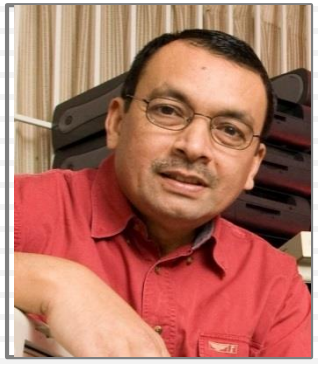
3R Technologies for WEEE (E-waste)

PLENARY SESSION 6

Resource Security and 3R Technologies

8th Regional 3R Forum of Asia and the Pacific, 9-12 April 2018, Indore, Madhya Pradesh, India



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What is E-waste?

- Temperature exchange equipment (refrigerators, freezers, air conditioners, heat pumps).
- Screens, monitors (televisions, monitors, laptops, notebooks, and tablets).
- Lamps (fluorescent lamps, compact fluorescent lamps, high intensity discharge lamps and LED lamps).
- Large equipment (washing machines, clothes dryers, dish washing machines, electric stoves, large printing machines, copying equipment and photovoltaic panels).
- Small equipment (vacuum cleaners, microwaves, toasters, electric kettles, electric shavers, scales, calculators, radio sets, video cameras, electrical and electronic toys, small electrical and electronic tools, small medical devices, small monitoring and control instruments).
- Small IT and telecommunication equipment (mobile phones, GPS, pocket calculators, routers, personal computers, printers, telephones).

Global E-waste Generation

- During 2016 world generated around 44.7 million tonnes (Mt) of E-waste
- Global e-waste generation to reach 52.2 Mt by 2021
- Asian region produced the highest amount of e-waste (18.2 Mt or 40.7% of total), followed by Europe (12.3 Mt), the Americas (11.3 Mt)
- The top three Asia-Pacific countries with the highest e-waste generation in absolute quantities are China (7.2 Mt), Japan (2.1 Mt) and India (2 Mt).

Source: Global E-waste Monitor 2017 (UNU)

ITU

UNITED NATIONS UNIVERSITY
UNU-VIE SCYCLE
Sustainable Cycles Programme

ISWA
International Solid Waste Association

UNITED NATIONS UNIVERSITY
UNU-VIE SCYCLE
Sustainable Cycles Programme

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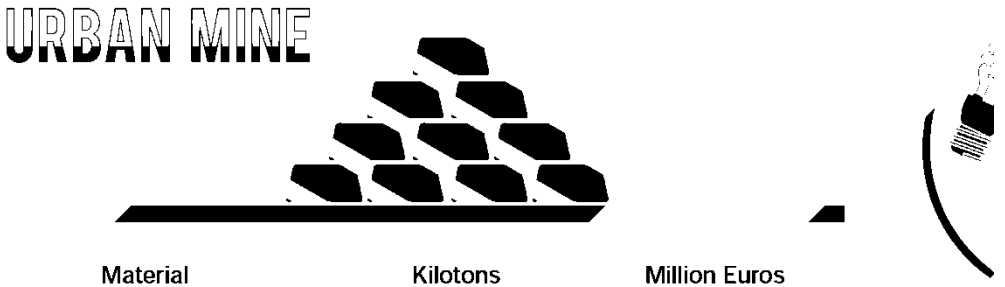
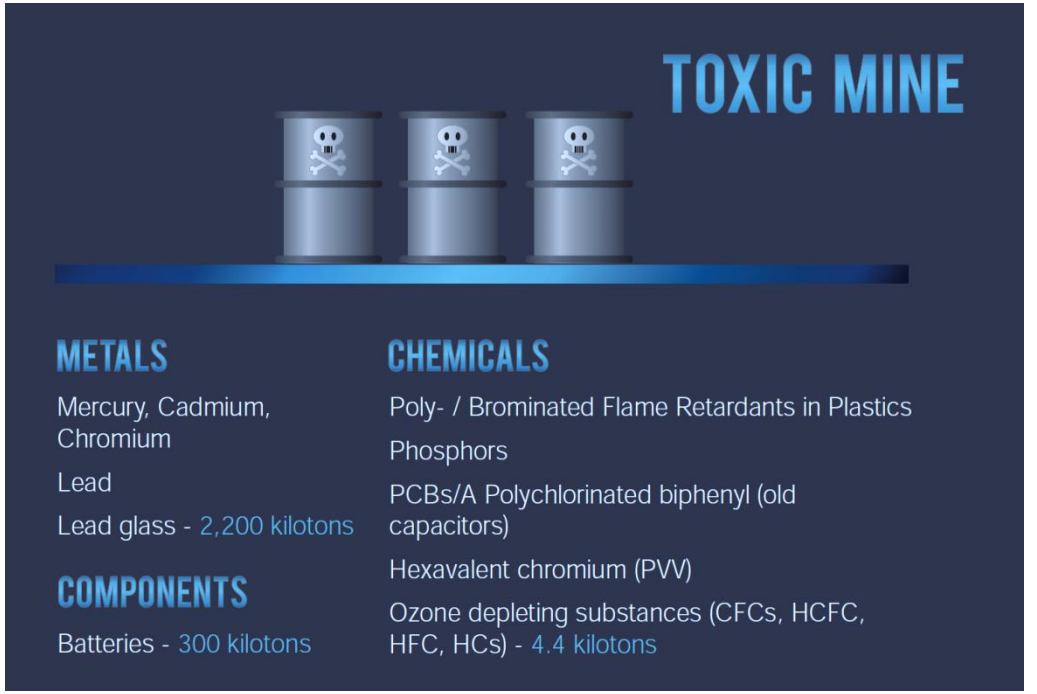
Ministry of the Environment

Global E-waste Monitor (UNU)



Material	Kilotons	Million Euros
METAL		
Iron, Steel (Fe)	16,500	9,000
Copper (Cu)	1,900	10,600
Aluminum (Al)	220	3,200
Precious Metals		
Gold (Au)	0.3	10,400
Silver (Ag)	1.0	580
Palladium (Pd)	0.1	1,800
PLASTICS		
PP, ABS, PC, PS	8,600	12,300



E-waste Generation In India

- India is likely to generate 5.2 million metric tonnes of e-waste per annum by 2020 from a current level of 1.8 million tonnes growing at a compound annual growth rate of 30%
- Only 1.5% of India's total e-waste ends up in recycling due to poor infrastructure, legislation and framework.
- Over 95% of e-waste generated is managed by the unorganised sector and scrap dealers in the market.
- 65 cities in India generates more than 60% of the total e-waste generated in India and 10 States generate over 70% of the total e-waste generated.

Sources: Associated Chambers of Commerce and Industry of India (ASSOCHAM) and Borthakur, A., Singh, P. (2012) Electronic waste in India: Problems and policies, *International Journal of Environmental Sciences*, 3, 1, 353-362

E-waste Regulations in India

- In 2005, India's Central Pollution Control Board developed guidelines for environmentally sound management of e-waste in India.
- The Ministry of Environment and Forest as part of the Environmental Protection Act of India enacted the 'E-waste (Management and Handling) Rule of 2011 which took effect from 1st May 2012
- In 2016, the Central Government of India notified the E-waste (Management) Rules, 2016 (the EWM Rules, 2016) which now supersedes the E-waste (Management and Handling) Rules, 2011 and came into force from 1st October 2016.
- One of the highlights of the EWM Rules, 2016 is the concept of Extended Producer Responsibility (EPR).

Key components of E-waste resource recovery and recycling chain

- Treat the hazardous compounds contained in e-waste in an environmentally sound manner while preventing secondary and tertiary emissions
- Recover valuable material using efficient processes
- Create economically and environmentally sustainable businesses
- Consider social impact and local context of operations

Issues related to 3Rs in E-waste Management

- Only a fraction of e-waste is currently recycled in even in developed countries.
- End-of-life EEE does not reach the recycling process as part of the EEE is stored at home
- Only a part of collected e-waste is sent directly to recycling for environmentally sound recovery of materials
- Remainder is reused and then recycled or exported for reuse in developing countries
- Rudimentary recycling processes employed in developing and transition economies achieve far less recovery yields especially with valuable metals.
- Advanced integrated smelter could recover over 95% of the gold, recycling practices in developing countries could achieve only around 25%.

E-waste Recycling Technology

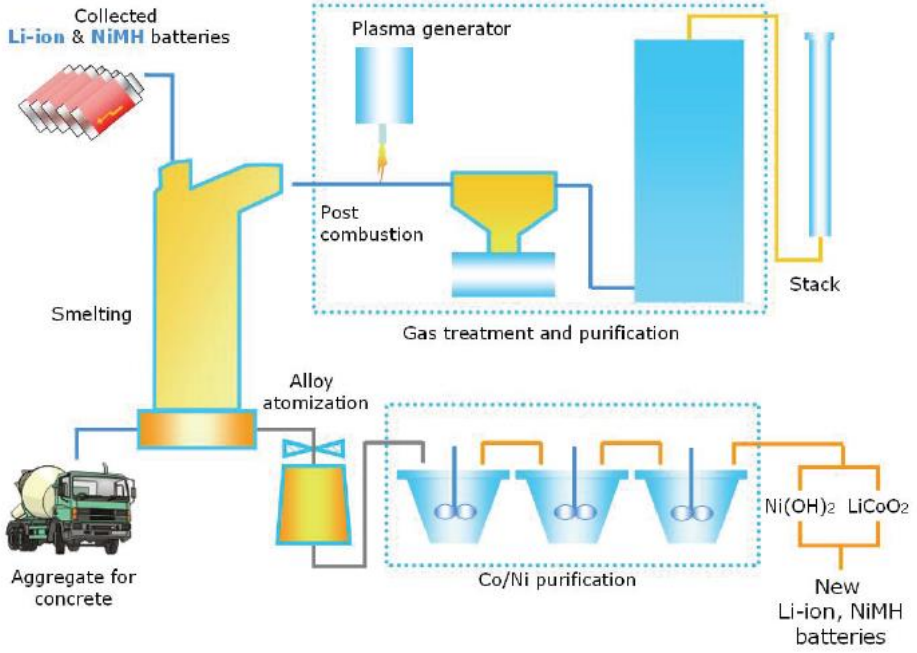


Figure 5.4: Material flows and main process units of Umicore's battery recycling process (by courtesy of Umicore Precious Metals Refining)

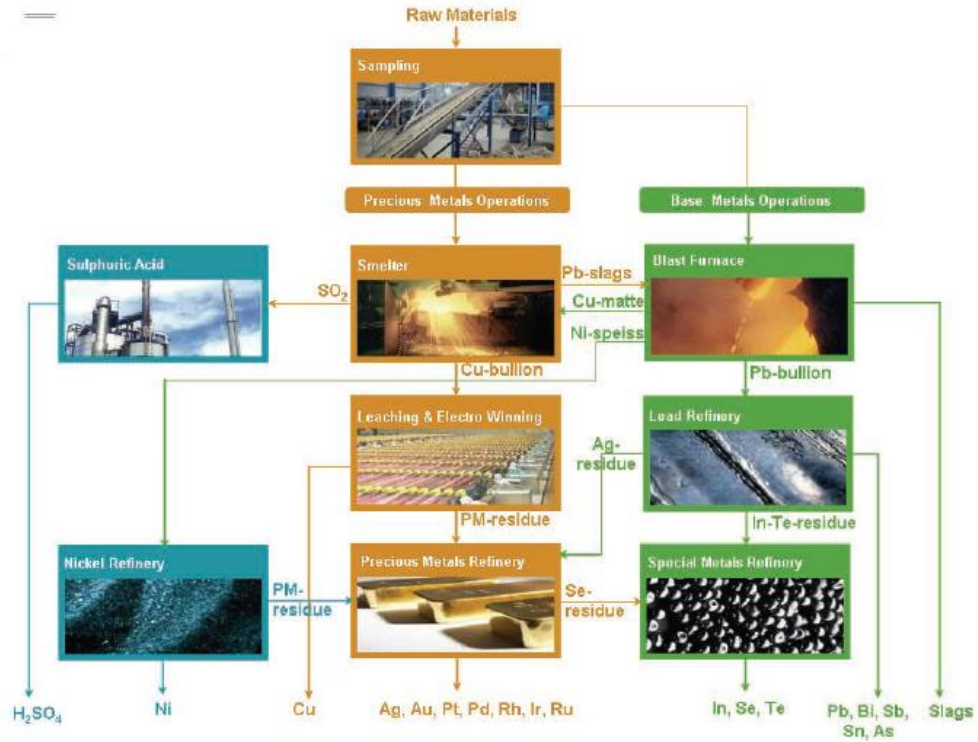


Figure 5.3: Material flows and main process units at Hoboken plant (by courtesy of Umicore Precious Metals Refining)

Formal E-waste Recycling in India

- **E-Parisaraa Pvt. Ltd** (India's first government authorized electronic waste recycler which started operations from September 2005)
- **Terrapro** (India's first Producer Responsibility Organisation (PRO) set up to assist manufacturers and producers to comply with the new E-waste Management Rules 2016)
- **Attero Recycling** (India's one of the largest e-waste recycling and metal extraction companies in India)
- **Ecoreco** Eco Recycling Ltd (Ecoreco)
- **Karma Recycling** (trade-in operator and redistributor of mobile devices in India

Note: Examples only to demonstrate India's formal e-waste recycling potential.

Extended Producer Responsibility (EPR)

EPR schemes make producers physically or financially responsible for the environmental impacts of their products throughout their life cycle.

EPR Categories include:

- Product take-back schemes that require the producer or retailer to collect the product at the post-consumer stage.
- Economic and market-based instruments that include measures such as deposit-refund schemes, Advanced Disposal Fees (ADF)
- Regulations and performance standards
- Information-based instruments

EPR for E-waste India

- **Samsung Takeback and Recycle (STAR) Progam** (Consumers can deposit Samsung-branded consumer electronics at no cost at any of the drop-off locations in major cities in India)
- **Xiaomi India E-waste Recycling Program (**Xiaomi has launched an e-waste management programme in India under the name “Mi India Product Take-Back & Recycling Program)
- **LG National E-waste Recycling Program (**LG Electronics has developed a partnership Pollution Control Board authorized e-waste recyclers for facilitating their customers to enable them to dispose off e-waste products)

Public Private Partnerships (PPPs) for E-waste

- **Clean E-India (** Initiative International Finance Corporation and Attero to help properly manage e-waste)
- **E-waste: From Toxic to Green (**Chintan has created a partnership with Safai Sena, a registered association of waste pickers to improve collection, segregation and storage of e-waste)
- **Microsoft-GIZ E-waste Partnership**
- **eC2: E-Waste Management Program India**

Need for a Science-Policy-Business Interface towards Economic Utilisation of E-waste

Disconnected

- Heavy emphasis on basic research related to impacts of poor e-waste management
- Policies based on keen-jerk reactions

Interacting

- Good balance of basic and translational research (Impacts and Solutions)
- Policies based on sound scientific research and relevant stakeholder engagement

Different Requirements (Conflicts??)

- Government – Develop regulations and policies to minimise environmental and health impacts
- Informal Sector – Maintain current operations holding up to 95% of stock (employment, financial dependence)
- Formal Sector – Looking for return of investment (need to divert stock from informal sector)
- Research Community - Institutional pressures to publish

Holistic and Consultative Approach Needed

Way Forward

- Well defined national e-waste management strategy based upon circular economy and 3R concepts.
- Such strategy should not only address the environmental and health impacts of e-waste (end-of-pipe) but also look at the reduction of e-waste through green design (up-the-pipe).
- It should also create enabling conditions for relevant stakeholders to develop business and economic opportunities to recover the materials from e-waste.
- The strategy should take into account the financial, institutional, political and social aspects of e-waste management, in particular, incorporating the activities of informal e-waste recycling sector

Key Policy Questions

- 3R technologies that drive towards resource security and circular economic development are essential for the region. How do we create an enabling environment for the private sector to harness potential business and economic opportunities in recycling and resource recovery e-waste in the region??
- How do we combine the strengths and capabilities of informal and formal e-waste recycling sectors to develop a sustainable e-waste management system in the region?
- How do we address the consumer's e-waste disposal behaviour and awareness in the context of complex socio-cultural and economic conditions in the country so that the implementation of innovative 3R technologies could be sustainable in the longer term??