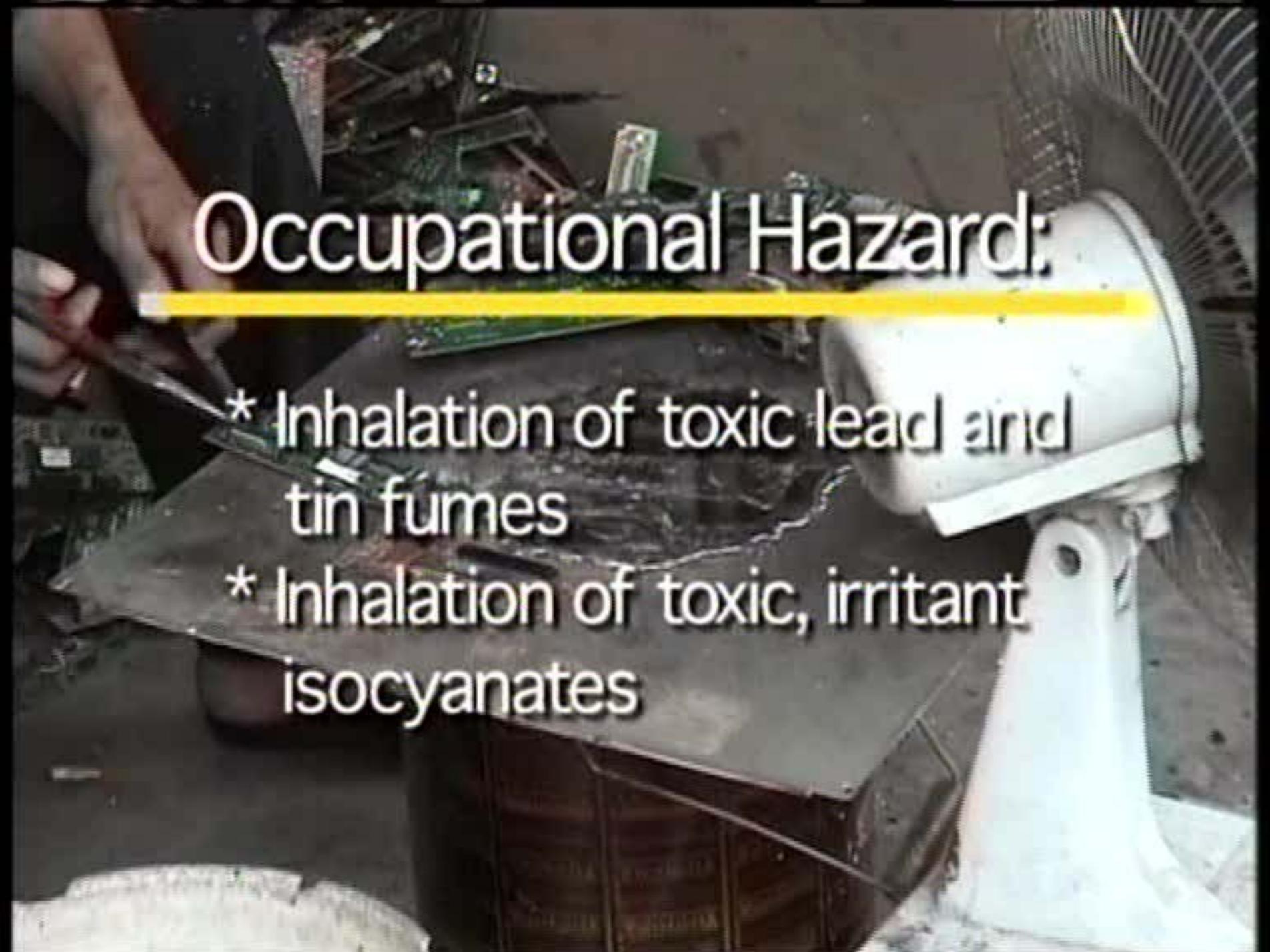


# Occupational Hazard:

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- \* Concentrated exposure to toxic brominated flame retardants, dioxins and other harmful hydrocarbon emissions



A person is working at a workbench in a workshop. They are using a tool to work on a component. A large white fan is positioned to the right of the workbench. The background shows various tools and equipment.

# Occupational Hazard:

- \* Inhalation of toxic lead and tin fumes
- \* Inhalation of toxic, irritant isocyanates

# Environmental Hazard:

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- \* Lead, tin contamination of land, air, and water
- \* Dioxins released by circuit board burning



# Occupational Hazard:

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- \* Acrid and toxic fumes from chlorine & sulphur dioxide gases
- \* Acid burns

# Environmental Hazard:



- \* Acid sludges dumped into the river ecosystem













## In the United States....

- Last year, there were about 36 electronics bills introduced in 22 states
- 7 states have electronics recycling laws:
  - California
  - Maine
  - Maryland
  - Minnesota
  - North Carolina
  - Oregon
  - Washington

## The Easy Way Out

- Up until recently, many countries chose the soft option of exporting E-Scrap, either whole or pre-treated
- Around 80% of the United States e-waste is exported to Asia.
  - Less profitable to handle domestically and therefore exported
- This is no longer an option

## A New Focus

- Processing is now becoming the norm for handling E-Scrap
  - Returns the material back to its commodity
  - Each state and country needs to be responsible for their own e-scrap
- This ensures the removal of all harmful & toxic materials from the waste stream remains in the country that can manage it

## Modern European Recycling Plant



Modern plants will reduce e-scrap in 2 streams:

1. Processing E-Scrap to produce pure, discreet raw materials, such as iron and steel, copper and precious metals, and glass and plastics, which can be used again in production
2. Removing all hazardous materials as part of the automated process

## Sample Ad used in Ireland



### **Waste Electrical and Electronic Equipment** ("WEEE")

- Directive from the European Commission that requires European Union (EU) member states to enact local legislation and implement the law by August 2005.
- WEEE mandates free recycling of electrical and electronic equipment throughout the EU. The consumer pays nothing at the point of collection. The manufacturer pays for all costs associated with collection, transportation, and recycling.

## CRT Separation Plant

- Cathode ray tubes are removed from monitors and TVs and the glass is separated into two usable fractions.



## Beginning of Modern Mixed Electronic Line

- Once the material leaves the shedder, it travels along conveyor belts through several separation steps which include magnetic separators, sieves and cyclone separators



- The residual material is then processed further through a hammer mill that produces a pellet sized fraction



- The material then moves the metal-plastic separation



- The separated plastic granulate is sent to a specialist recycler for further processing into reusable raw materials



- Non ferrous metal fractions are further separated and sent to a precious metal refinery



## What is a Qualified Recycler?

- State Registered
- ISO Certified or similar
- Export at ISRI commodity levels only
- Ship commodities only
- Traceability of Pounds In and Pounds Out
- Transparency
- Audit Trails

## What is a Qualified Recycler? (continued)

- Documented hazardous disposal process
- Work with business partners and vendors that meet all applicable environmental and health regulations (downstream audit)
- Utilize recycling and smelting operations downstream that provide the best environmental protections worldwide
- Licensed (EPA, DEQ)
- Adequate liability insurance
- Trained in the skills needed to understand and perform the waste reduction and recycling industry

## California's Electronic Recycling Model

- Approved collectors receive .20 cents/pound from approved recycler
- Approved recycler receives .48 cents/pound from state
- Must provide individual ID documentation for any materials bought from a non-approved recycler such as individual person or business in order to receive credit
- Materials are handled in CA
  - Laptops, DVDs, and CRTs
  - Interesting: computers (desktop) are not one of them
- State funding is through recycling fee paid on new TV's- \$6.00 to \$8.00 per unit - reviewed regularly
- Fund took in \$100,000,000 first year and paid out \$60,000,000
  - now fund is balanced on input equals output

## PROs and CONs of California's Recycling Legislation

PRO	CON
Created an effective and efficient recycling stream	Too much paper work
Created competition among recyclers	Cash flow – it takes 90 days to pay
Created jobs	Too many people operating outside the system – need more enforcement

## Take-Back Schemes

- IPR – Individual Producer Responsibility each producer/and or retailer is responsible for the product they sell in a market
- Collective that several producers can go to independently contracted recyclers who they pay to provide the service
- Recycling fee added to purchases and monitored by a state or national agency through qualified recyclers

- Thank you for allowing GLR to present a short overview of the e-recycling business
- I would happy to answer any questions as time permits .