






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INTEGRATED WASTE MANAGEMENT FOR A SMART CITY

FOCUSED ON MSW, C&D AND E-WASTE MANAGEMENT

Welcome to Week-11

BRAJESH KUMAR DUBEY
DEPARTMENT OF CIVIL ENGINEERING

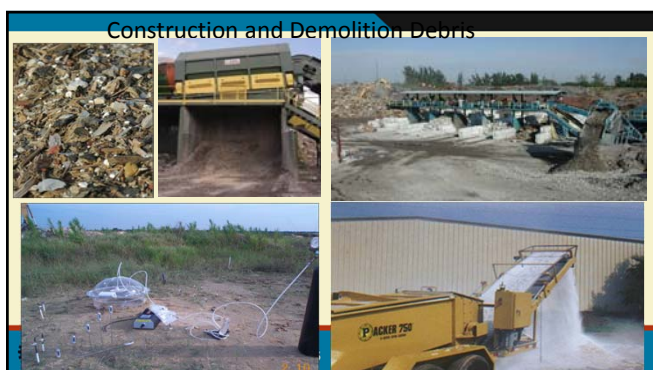
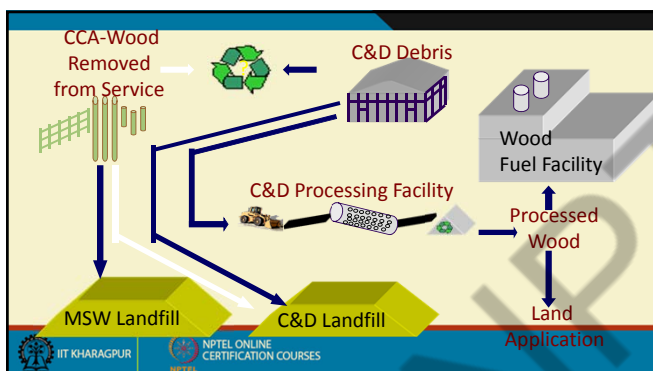




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CONSTRUCTION AND DEMOLITION (C&D) WASTE

C&D WASTE MANAGEMENT

Dr BRAJESH KUMAR DUBEY
DEPARTMENT OF CIVIL ENGINEERING



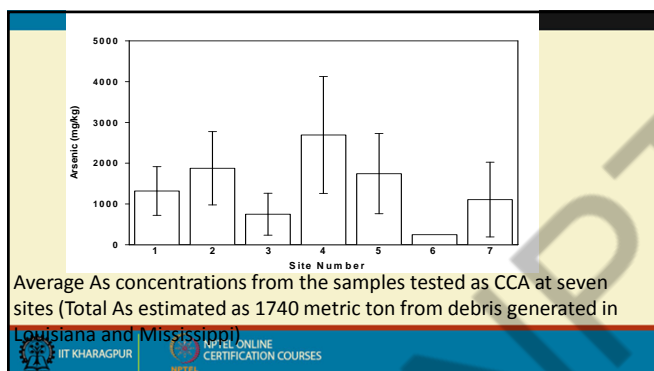
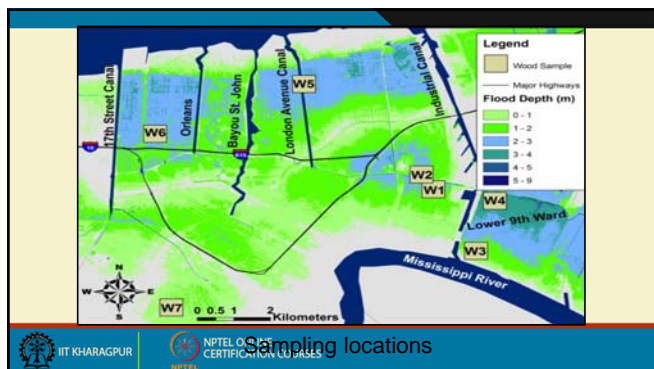


Research
 VOL. 41, NO. 1, 2007 / ENVIRONMENTAL SCIENCE & TECHNOLOGY • 1523
Quantities of Arsenic-Treated Wood in Demolition Debris Generated by Hurricane Katrina
 BRAJESH DUBEY,*
 DEEJANA M. NOLLO-GARRIELE,*¹ AND
 TIMOTHY G. TOWNSEND²
 Department of Environmental Engineering Sciences,
 University of Florida, PO Box 116020, Gainesville, Florida
 32611-6450, and Department of Civil, Architectural and
 Environmental Engineering, University of Miami,
 Coral Gables, Florida 33124-0830

Known and Unexplored
 ORGANIC CONSTITUENTS
 in the Earth's Atmosphere
 Arsenic-Treated Wood in
 Hurricane Katrina Debris
 Human Exposure to PBBs

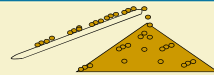
Environmental Science & Technology Online News
http://pubs.acs.org/subscribe/journals/esthag-af/2007/jan/science/ee_katrina.html

Science News – January 24, 2007
Arsenic in Hurricane Katrina wood debris
 Treated lumber from houses and other structures destroyed by the hurricane poses a hazardous waste disposal problem.



Procedures for Determining Potential for Beneficial Use

- Must assess risk to human health and the environment
- Multiple pathways and receptors may need to be considered
 - Direct human exposure
 - Contamination of groundwater
 - Impact on ecosystems



Industrial Waste

1. Measure Total Concentration (mg/kg)
2. Measure Leachable Concentration (mg/kg)

Compare results to appropriate risk-based Thresholds. The reuse application is dictated by results.

Crushed Concrete



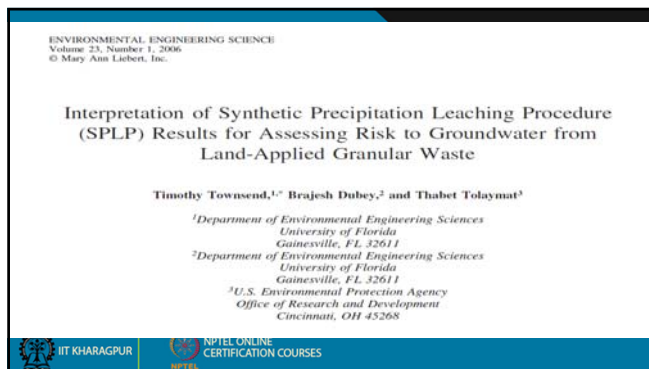
Milled Asphalt Pavement




Chipped Wood





Asphalt Roofing Shingles







CONSTRUCTION AND DEMOLITION (C&D) WASTE
C&D WASTE MANAGEMENT RULES 2016
 Dr. BRAJESH KUMAR DUBEY
 DEPARTMENT OF CIVIL ENGINEERING

Hurricane Katrina Statistics

- Mississippi
 - 65 million yd³ debris (2 million yd³ in the water)
 - No hazardous spills
 - 6,000 – 7,000 homes to be demolished



(Source: Mississippi DEQ)

Hurricane Katrina Statistics



- Louisiana
 - Removed 16.5 million yd³ so far (58%)
 - About 28 million yd³ total “curbside debris”
 - 3 million lbs CFCs – 15% of world consumption
 - 1.5 million lbs from refrigerators
 - 1.5 million lbs from cars
 - 5,000 – 6,000 propane tanks
 - 30,000 homes to be demolished (approx. 12 million yd³)

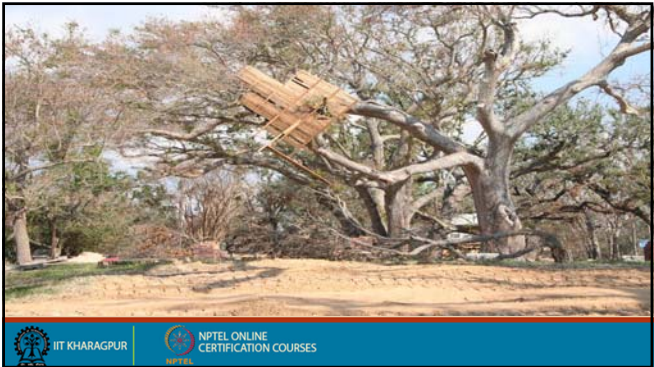
(Source: Louisiana DEQ)

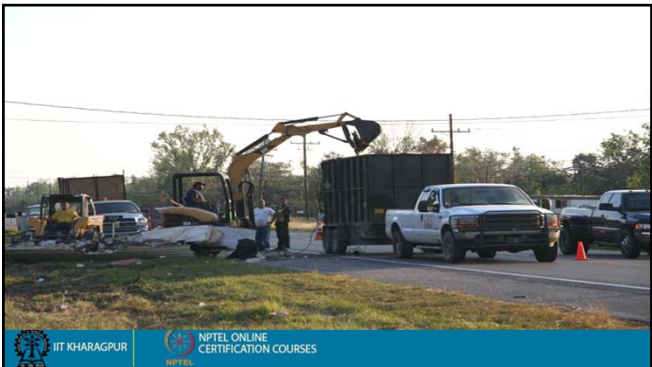



Hurricane Katrina Statistics

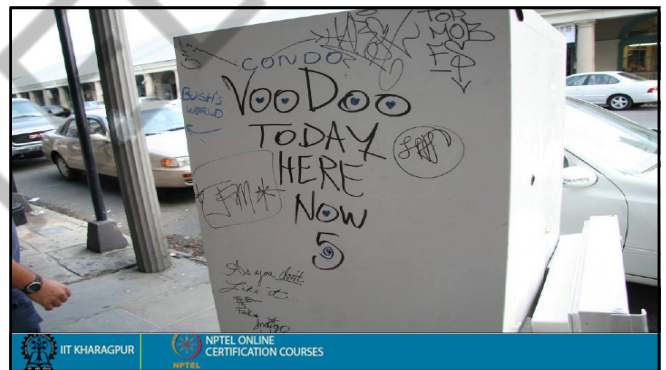
- Total: ~ 45 million yd³
- For Comparison
 - Approx. 49 million yd³ of debris was generated in FL during 2004 hurricane season from all storms
 - Approx. 30 million yd³ of C&D debris generated during 2002 in Florida

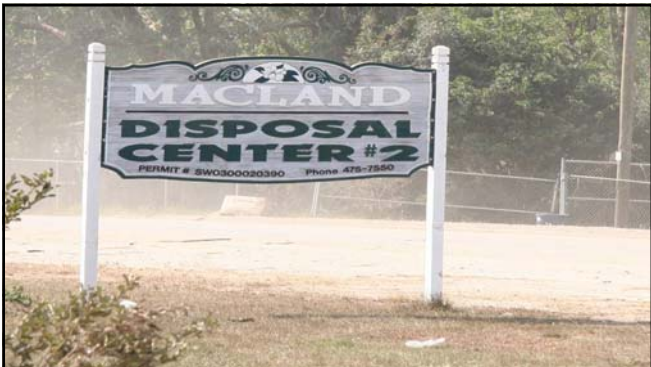



































Hurricane Katrina Challenges

- Little recycling
 - Mostly large metal objects (white goods, cars)
 - Vegetative debris is ground, but used as ADC
 - Formosan termites – really a problem?
 - NESHAP Regulations – different for homes standing and those collapsed
 - Inadequate infrastructure pre-Katrina
 - USACE is somewhat unfamiliar with solid waste management
 - FEMA reimbursement deadlines led to more disposal

Hurricane Katrina Challenges

- Disposal
 - Clay or natural liners
 - No leachate collection
 - H_2S problems from drywall likely in the future
 - USACE sets tipping fee – many established landfills unwilling to accept at that amount
 - Must create new or use less preferable landfills
 - Hazardous waste kept out?

Hurricane Katrina Challenges

- Refrigerators
 - Big problem
 - In MS, 1 of every 25 refrigerators still had refrigerant
 - How to manage more effectively in the future?
- Electronic waste
 - Much not removed from waste stream
 - Cannot be reused due to saltwater intrusion

Katrina: Biggest Lesson to Learn

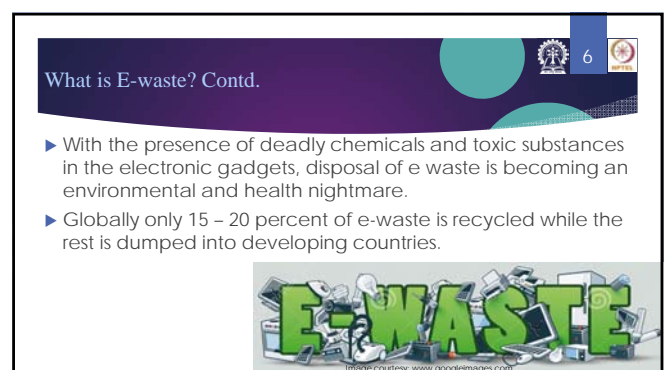
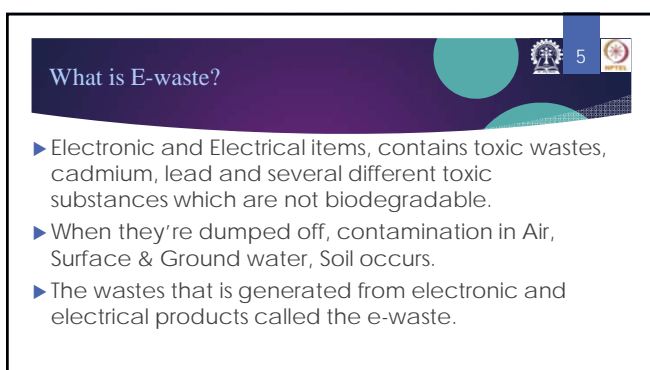
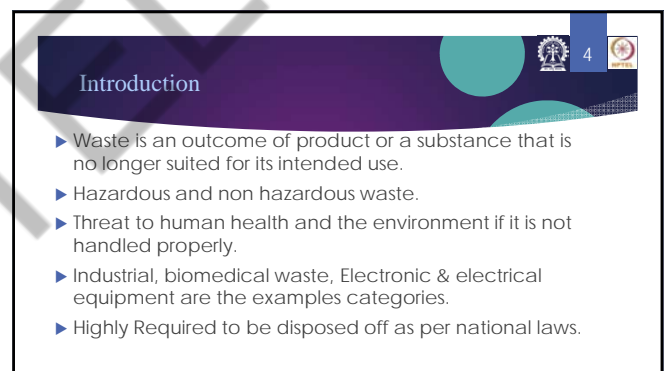
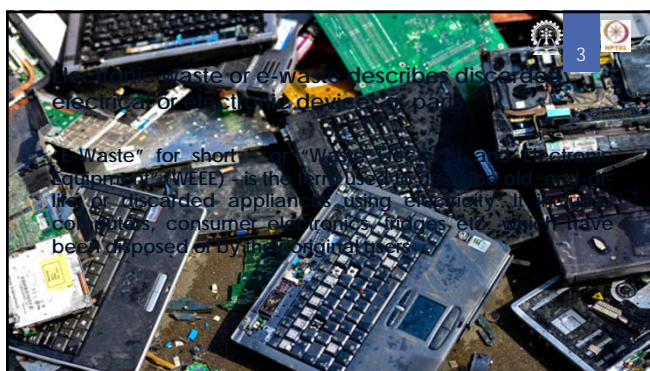
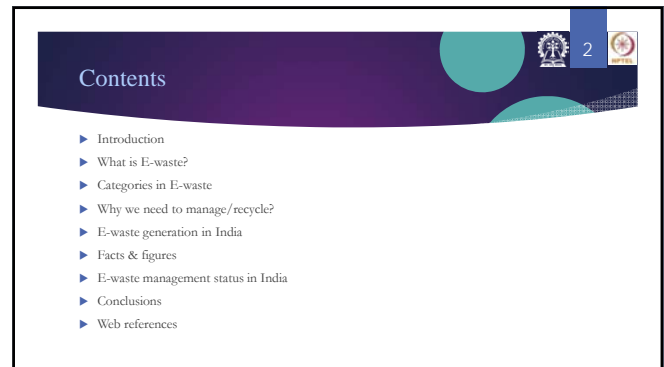
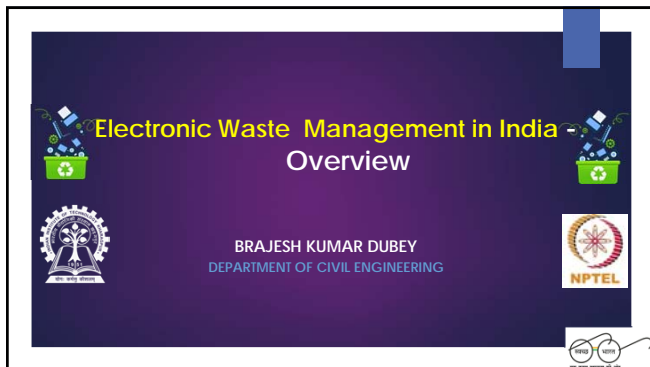
- Disaster debris clean up plan
 - Should be part of every local government's solid waste management plan
 - Include provisions for disasters in MSW collection contracts
 - Informed decisions made well in advance
 - Ensures it is handled by experienced solid waste professionals
 - Sister counties/cities? – sharing information directly



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Categories in E waste

Electrical and Electronic equipment can be Categorized into..

- ▶ Large household appliances.
Refrigerator, freezer, washing machine & other appliances.
- ▶ Small household appliances
Vacuum cleaners, watches, grinders, etc.
- ▶ IT and telecommunication equipment
PCs, printers, telephones, etc.

Categories in E waste...

- ▶ Consumer equipment
TV, radio, cam, amplifiers etc
- ▶ Lighting equipment
CFL, High intensity Sodium lamp.
- ▶ Medical devices
Radiotherapy equipment, cardiology, dialysis, nuclear medicine, etc.
- ▶ Automatic dispensers
For hot drinks, hot & cold bottles

Categories of E-waste (A)



Large Household Appliances

Refrigerator, Freezer, Washing machine, Cooking appliances etc.



Information and Communication Technology Equipment

Computers, Laptops, Mobiles, Computer Accessories, Printers, Copying Equipment etc.



Consumer Electronics

Toaster, Coffee machines, Clocks, Watches, Hair dryer, Shavers etc.

Categories of E-waste (B)



Large Household Appliances

Refrigerator, Freezer, Washing machine, Cooking appliances etc.



Small Household Appliances

Vacuum cleaner, Watch, Grinders, Hair dryer etc.



Electrical and Electronic Tools

Drills, Saws, Sewing Machines etc.

Categories of E-waste



Consumer Equipment

TV, Radio, Video Camera, Amplifiers etc.



Lighting Equipment

CFL, Sodium Vapor Lamp, Fan, Switches, Wires etc.



Toys, Leisure and Sports Equipment

Computers, Phones, Video games, Electric trains etc.



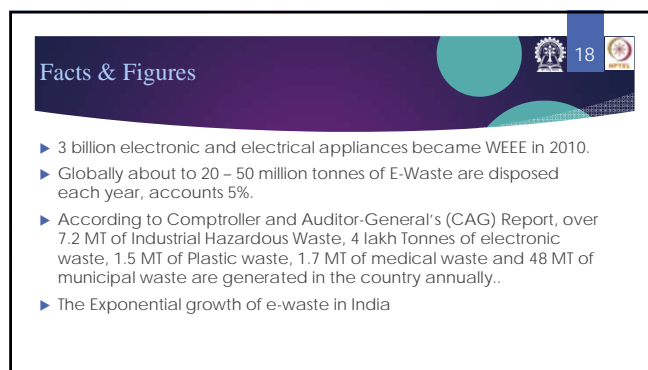
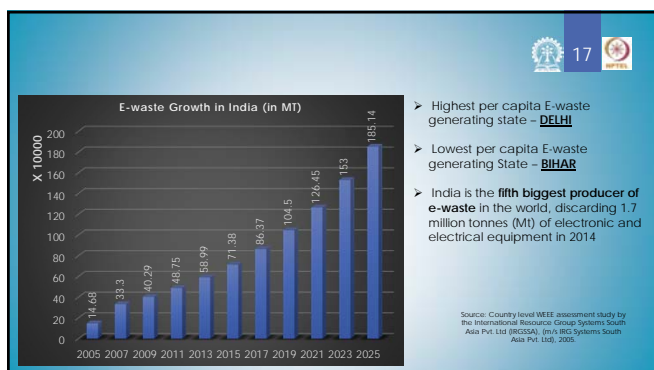
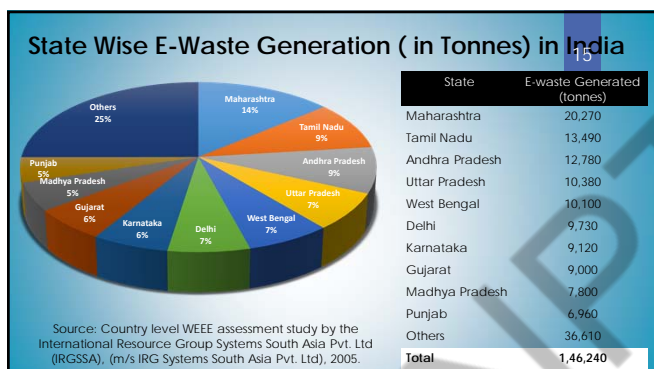
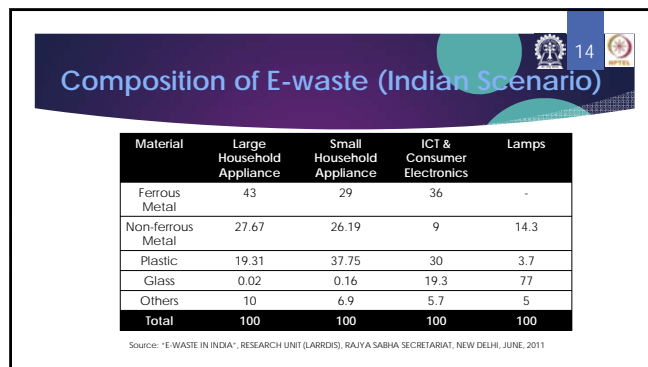
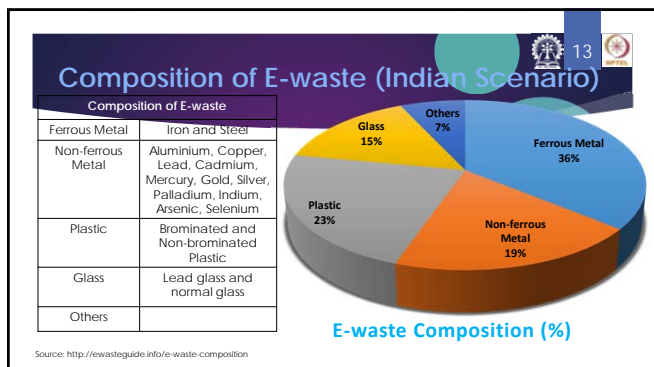
Medical Devices

Radiotherapy, Cardiology, Neurology, Dialysis equipment etc.



Monitoring and Controlling Equipment and Automatic Dispenser

Smoke Detector, Thermostat, ATM, Coffee vendors etc.



Environmental and Health Hazards		
Pollutant	Use/ Occurrence	Danger
Arsenic	Semiconductors, diodes, microwaves, LEDs (light-emitting diodes), solar cells	Chronic exposure to arsenic can lead to various diseases of the skin and decrease nerve conduction velocity. Chronic exposure to arsenic can also cause lung cancer and can often be fatal
Barium	Electron tubes, filler for plastic and rubber, lubricant additives	Short-term exposure to barium could lead to brain swelling, muscle weakness, damage to the heart, liver and spleen. Animal studies reveal increased blood pressure and changes in the heart from ingesting barium over a long period of time
Beryllium	switch boards and printed circuit board	Carcinogenic: Chronic Beryllium Disease (berylliosis), a disease which primarily affects the lungs. Exposure to beryllium also causes a form of skin disease that is characterised by poor wound healing and wart-like bumps
Brominated Flame Retardant	Casing, circuit boards (plastic), cables, PVC cables	Combustion of halogenated case material and printed wiring boards at lower temperatures releases toxic emissions including dioxins which can lead to severe hormonal disorders

Source: <http://ewasteguide.info/e-waste-composition> & <http://www.lemnitech.com/periodic/elements/index.htm>

Environmental and Health Hazards		
Pollutant	Use/ Occurrence	Danger
Cadmium	Batteries, pigments, solder, alloys, circuit boards, computer batteries, monitor cathode ray tubes (CRTs)	A carcinogen. Long-term exposure causes Itai-itai disease, which causes severe pain in the joints and spine. It affects the kidneys and softens bones
Chrome	Dyes/pigments, switches, solar	Inhaling hexavalent chromium or chromium 6 can damage liver and kidneys and cause bronchial malades including asthmatic bronchitis and lung cancer
Cobalt	Insulators	Accumulate to toxic levels in the liver, kidney, pancreas, and heart, as well as the skeleton and skeletal muscle. Cobalt has been found to produce tumors in animals and is likely a human carcinogen as well
Copper	Conducted in cables, copper ribbons, coils, circuitry, pigments	Nausea, Vomiting, Diarrhea, Liver Damage, Kidney Damage, Death
Lead	Lead rechargeable batteries, solar, transistors, lithium batteries, PVC (polyvinyl chloride) stabilizers, lasers, LEDs, thermoelectric elements, circuit boards	A neurotoxin that affects the kidneys and the reproductive system. High quantities can be fatal. It affects mental development in children

Source: <http://ewasteguide.info/e-waste-composition> & <http://www.lemnitech.com/periodic/elements/index.htm>

Environmental and Health Hazards		
Pollutant	Use/ Occurrence	Danger
Liquid Crystals	Displays	
Lithium	Mobile telephones, photographic equipment, video equipment (batteries)	Corrosive to the eyes, the skin and the respiratory tract. Corrosive on ingestion. Inhalation of the substance may cause lung oedema
Mercury	Components in copper machines and steam irons; batteries in clocks and pocket calculators, switches, LCDs	Affects the central nervous system, kidneys and immune system. It impairs foetus growth and harms infants through mother's milk.
Nickel	Alloys, batteries, relays, semiconductors, pigments	lung cancer, nose cancer, larynx cancer and prostate cancer, Asthma and chronic bronchitis, Carcinogenic.

Source: <http://ewasteguide.info/e-waste-composition> & <http://www.lemnitech.com/periodic/elements/index.htm>

Environmental and Health Hazards		
Pollutant	Use/ Occurrence	Danger
PCBs (polychlorinated biphenyls)	Transformers, capacitors, softening agents for paint, glue, plastic	PCBs have also been shown to cause a number of serious non-cancer health effects in animals, including effects on the immune system, reproductive system, nervous system, endocrine system and other health effects
Plastics	circuit boards, cabinets and cables	Carcinogenic. It can harm reproductive and immune systems. Burning PVC, a component of plastics, also produces dioxins. BFR can leach into landfills
Selenium	Photoelectric cells, pigments, photocopiers, fax machines	Exposure to high concentrations of selenium compounds cause selenosis. The major signs of selenosis are hair loss, nail brittleness, and neurological abnormalities (such as numbness and other odd sensations in the extremities)

Source: <http://ewasteguide.info/e-waste-composition> & <http://www.lemnitech.com/periodic/elements/index.htm>

Environmental and Health Hazards		
Pollutant	Use/ Occurrence	Danger
Silver	Capacitors, switches (contacts), batteries, resistors	Cardiac abnormalities, permanent brain and nervous system damage
Zinc	Steel, brass, alloys, disposable and rechargeable batteries, luminous substances	Too much zinc can still cause eminent health problems, such as stomach cramps, skin irritations, vomiting, nausea and anaemia
Toner Dust	Toner cartridges for laser printers / copiers	An irritant to people with respiratory conditions such as asthma or bronchitis
Americium	Medical equipment, fire detectors, active sensing element in smoke detectors	Radioactivity
Chlorofluorocarbon (CFC)	Cooling unit, insulation foam	deleterious effect on the ozone layer. This results in increased incidence of skin cancer in humans and in genetic damage in many organisms

Source: <http://ewasteguide.info/e-waste-composition> & <http://www.lemnitech.com/periodic/elements/index.htm>

Hazard due to Improper Disposal	
Disposal Type	Hazard
Incineration	Brominated flame retardants at a high temperature of 600-800°C generate extremely toxic polybrominated dioxins (PBDDs) and polybrominated furans (PBDFs); PVCs generate toxic flue gas;
Landfilling	Hazardous metal (e.g. Lead, Chromium, Mercury, Cadmium etc.), PCBs, PBDEs leach into the soil and groundwater.
Recycling	It often causes hazardous emission, due to recycling of plastics, halogenated substances and heavy metals like lead, cadmium etc. Shredding without proper disassembly causes hazardous substances dispersed into environment.

Source: <http://ewasteguide.info/e-waste-composition>

Why do we need to recycle ?

- ✓ Land filling of e wastes can lead to the leaching of lead into the ground water.
- ✓ If the CRT is crushed and burned, It emits toxic fumes into the air.
- ✓ The cadmium from one mobile phone battery is enough to pollute 600 m3 of water.
- ✓ Huge impact on health & Environment because of E-waste around.
- ✓ Unfortunately, Barely 4% of the E Waste produced in India is recycled.

Electronic Waste Management in India Overview

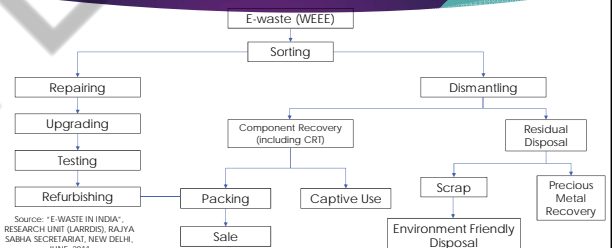
BRAJESH KUMAR DUBEY
DEPARTMENT OF CIVIL ENGINEERING

Why do we need to recycle ?

- ❖ Huge gap between generation & recycling of E-Waste



Management of E-Waste



TOP E-WASTE MANAGEMENT COMPANIES IN INDIA

E Parivaraa - India's First E-waste recycler

For material go to (URL) Tel No: 080 425 35267

Address:
B-41/1, Peenya Industrial Area, 3rd Stg, Peenya Industrial Area, Bengaluru, Karnataka 560058
Phone: 080 2836 0902

Electronic Recycling

1800 425 35267

Message to E-Parivaraa

E-Parivaraa Pvt. Ltd., India's first Government authorized electronic waste recycling plant, established in 2005, is engaged in handling, recycling and reusing of waste electrical and electronic equipment (WEEE) in an eco-friendly way. The initiative is to aim at reducing the accumulation of used and discarded electronic and electrical equipment, which pose a health and safety hazard, and to convert them into reusable materials. The company also provides a safe disposal facility for hazardous waste and ensures that the waste is recycled into useful products.

E-WASTE MANAGEMENT
GETS A NEW LEASE OF LIFE.

Delhi
Gurgaon (Haryana)
Mumbai
Kolkata
Hyderabad
Chennai
Bangalore
Kerala

Address:
Plot No.37, APIIC Industrial Park, IDA
Mankhal, Mankhal Industrial Development
Area, Malikdanguda,
Telangana 501359
Phone: 1800 419 0161



Unit details

- Unit : M/s. Earth Sense Recycle Pvt Ltd.
- Head Quarters: Chennai
- Capacity (MTA): 2160
- Units locations: Andhra Pradesh (1,800 MTA) , Maharashtra (360 MTA), and 4 more.
- Collection center locations: Trivandrum, Coimbatore, Kolkata, Bengaluru.

SIMS RECYCLING SOLUTIONS

Electronics recycling
Responsible
Global
Ethical

KARNATAKA
TAMIL NADU
UTTAR PRADESH

Organize e-waste events with the click of a button. Every kg of e-waste "Removes" for your community.

Engage your Community in initiatives. Request e-waste packages online and we'll schedule a timely pickup.

COMMUNITIES BUSINESSES RETAILERS

Be a Part
Delhi
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Get your eWaste picked!
Call on 1800 419 3283
Recycle Responsibly & Get Paid!

ADDRESS: H-59 Sector 63, Noida, UP 201301,
P: +91-120-4087100 F: +91-120-4087101

Attero's recycling, is the only unit which does the complete e-waste management process with its end to end e-cycling plant, zero dumping technology.

Attero's Clean E-India

Home to Attero

Call e-Captain
e-Captain collects old electronics from your door step
Get benefit from it

Attero is a NASA recognized technology innovator, promoting eco-friendly reuse and recycling E waste.
Wide range of services, include country-wide pick up, collection, tracking, logistics management, recovery, refurbishment, e-waste recycling and disposal.

Attero to Nature

Transport old electronics to Attero centre for processing
Scientific way of recycling
For a better tomorrow

Recycling Solutions

- Attero's Recycling technology aims to take today's waste and turn it into conflict-free, sustainable resources for tomorrow.
- Mobile phone recycling: Scanned and updated in the system, separating components which can be used again in different industries, such as electronics, plating, jewelry, automotive and art foundries.
- Display unit recycling: Cathode Ray Tubes (CRT) contain lead, glass which can be recovered and reused. The process involves glass cutting, heating & air blow. Using Magnetic Separator, ferrous metals removed.
- Battery recycling: Furnace smelting, treatment with alloys are the technologies involved. Attero recycles all types of batteries classified as e-waste by the EPA.
- PCB recycling: Printed circuit boards Component Removal Machine which separates components.
- IT Goods recycling: Includes desktops, laptops, servers to printers, scanners, copiers etc.

Unit details

- Unit: M/s. Attero Recycling Pvt. Ltd
- Capacity (MTA): 12000
- Location: Uttarakhand
- Collection center locations: Delhi, Hyderabad, Bengaluru.
- E-mail: cleaneindia@gmail.com

'Clean The Environment' 'Protect The Environment'

Computer Hardware, Electronics & Accessories

Address:
Tech Logic, Unit II,
Shed No.36, 2nd
Main,
Ranganathapura,
Bangalore,
India 560 044

Recycling of E-Waste
Recycling of Toner Cartridge
100% Data Destruction
Onsite Hard Disk Shredding/ Scraping

A Commitment for GREEN EARTH

E-Waste Recyclers India

EWRI is here with one mission, save the environment from our e-waste so we can keep this planet green for generations to come.

WEEE Recycle

Establishing E-Waste Centers to Enhance Environment Friendly Recycling

Home About WEEE Recycle Features Resources Publications Activities in Cities

Welcome to WEEE Recycle

The rapid growth of the electronic industry coupled with high product obsolescence leads to the generation of large quantities of electronic waste (e-waste), one of the fastest growing waste streams worldwide. An assessment carried out in India under an EU-India Project in 2007, by the Manufacturers Association of Information Technology (MAIT) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, quantified e-waste generation to approximately 130,000 MT, expected to reach 470,000 MT by 2011. Of the generated waste, only 19,000 MT is recycled primarily by the informal sector. Due to the vast quantity of waste in the urban solid waste stream, there is little awareness on its safe management.

There is an urgent need to bridge the existing gap between e-waste generation and recycling. This can be achieved by improving the channelization mechanisms for proper recycling and establishing a system of accountability in e-waste management.

This project aims at improving the situation of e-waste management in India by involving producers, recyclers informal and formal encompassing small and medium scale

E-Waste Collection Centres

Click on the city nearest to you to find the nearest E-Waste Collection Centre

Expert Speak

Dr. N. John Robert
Member of Public Administration and Business Administration
Working since 15 years in the field of Waste Management, E-Waste

Expert Speak Address:

Ramakrishna Dalmia Wing, 4th Floor, PHD House, 4/2, Siri Institutional Area, August Kranti Marg, New Delhi 110 016, India
Tel: +91-11-2685 5487, 4287 8418

Aiding You Fulfill Social Responsibility Through Sustainable Practices

IT Asset Management Reverse Logistics Value Recovery Environment Management

Greenscape Eco Management: 511-512, Elegance Tower Jasola Non-Hierarchical Commercial Center New Delhi - 110025 Phone: +911140515662

Welcome to Greenscape Eco Management

Greenscape Eco Management has been inception in late 2007 and has grown to be India's leading provider of IT Asset Disposition services. Greenscape Eco Management serves corporate clients in the IT, IT enabled, and business sectors to manage their electronic waste in an environmental friendly manner while also generating revenue for the clients. Our services is founded on the delivery of world-class supply chain

Solutions

Regardless of the waste management requirements - large or small, complex or simple - our service portfolio coupled with our rich experience of dedicatedly working teams will create the best solution for your business.

Collection & Reverse Logistics Management
Dis-manufacturing & Component Harvesting
Data Destruction



Action plan followed in recycling

- ❖ Collection of disposed Zinc, Brass, Copper, lead etc.
- ❖ Recovery starts with the separation of containing metals from other materials,
- ❖ Typically by magnetics, sink-float, or hand sorting etc.
- ❖ Pretreatment, Melting, Refining etc. are the processes followed up by the JS Pigments in recycling E waste for environmental sustainability

Unit details

- ❖ Unit: M/s. J.S. Pigments Pvt. Ltd.
- ❖ Head Quarters: Kolkata
- ❖ Capacity (MTA): 600 MTA
- ❖ Units locations: Kolkata
- ❖ Collection center locations: West Bengal, Odisha, Assam, Madhya Pradesh
- ❖ E-mail: jspigments@gmail.com



Processes involved

- ▶ Recycling is being done by simply tossing the right matter in the right bin.
- ▶ **REMOVAL OF COVER:** Remove the main cover by taking out the screws. Place it in waste container.
- ▶ **REMOVAL OF CABLE ASSEMBLIES AND WIRING:** Discard the component with cable assembly attached in the appropriate waste container.
- ▶ **DISMANTLING OF REAR PANEL:** Place the fasteners in the metals waste container
- ▶ **REMOVAL OF PC BOARDS:** PCB's consist of sheet metal brackets, metal stand offs disassembled and placing into waste container.
- ▶ **DISMANTLING OF OTHER COMPONENTS:** Power Supplies, Keyboards, Displays, Hard Drives, Speakers etc

Unit details

- ❖ Unit: M/s Hi- Tech Recycling India Pvt Ltd.
- ❖ Head Quarters: Maharashtra
- ❖ Capacity (MTA): 500
- ❖ Units locations: Maharashtra
- ❖ Collection center locations: Pune
- ❖ Website: www.hitechrecycling.in



Cutting edge technology, highly advanced techniques with a team of diligent professionals.

- ❖ Following are the steps involved in e-waste handling: Collection of e-waste material from premises and safe transportation to our factory premises.
- ❖ Sorting
- ❖ Identify Usefulness
- ❖ Identify hazardousness
- ❖ Dismantling
- ❖ Segregation
- ❖ Treatment / Disposal

Unit details

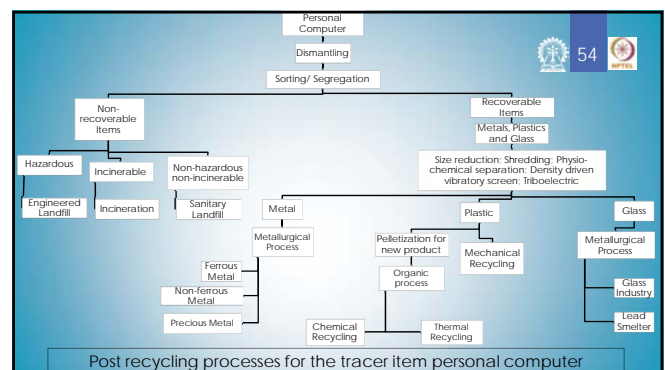
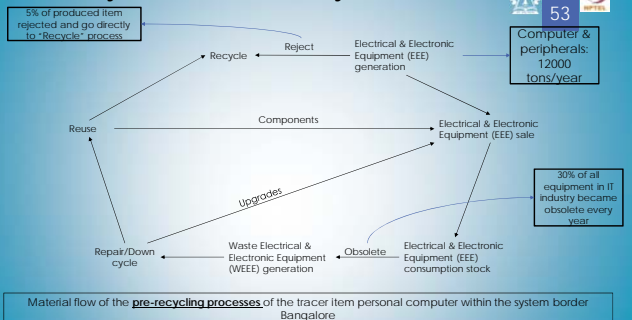
- ❖ Unit: Earth E-Waste Management Pvt. Ltd
- ❖ Head Quarters: Gujarat
- ❖ Capacity (MTA): 6000
- ❖ Units locations: Gujarat
- ❖ Collection center locations: Surat
- ❖ E-mail: info@eemplindia.com

E-Waste Management: A Case Study of Bangalore, India

- Date: March, 2009
- Location: Bangalore Rural district and Dobaspet Industrial Area
- E-waste Management Companies:
 - ❑ Ash Recycler
 - ❑ E-parisaraa
- Process of Study: One to one interview and Software modelling
- Field of Study:
 - ❑ Sourcing, Logistics and Processing of E-waste
 - ❑ Current Handling Capacity of E-waste Management Companies
 - ❑ Status of Technology Used Currently and Challenges Faced

Source: P.K. Jatindra, K. Sudhir, "E-Waste Management: A Case Study of Bangalore, India", Research Journal Environmental and Earth Sciences, 2009, 1(2) 111-118

Field Survey and Material Flow Analysis:



E-waste Management at Organizational Level:

E-waste is segregated into four categories namely-

1. Computer and Computer peripherals
2. PCBs (printed circuit boards) and electronic components
3. Electrical wires/cables, cut wires
4. All other electronic equipment

Three Main Stakeholders Of The Process:

- The Government- agencies associated with E-waste that include Karnataka State Pollution Control Board (**KSPCB**), Bruhat Bengaluru Mahanagar Palike (**BBMP**), Department of Information Technology, Government of Karnataka
- The Generators (mainly producers and consumers)
- The Recyclers (Both formal and informal recyclers)

Material Recovery from E-waste:

- Glass: 20%
- Plastic: 23%
- Metal: 57%
 - ✓ PCBs: 4%
 - ✓ Cables: 5%
 - ✓ Ferrous Metal: 20%
 - ✓ Non-ferrous Metals: 28%



From 1 ton computer waste 99% is used for precious metal recovery and other 1% is for landfilling

Status of Technology, Challenges and Innovative Options:

- Current recycling operations are limited only to pre-processing of E-waste material
- The only technology being used for E-waste recycling in Bangalore is the shredding/ pulverizing technology followed by **pyrometallurgical** and **hydrometallurgical** process
- Hydrometallurgical processing techniques include cyanide leaching, halide leaching, thiourea leaching, and thiosulfate leaching of precious metals
- The processes used are a combination of manual and mechanical processes, in which manual processes forms a large part

Digital India: E-waste Management: An Indian Government Initiative

