









# Participant Handbook

Sector

**Telecom** 

Sub-Sector

**Handset** 

Occupation

**E-Waste Management** 

Reference ID: TEL/Q2400, Version 5.0

NSQF Level 4



Telecom E-Waste Handler

#### This book is sponsored by

Telecom Sector Skill Council

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Skilling is building a better India.

If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi Prime Minister of India











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is hereby issued by the

TELECOM SECTOR SKILL COUNCIL

for

#### **SKILLING CONTENT: PARTICIPANT HANDBOOK**

Complying to National Occupational Standards of Job Role/ Qualification Pack: "Telecom E-Waste Handler" QP No. "TEL/Q2400, NSQF Level 4.0"

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The preparation of this handbook would not have been possible without the Telecom Industry's support. Industry feedback has been extremely encouraging from inception to conclusion and it is with their input that we have tried to bridge the skill gaps existing today in the industry.

This participant handbook is dedicated to the aspiring youth who desire to achieve special skills which will be a lifelong asset for their future endeavors.

#### **About this book**

India is currently the world's second-largest telecommunications market with a subscriber base of 1.20 billion and has registered strong growth in the last decade and a half. The industry has grown over twenty times in just ten years. Telecommunication has supported the socioeconomic development of India and has played a significant role in narrowing down the rural-urban digital divide to some extent. The exponential growth witnessed by the telecom sector in the past decade has led to the development of telecom equipment manufacturing and other supporting industries.

Over the years, the telecom industry has created millions of jobs in India. The sector contributes around 6.5% to the country's GDP and has given employment to more than four million jobs, of which approximately 2.2 million direct and 1.8 million are indirect employees. The overall employment opopportunities in the telecom sector are expected to grow by 20% in the country, implying additional jobs in the upcoming years.

This Participant handbook is designed to impart theoretical and practical skill training to students for becoming Telecom E-Waste Handler in the Telecom Sector.

Telecom E-Waste Handler is responsible for collecting e-waste from retailers, repair shops and other unorganized stakeholders.

This Participant Handbook is based on E-Waste Handler Qualification Pack (TEL/Q2400) and includes the following National Occupational Standards (NOSs):

- TEL/N2401: Undertake telecom e-waste collection, handling, and disposal operations
- TEL/N9108: Follow sustainability practices in telecom operations
- DGT/VSQ/N0101: Employability Skills (30 Hours)

The Key Learning Outcomes and the skills gained by the participant are defined in their respective units. Post this training, the participant will be able to manage the counter, promote, and sell the products and respond to queries on products and services.

We hope this Participant Handbook will provide sound learning support to our young friends to build an attractive career in the telecom industry.

# **Symbols Used**













Objectives

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# 1. Introduction to the Telecom Sector and the Role of E-Waste Handler

Unit 1.1 - Introduction to the Program

Unit 1.2 - Introduction to E-Waste

Unit 1.3 - Roles and Responsibilities of a Telecom E-Waste Handler



# - Key Learning Outcomes



#### By the end of this module, the paricipants will be able to:

- 1. Explain the significance of managing and reducing electronic waste through proper collection, segregation, and recycling practices.
- 2. Elucidate the key skills and technical expertise required for a Telecom E-Waste Handler to identify, handle, and dispose of telecom e-waste safely and efficiently.
- 3. Describe the challenges faced in collecting, segregating, and managing telecom e-waste, including handling hazardous materials, and ensuring regulatory compliance.
- 4. Determine the impact of precision and quality control in telecom e-waste handling to ensure safe disposal, resource recovery, and environmental sustainability.
- 5. Discuss the role and responsibilities of a Telecom E-Waste Handler in maintaining high safety standards, ensuring proper waste management, and promoting sustainable practices.

# **UNIT 1.1: Introduction to the Program**

# Unit Objectives ©



#### By the end of this unit, the participants will be able to:

- 1. Discuss about the telecom industry and its various sub-sectors in India
- 2. Outline the growth of the mobile handset industry in India
- 3. List the top telecom product manufacturers in India
- 4. Identify the regularity authorities in the Telecom industry in India

#### 1.1.1 Introduction to the Telecom Sector in India

India's telecom sector has grown faster than the overall economy in recent years. As of 2025, the country has over 1.2 billion subscribers, making it the second-largest telecom market in the world. Broadband users have crossed 979 million, showing rapid digital adoption.

The sector continues to generate new jobs, especially in sales, supervisory, and managerial roles, driven by 5G expansion, rising data usage, and rural market growth.

#### **Key Segments:**

- DistriNetwork & IT Services building infrastructure and connectivity.
- Service Providers offering mobile, internet, and digital services.
- Retail & bution ensuring product availability and customer engagement at the ground level.

The telecommunication sector is the backbone of India's digital economy and has revolutionized human communication by delivering high-speed voice and data services. With the rollout of 4G and 5G networks, the industry continues to drive industrial, economic, and social growth.

India is currently the second-largest telecommunications market in the world, with over 1.2 billion subscribers as of mid-2025. Broadband users have crossed 979 million, reflecting rapid internet adoption across urban and rural areas.

The telecom sector contributes significantly to India's GDP and is a major generator of employment. The rollout of 5G, cloud computing, AI, IoT, and big data analytics has created strong demand for skilled professionals. According to the Telecom Sector Skill Council (TSSC), the industry has a demand-supply gap of nearly 28%, especially in areas like 5G, mobile app development, AI/ML, and robotic process automation.

To bridge this gap, TSSC is working to train a world-class workforce and support the growth of telecom manufacturing, services, and distribution clusters.

# 1.1.2 Various Sub-Sectors of the Telecom Industry

#### Telecommunication is a multi-dimensional industry. It is divided into the following sub-sectors

- Telecom Infrastructure It is a physical medium through which all the data flows. This includes telephone wires, cables, microwaves, satellites, and mobile technology such as fifth-generation (5G) mobile networks.
- Telecom Equipment It includes a wide range of communication technologies, from transmission lines and communication satellites to radios and answering machines. Examples of telecommunications equipment include switches, routers, voice-over-internet protocol (VoIP), and smartphones.
- Telecom Services A service provided by a telecommunications provider or a specified set of user-information transfer capabilities provided to a group of users by a telecommunications system. It includes voice, data and other hosts of services.



Fig. 1.1.1: Telecom Sub-Sectors

- Wireless Communication It involves transferring information without a physical connection between two or more points.
- Broadband It is wide bandwidth data transmission which transports multiple signals at a wide range of frequencies and Internet traffic types, that enables messages to be sent simultaneously and used in fast internet connections.

#### The major segments within these sub-sectors include the following:

- Wireless communications
- Communications equipment
- Processing systems and products

- Long-distance carriers
- Domestic telecom services
- Foreign telecom services
- · Diversified communication services

#### -1.1.3 Indian Handset Market

India is the 2nd largest mobile handset market in the world. According to a recent study by Frost and Sullivan, the Indian mobile handset market is expected to continue to grow.

The Indian smartphone market surpassed the USA for the first time on an annual level, becoming the 2nd largest smartphone market globally, reaching

158 million shipments in 2019 with a 7% year- on-year growth, according to the latest research from Counterpoint's Market Monitor service. It is projected to be a threefold increase in the number of telecom participants, and the current number of sixty-eight mobile handsets players will go up above 200.

Another vital part of the survey is the increasing use of smartphones by the Indian consumer. The growing preference for high-end handsets and the desire to use new emerging web technologies could see the smartphone markets' revenues go very high.

While the revenues in the urban areas are reaching a saturation point, many mobile manufacturers like Micromax, Karbonn, etc. have also started manufacturing phones for rural and semi-urban areas. The smartphone market is expected to grow tenfold in the coming year.



Fig 1.1.2: Handset manufacturing unit in India

# 1.1.4 Top Mobile Handset Players in India

India remains the second-largest smartphone market in the world, with strong competition among global and domestic brands.

#### Market Share - Q2 2025:

- vivo 21%
- Samsung 16%
- OPPO (excluding OnePlus) 13%
- Xiaomi 13%
- realme 9%
- Others (Apple, Motorola, Infinix, Nothing, Tecno, etc.) 28%

#### **Trends & Insights:**

- vivo leads the market in terms of shipment volumes, performing well both online and offline.
- Samsung dominates the premium smartphone segment (\$800+), followed closely by Apple.
- OPPO and Xiaomi continue to compete head-to-head with strong mid-range offerings.
- realme is growing steadily, targeting budget-conscious consumers.
- Apple maintains a small share in volume but remains one of the strongest brands in the premium category, showing rapid revenue growth in India.
- Other brands like Motorola, Infinix, Nothing, and Tecno are gaining traction in specific segments, adding to the competitive landscape.

#### **India's Smartphone Market Share:**

India Smartphone Market Share - Q2 2025

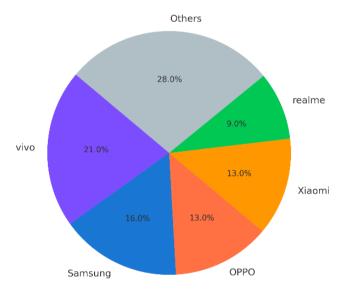


Fig. 1.1.3: India's Smartphone Market Share

India is the second-largest smartphone market globally, with shipments reaching 39 million units in Q2 2025 (+7% YoY). In the first half of 2025, total shipments stood at 70 million units, showing a steady rebound.

# 1.1.5 Regulatory Authorities in the Telecom Industry in India

#### Multiple regulatory authorities control the telecom sector in India. They are:

#### **TRAI - Telephone Regulatory Authority of India**

The Telecom Regulatory Authority of India, established in February 1997, regulates telecom services in India. Its scope includes fixing/revising tariffs for telecom services. The mission of TRAI is to create the environment needed for the growth of telecommunication at a pace that will empower India to play a major role in the emerging global information society.

One of the main objectives of TRAI is to provide a fair and transparent policy that facilitates fair competition. In January 2000, the Telecom Disputes Settlement and Appellate Tribunal (TDSAT) was set up to settle any dispute between a licensor and a licensee, between two or more service providers, between a service provider and a group of consumers, and to hear and dispose of appeals against any direction, decision or order of TRAI.

#### **TDSAT - Telecom Disputes Settlement and Appellate Tribunal**

It is a special body set up exclusively to judge any dispute between the DoT and a licensee, between two or more service providers, or between a service provider and a group of consumers. An appeal against TDSAT shall be filed before the Supreme Court of India within ninety days.

#### DoT:

The Department of Telecommunications, abbreviated to DoT, is a department of the Ministry of Communications of the executive branch of the GOI.

The DoT promotes standardization, research and development, private investment and international cooperation in matters relating to telecommunication services. It acts as a licensing body, formulates and enforces policies, allocates and administers resources such as spectrum and number, and coordinates matters in relation to telecommunication services in India.

| – Notes |  |  |
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## **UNIT 1.2: Introduction to E-Waste**

# **Unit Objectives**



#### By the end of this unit, the participants will be able to:

- 1. Discuss about various types of waste
- 2. Recognise e-waste
- 3. Analyse the condition of e-waste generated in India
- 4. Identify telecom e-waste
- 5. List the health issues arising from e-waste
- 6. Discuss the importance of proper e-waste disposal

#### -1.2.1 What is Waste?

Any unusable and unwanted materials which are regarded as a substance of no use are considered Waste. Garbage is mainly considered solid waste, including domestic waste, from schools, offices, etc., and industries and factories. Sources of waste can be classified as:

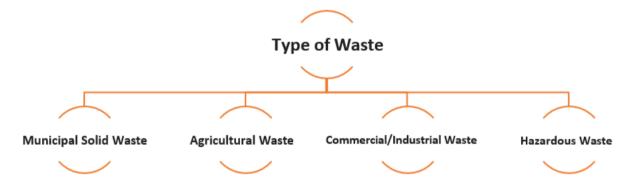


Fig. 1.2.1: Type of Waste based on its source

#### **Category of Wastes**

Wastes are also divided into various:



Fig. 1.2.2: Categories of Waste

#### Waste can also be classified based on degradability:

| Basis for Comparison           | Degradable Waste  | Non-Degradable/Hazardous<br>Waste   |  |  |
|--------------------------------|---|---|--|--|
| Meaning                        | Degradable waste can be broken down, in a reasonable amount of time, into its base compounds (carbon dioxide, water, methane or organic molecules) by micro-organisms, regardless of what those compounds may be. | Any material that can not be synthesised into carbon dioxide, methane gas, water or other organic molecule comes under non-biodegradable waste. |  |  |
| Examples                       | Dead animals and plants, their waste, rotten fruits, vegetables, flowers, paper, etc.   | Chemicals, paints, metals, plastic, rubber, plastic, etc.   |  |  |
| The rate of decomposition Slow |   | Fast  |  |  |
| Decomposed by                  | Bacteria, fungi, and other micro-<br>organisms can decompose the material<br>into the soil.   | These substances do not degrade easily by natural agents.   |  |  |
| Use                            | After degradation, the residue can be used to produce manure, biogas, fertilisers, compost, etc.  | As their degradation rate is slow, separating and recycling are not easy and affordable.  |  |  |
| Hazard                         | Bio-degradable substances are not harmful to the environment.   | Non-Degradable substances are harmful to the environment.   |  |  |

Table 1.2.1: Degradable vs Non-Degradable Waste

#### 1.2.2 Electronic Waste

Also known as e-waste, or e-scrap, it describes discarded electrical or electronic devices, components, and leftover raw materials. Used electronics destined for refurbishment, re-use, resale, and salvage recycling through material recovery or disposal are also considered e-waste.

E-waste, called e-scrap, contains various toxic and hazardous materials and chemicals that are released into the environment if not disposed of properly. Electronics recycling is recovering material from old devices to use in new products.

Modern man's life is surrounded by so many electronic gadgets that we cannot imagine any activity of our day-to-day life that does not involve our electronic dependence. We wake up with an alarm on our mobile phone and end our day by setting the alarm for the next day on our phone or digital clock and voice command gadgets. Our mobile phone, television, printer, copier, fax machine, stereo, projector, ATM, Cathode Ray Tube (CRT), Printed Circuit Board (PCB), LED, LCD, Card Payment Machine, calculator, Laptop, batteries, and the list is unending. But the lifespan and the duration of these gadgets are very short. Due to the limited durability, we sometimes surround ourselves with hazardous, degradable, and electronic waste.

Annually, computer devices account for nearly 70 per cent of e-waste, 12 per cent comes from the telecom sector, 8 per cent from medical equipment and 7 per cent from electric equipment. The government, public, and private sector companies generate nearly 70 to 75 per cent of the e-waste in India, and the contribution of the individual household is only 15 to 16 per cent.



Fig. 1.2.3: E-waste

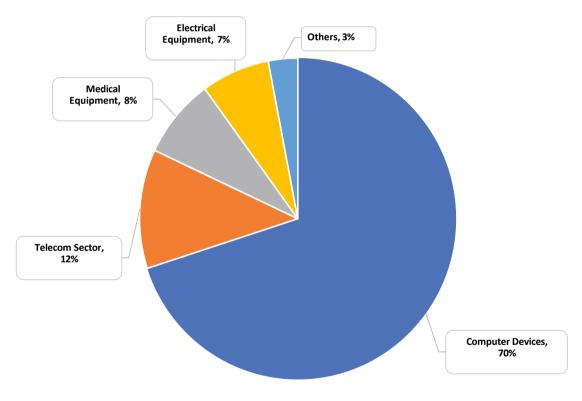


Fig. 1.2.4: E-waste generating sectors in India

# 1.2.3 Break-up of E-Waste Generated in India

According to a report by the Central Pollution Control Board (CPCB), India generated 1,014,961 tonnes of e-waste in FY 2019-2020 – up 32% from FY 2018-2019.

Among the top ten cities in India, Mumbai ranks first in generating e-waste, followed by Delhi, Bangalore, Chennai, Kolkata, Ahmadabad, Hyderabad, Pune, Surat and Nagpur. The 65 cities generate more than 60% of the total e-waste, whereas 10 states generate 70% of the total e-waste.

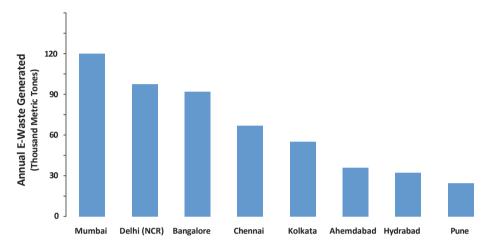


Fig. 1.2.5: Major e-waste producing states in India
Source: www.ncbi.nlm.nih.gov/pmc/articles/PMC6236536

Other equipment including household e-waste

Equipment

Telecommunication
Equipment

Other equipment including household e-waste

Computer Equipment

Fig. 1.2.6: Break-up of e-waste generated in India

#### 1.2.4 E-Waste Awareness

Disposal of e-waste is an evolving global environmental and public health issue, as this waste has become the most rapidly growing segment of the formal municipal waste stream globally. E-waste or escrap is loosely discarded in most places.

In India, most electronic waste items are stored in households as people do not know how to discard them. This ever-increasing waste is a complex source of metals such as silver, gold, copper, and zinc that can be recovered and brought back into the production cycle.

Inappropriate dismantling and processing of e-waste render it hazardous to human health and the ecosystem. Therefore, the need for proper e-waste management has been realised. Reviewing the public health risks and strategies to combat this growing menace is necessary.

#### 1.2.5 E-Waste Problems

E-waste poses a massive risk to humans, animals, and the environment. Due to heavy metals and highly toxic substances such as Mercury, Lead, Beryllium, and cadmium have become a significant threat to the environment, even in tiny quantities.

E-waste can be toxic and, most of the time, non-biodegradable and accumulates in the environment, soil, air, water and living things. For example, open-air burning and acid baths used to recover valuable materials from electronic components release toxic materials leaching into the environment.

The adverse health effects of these toxins on humans include brain, heart, liver, kidney and skeletal system damage. Toxins from e-waste can accumulate in our bodies and lead to DNA damage and cancer. Children are particularly vulnerable because they are still growing, and pregnant women exposed to e-waste can pass on increased health hazards to their children in the womb.

E-waste disposal can also cause climate change due to the chemicals released when it is burned. Discarded electronic devices contain materials like Copper (Cu), Aluminium (Al), and Iron (Fe), and when burned, these metals accumulate in the air.

Apart from the environmental and health issues, e-waste can also result in data theft. The computer's hard drive, or the smartphone's memory stick, contains confidential information, and this data can easily be retrieved if not disposed of incorrectly.

There are dozens of disposal methods, but most aren't perfect. Physical destruction or dismantling your electronic device is the only way to get it done. However, it should be done by a professional as modern laptops and smartphone batteries can explode if heavily damaged or dismantled incorrectly.

#### Different e-waste sources, their constituents, and health impacts:

- 1. Solder in Printed Circuit Boards (PCB), glass panels and gaskets in computer monitors.
  - Lead (Pb)

#### Health effects are:

- It causes damage to central and peripheral nervous systems, blood systems and kidneys damage.
- Adverse effects on the brain development of children cause damage to the circulatory system and kidneys.

#### 2. Chip Resistors and Semiconductors:

Cadmium

Health effects are:

- It causes an irreversible impact on human health as it accumulates in the kidneys and liver.
- It also causes neural damage.

#### 3. Relays and switches and Printed circuit boards

Mercury

Health effects are:

- It may cause chronic damage to the brain
- It also causes respiratory and skin disorders due to bioaccumulation in fishes.

#### 4. Galvanised steel plates and decorators or hardeners for steel housing.

• Chromium

Health effects are:

Causes Bronchitis

#### 5. Cabling and computer housing

Plastic and PVC

Health effects are:

• Burning produces dioxin that causes reproductive and developmental problems.

#### 6. Electronic equipment and circuit boards

· Brominated flame retardants

Health effects are:

• Disrupt endocrine system functions

#### 7. Front panels of CRTs

• Barium, Phosphorus and heavy metals

Health effects are:

• Cause muscle weakness and damage to the heart, liver and spleen.

#### 8. Copper wires, Printed circuit board tracks

• Copper

Health effects are:

• Stomach cramps, nausea, liver damage or Wilson's disease.

#### 9. Nickel-Cadmium Rechargeable batteries

Nickel

Health effects are:

 Allergy of the skin to nickel results in dermatitis, while allergy of the lung to nickel results in asthma.

#### 10.Lithium-ion battery

• Lithium

Health effects are:

- Lithium can pass into breast milk and may harm breast-feeding babies.
- Inhaling of the substance cause pulmonary oedema.

#### 11. Motherboard

• Beryllium

Health effects are:

- It is one of the potential causes of Lung cancer
- Inhalation of fumes and dust causes chronic beryllium disease or Berylliosis.

# 1.2.6 E-Waste Recycling in India

Only 22.7 per cent of the total 10,14,961.21 tonnes of e-waste generated in 2019-20 in India was collected and recycled or disposed of. This e-waste contained 21 types of Electrical and Electronic Equipment (EEE) notified under the 2016 E-Waste (Management) Rules.

In 2018-19, about 21.35 per cent of the total generated e-waste was handled, dismantled, and recycled in India, while in 2017-18, this percentage was only 9.79 per cent. The E-Waste (Management) Rules, 2016 gives the responsibility to producers to manage a system of e-waste collection, storage, transportation, and environment-friendly dismantling and recycling through Extended Producer Responsibility (EPR) authorisation. The rules also encourage the establishment of an efficient e-waste collection mechanism.

95 per cent of the e- Waste in India is recycled in the non-formal sector, and only 5 per cent of the volume is handled in the formal unit. India now has 178 registered e-waste recyclers, recognised by the state governments to process e-waste.





Fig. 1.2.7: E-waste recycling in the unorganised sector

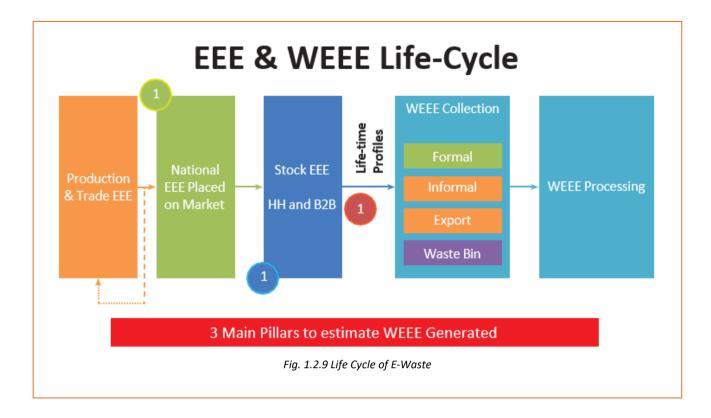
Fig. 1.2.8: E-waste recycling in the organised sector

# -1.2.7 Life Cycle of E-Waste

The "Four-Phase-Model" — from Electrical and Electronic Equipment (EEE) to Waste Electrical and Electronic Equipment (WEEE)

#### The material flow model covers four phases of EEE as well as end-of-life EEE (WEEE):

- Phase I: Production and sales of EEE, including import, export, and input of equipment for re-use from repair of WEEE.
- Phase II: Consumption of EEE, use of EEE in households, offices and industry.
- Phase III: Collection of end-of-life EEE (WEEE), including transfer to treatment/disposal sites, import/ export.
- Phase IV: Treatment/disposal alternatives for WEEE, landfill, incineration, shredder, repair and disassembly, material and energy recovery, including the emitted material or substances.



# 1.2.8 General Guidelines for Collection and Storage of E-Waste

After assessing the necessity of collecting e-waste, producers may devise an efficient collection mechanism which may include take-back through collection centres, dealers or directly through authorised recyclers.

For the collection of e-waste, producers can collaborate with professional agencies like Producer Responsibility Organisation (PRO)/e-waste exchange. The producer may also directly manage a system for collecting e-waste by involving relevant stakeholders such as consumers, bulk consumers, resident associations, the informal sector, retailers and dealers, etc.

The producers may announce their collection system, including details of their collection points, bins and collection vans linked to collection centres, take-back system, deposit refund scheme, e-waste exchange, retailers/dealers and PRO etc., to make the collection system effective and workable. If the take-back system is being provided, it should be accessible to all citizens anywhere in the country. It may be provided through retailers and dealers or service centres.

| <ul><li>Notes</li></ul> |  |
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## UNIT 1.3: Roles and Responsibilities of a Telecom E-Waste Handler

# **Unit Objectives ©**



#### By the end of this unit, the participants will be able to:

- 1. Identify the role and responsibilities of a telecom e-waste handler
- 2. List the key competencies of a telecom e-waste handler
- 3. Illustrate the career progression of a Telecom E-waste handler
- 4. Discuss about the organisational policies on incentives, delivery standards, personnel management and public relations (PR) pertinent to the job role
- 5. Explain the importance of seeking help from experts to avoid any escalation

### 1.3.1 Job Role of a Telecom E-Waste Handler

The major responsibilities of a Telecom E-waste handler include:

- · Collecting e-waste from retailers, repair shops, and other unorganized stakeholders.
- Promoting the importance of telecom e-waste management and disposal.
- Use effective waste management/recycling practices
- Handle e-waste with safety and standardized precautions
- Creating awareness about the ill effects of improper handling of e-waste.
- Transporting the collected e-waste to the central warehouse/recycling unit.
- Packaging the e-waste, labelling, and maintaining the log.
- Maintain a safe, healthy, and secure working environment.



Fig. 1.3.1: Telecom e-waste handler

# 1.3.2 Key Competencies of E-waste Handler

#### Primary skills that a Telecom e-waste handler should have:

- Well-versed with the ill effects of improper recycling/treatment of e-waste
- Knowledge about toxic and hazardous waste
- Knowledge of safety procedures for transporting and packaging collected e-waste
- Well-versed with the product/type wise packaging
- · Proficiency in weighing and labelling
- Knowledge of warehouse etiquettes and firefighting to avoid damage to the stored e-waste

#### **Personality Traits:**

A telecom e-waste handler should pose the following personality traits:

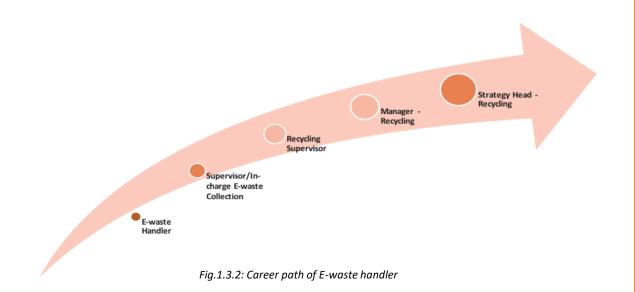
- Good communication skills
- · Ability to convince
- · Prioritise and execute tasks result-oriented
- Time management
- Strong interpersonal skills

#### **Working hours:**

- Working hours are 8 to 9 hours daily for 5 to 6 days a week. This may vary from company to company
- The shift system is not available

# **1.3.3 Career Opportunities**

E-waste management is one of the emerging sectors in India with immense career opportunities. The below picture shows the vertical career progression of a Telecom E-Waste Handler.



# 1.3.4 Organizational Policies on Incentives and Delivery Standards

#### **Incentive Policy**

An incentive policy aims to encourage employee production. An incentive policy is any system adopted to motivate the behaviour of people. An organisation can implement an incentive policy to help it reach its objectives or goals. Incentive plans may range from variable pay added to a base rate of pay, prizes for accomplishing specific outcomes or recognition ceremonies to congratulate employees for exhibiting desired behaviours.

Incentives take many different forms and vary from company to company. Smaller organisations might have an informal incentive program, which might be as simple as a manager giving an employee a gift card to thank them for putting in extra hours on a task. In larger organisations, there may be a formalised reward system through which employees can earn rewards in cash or kind.

#### For an e-waste handler, the incentive plans may take several forms:

- A bonus in addition to the fixed payment for exerting more significant effort and exceeding standardised production
- If the employee completes the work in less than the standard time set, they are paid an incentive for their effort
- Another system where an employee is incentivised based on the tonnage of e-waste handled/ processed in a day/month

#### **Delivery Standards**

A telecom e-waste handler must display a solid delivery standard and believe in the skills they hold to perform the assigned task. Some elements of a strong delivery standard are:

- Knowing your job
- Maintaining positive attitude
- · Creatively solving problems
- · Quick response
- · Adhering to the timeline
- · Displaying professionalism

#### **Public Relations**

- Public relations (PR) is managing and circulating information from an individual or an organization to the public to affect public perception.
- PR helps to shape what is known about the offerings, implants trust and credibility about the company and builds relationships on your company's behalf.
- PR by a telecom e-waste handler can also educate the prospects, customers, vendors, and investors about what the organization do, how well they do it, and what lies in the future.

# **1.3.5 Seeking Help from Experts**

It is always advisable to take help from an expert when the situation is out of your control.

Inappropriate handling of sensitive situations may attract unnecessary escalations. You can even make costly mistakes or risk your and others' lives out of naivety.

People who have developed expertise in particular areas are, by definition, able to think effectively about problems in those areas.

#### Steps to approach an expert for help:

- Be formal
- Introduce yourself briefly
- Ask questions that are clearly defined and specific to your exact circumstance
- Be courteous throughout the conversation
- Acknowledge the help

# **Exercise**



| Multi   | nle | Choi | ice O | uest | ions:  |
|---------|-----|------|-------|------|--------|
| IVIGICI | PIC | CITO | ice Q | ucst | 10113. |

| 1. | <br> |   | is a | sub-sector | of the | telecom | industry. |
|----|------|---|------|------------|--------|---------|-----------|
|    |      | _ |      |            |        |         |           |

- a) Telecom infra
- b) Telecom equipment
- c) Telecom services
- d) All of the above

| 2. India is the | largest mobile handset manufacti | urer in the world. |
|-----------------|----------------------------------|--------------------|

- a) Second
- b) Third
- c) Forth
- d) Fifth
- 3. PCB in content to telecom e-waste stands for:
- a) Plastic Covered Board
  - b) Printed Circuit Board
  - c) Polymer Carbon Board
  - d) Poly Carbonate Board
- 4. Which city in India ranks one in generating e-waste?
  - a) Mumbai
  - b) Delhi
  - c) Chennai
  - d) Hyderabad

| 5. WFFF | stands for |  |
|---------|------------|--|
| 5. WEEE | stands for |  |

- a) Waste Electrical and Elementary Equipment
- b) Waste Electrostatic and Electronic Equipment
- c) Waste Electrical and Electronic Equipment
- d) None of the above

#### **Descriptive Question:**

- 1. Explain the types of incentive programs for e-waste handlers offered by the telecom companies.
- 2. Elaborate the significance of e-waste awareness.
- 3. Differentiate between degradable and non-degradable waste.
- 4. Explain the significance of TRAI in the Indian telecom sector.
- 5. Discuss about the various sub-sectors of the telecom industry.

| -Notes | <u> </u> |      |      |      |
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#### Scan the QR Code to watch the related videos



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Introduction to the Telecom Sector in India



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Indian Handset Market



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Top Handset Manufacturers in India



youtu.be/VeoHhkjV6qo

Regulatory Authorities in the Telecom Industry in India



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What is Waste?



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Electronic Waste



youtu.be/dI-DEBygfRg

Break-up of e-waste Generated in India



youtu.be/aHaySL8EL6g

E-Waste Awareness



youtu.be/bEw34DyFBS4

**E-Waste Problems** 



youtu.be/blUf9WRHt7w

E-Waste Recycling in India



youtu.be/E-JixTdyCoQ

General Guidelines for Collection and Storage of E-Waste













# 2. Collection, Handling, and Segregation of Telecom E-Waste

Unit 2.1 - Collection, Handling, and Segregation of Telecom E-Waste



# - Key Learning Outcomes



#### By the end of this module, the paricipants will be able to:

- 1. Explain the value chain of telecom and non-telecom electronics from source to disposal.
- 2. Describe the principles of the circular economy and 3Rs in e-waste management.
- 3. Discuss the material composition of telecom e-waste including valuable and hazardous parts.
- 4. Explain the environmental and health impacts of improper e-waste handling.
- 5. Discuss pricing and economic considerations in telecom e-waste management.
- 6. Describe emergency protocols including fire safety and spill control.
- 7. Discuss how to maintain proper documentation for collected e-waste.
- 8. Explain the significance of PPE, hazard communication, and workplace safety.
- 9. Show how to classify telecom and non-telecom e-waste based on material composition and reuse potential.
- 10. Demonstrate how to identify valuable and hazardous components in telecom e-waste.
- 11. Show how to apply circular economy practices such as segregation for reuse and recycling.
- 12. Demonstrate how to communicate the benefits of responsible e-waste management using outreach tools.
- 13. Show how to follow safety guidelines and legal protocols while handling and storing telecom e-waste.
- 14. Demonstrate how to identify key sources of telecom e-waste.
- 15. Show how to select safe transport options in compliance with regulations.
- 16. Demonstrate how to use PPE when handling or transporting telecom e-waste.
- 17. Demonstrate how to use tools and equipment to dismantle and segregate e-waste.
- 18. Show how to categorize e-waste based on type and value.
- 19. Demonstrate how to follow procedures for systematic segregation.
- 20. Show how to adhere to safety protocols including proper PPE usage.
- 21. Demonstrate how to label and package segregated e-waste.

# UNIT 2.1: Collection, Handling, and Segregation of Telecom E-Waste

# **Unit Objectives ©**



#### By the end of this unit, the participants will be able to:

- 1. Explain the value chain of telecom and non-telecom electronics from source to disposal.
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- 3. Discuss the material composition of telecom e-waste including valuable and hazardous parts.
- 4. Explain the environmental and health impacts of improper e-waste handling.
- 5. Discuss pricing and economic considerations in telecom e-waste management.
- 6. Describe emergency protocols including fire safety and spill control.
- 7. Discuss how to maintain proper documentation for collected e-waste.
- 8. Explain the significance of PPE, hazard communication, and workplace safety.
- 9. Show how to classify telecom and non-telecom e-waste based on material composition and reuse potential.
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- 19. Demonstrate how to follow procedures for systematic segregation.
- 20. Show how to adhere to safety protocols including proper PPE usage.
- 21. Demonstrate how to label and package segregated e-waste.

# 2.1.1 Value Chain of Telecom and Non-Telecom Electronics from Source to Disposal Stakeholders in E-waste Collection

E-waste is generated in every sphere of life, whether in our homes, offices, hospitals, schools, or business places. There are a number of stakeholders associated with the process of generation of Ewaste. Often in the case of personal computers, TVs, etc., the consumers discard their old items for the sake of the latest version, features and options to meet their present needs. In India, the EEE may find more than one user, as the first user may resale or give the used EEE to their relative or friend for further use in case of domestic use. Some of the important stakeholders in relation to E-waste in India are shown in the Figure given below;

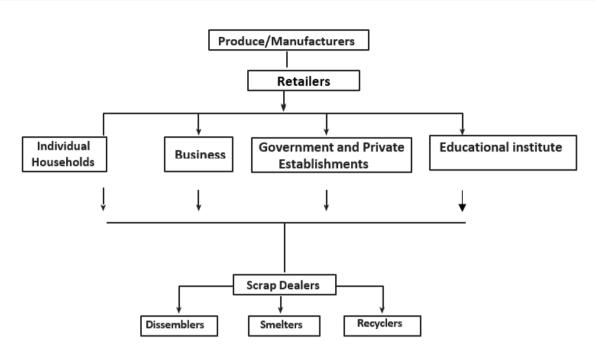


Fig. 2.1.1: Different stakeholders involved in the E-waste flow

There are three levels of E-waste generation hierarchy in India which give rise to three types of stakeholders involved in the generation of E-waste. All the stakeholders in India operate at three levels of the E-waste or WEEE generation hierarchy described below:

#### 1. First level: Preliminary E-waste generators

Preliminary E-waste generator comes from formally organised markets like manufacturers, importers, offices and organised markets. E-waste from domestic consumers comes either in exchange schemes or as a discarded item. Therefore, the major stakeholders are scrap dealers/ dismantlers who purchase E-waste from the first level in bulk quantities. These stakeholders have a limited capacity for dismantling and are involved in trading E-waste with "secondary E-waste generators". The market between the first and second levels is semi-formal, that is, part formal, while the market between the second and third levels is completely informal.

#### 2. Second level: Secondary E-waste generators

Secondary E-waste generators have limited financial capacity and are involved in item/component-wise dismantling process and segregation, for example, dismantling of CRT, PCB, plastic and glass from E-waste.

#### 3. Third level: Tertiary E-waste generators

"Tertiary level stakeholders" are the major stakeholders between the second and third level and are metal extractors, plastic extractors and electronic item extractors. They use hazardous extraction processes. Uncontrolled emissions are discharged into air and water during recycling, while the remaining WEEE/ E-waste fractions after recycling are dumped in open dump sites. Some major stakeholders identified along the flow include importers, producers/ manufacturers, retailers (businesses/ government/others), consumers (individual households, businesses others), traders, scrap dealers, dissemblers/dismantlers, smelters and recyclers. Along the flow, subsequently, E-waste gets generated at every level. In the context of India, the last three stakeholders in the E-waste trade value chain consisting of E-waste processing, production/end products and a part of E-waste generation fall entirely in the informal sector. The remaining stakeholders fall partially or wholly in the formal sector. However, the scenario is changing with the evolution of formal E-waste recycling units in the country.

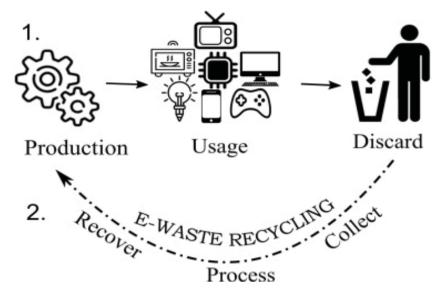


Fig. 2.1.2: E-waste management

### The various stakeholders involved in E-waste generation are listed below:

#### 1. Manufacturers and Retailers

The E-waste generated by the manufacturers and retailers includes the products that fail quality tests. It also includes the products under the guarantee period as replacement items. Whenever such replacement happens, the replaced product ends up as E-waste. The peripheral electronic and electrical items produced during the manufacturing of EEE add up as the E-waste stream produced by the manufacturer or retailer. For example, in the case of computers, E-waste generated from this sector comprises defective IC chips, motherboards, CRTs, and other peripheral items produced during production.

### 2. Imports

The import of E-waste by some developing countries like China and India is a major concern. As a developing country, India has become one of the major destinations for e-waste exports from developed nations. Huge quantities of E-waste like monitors, printers, keyboards, CPUs, typewriters, projectors, mobile phones, PVC wires, etc. are imported from India from OECD countries in charitable or reusable items.

### 3. IT Industries

Industries that provide IT services exclusively depend on the working of ICT; hence, many ICT equipment are in functions in these industries. Hardware is frequently replaced in this sector because of the introduction of newer and modified versioned software every few months as the company always prefers the latest version. Most of the time, old hardware is not compatible with new software. The average life of computers in the IT giants was found to be four to five years. Hence, it could be concluded that the generation of E-waste in this sector is enormous. India is fast emerging as an IT hub of the world. Looking at India's potential to grow as an IT hub, many global IT giants have established their branches in the country. Many of such giants are still coming to the country. Cities like Bangalore, Pune and Hyderabad are promising IT hubs within the country. Bangalore has even acquired the name the "Silicon Valley" of India. With the advent of IT industries, the pile of E-waste is growing at an alarming rate. However, the management of E-waste in the country is undeveloped. No proper management measures are considered to address the ever-increasing volume of Ewaste. India has the potential soon to become the "Ewaste hub" of the world.

### 4. Public and Private Sector, Government Departments, Corporate and Business Establishments

The business sector (government departments, public or private sector, MNC offices, etc.) was the earliest user of IT and IT products. Today, they account for a sizable amount of total installed Information & Communication Technology (ICT) equipment. Today, the banks need to compulsorily set up a large number of computers in their branches. Similar to the IT sector, the incompatibility of old systems to cater for the present needs and requirements prompts them to pass the obsolete electrical and electronic equipment to dismantlers/recyclers, who pick up these items based on auction or other standard business practices.

#### 5. Educational Institutes

Starting from the primary to the university level, the use of Information & Communication Technology (ICT) equipment is universal in schools across the globe. The use of computers in this sector is uprising at a rapid pace.

### 6. Individual households

Individual households contribute the least to the E-waste generation, being only 20% of the overall market. However, it is on an increasing trend today. In the middle to high-income group societies, the amount of E-waste generated is rising rapidly. People are attracted to the EEEs with new and modified features. With the attractive and smart discount and exchange offers in the major Indian cities, people are purchasing more EEEs. Moreover, a persistent view of Ewaste as a commodity causes reluctance among people to dispose of E-waste immediately.

### 7. Traders/Scrap Dealers/Dissemblers/Dismantlers

These are very important agents in relation to E-waste. Most of the stakeholders here operate as a part of the informal sector; hence, the amount of E-waste processed by them is extremely tricky to measure. These stakeholders are responsible for the treatment of E-waste received from other stakeholders like importers, producers or manufacturers, retailers, consumers like individual households, businesses, government, etc. Scrap dealers or "kawari wala" in India are responsible for collecting the E-waste. Immediately after securing Ewaste from various sources, scrap dealers decide which item to be dismantled and which to retain for resale. This decision is based on the resale of second-hand products. The not-to-be-resold WEEE/ E-waste items/components find their way to the storehouses for dismantling.

Rather than generating E-waste, these stakeholders are responsible for recycling and treating the existing Ewaste generated by other stakeholders. E-waste generated by these stakeholders includes all the peripheral electronic and electrical components produced during dissembling and dismantling activities.

### 8. Recyclers/Smelters

Recycling activity is a major concern for developing countries, including India, as most of such activities are carried out in the informal sector with a lot of potential for environmental and occupational health hazards. Usually, these stakeholders are not concentrated in a single place but spread over different areas, each handling a different recycling aspect. The general practices observed in the case of recycling in developing countries are open roasting, smelting and acid bath in the informal sector to recover different metals.

# -2.1.2 Principles of the Circular Economy and 3Rs in E-Waste Management

The circular economy is an economic system that focuses on eliminating waste and making the best use of resources. Unlike the traditional "take–make–dispose" model, it works on "reduce–reuse–recycle" principles. The main goal is to keep materials, products, and resources in use for as long as possible.

In telecom e-waste management, the circular economy ensures that old devices, cables, batteries, and other components are not just thrown away but are repaired, reused, or recycled to create new products or raw materials.

### **Key Features of the Circular Economy:**

- Resource Efficiency Using resources wisely to reduce wastage.
- Extended Product Life Repairing and maintaining telecom equipment for longer use.
- Recycling and Recovery Extracting valuable metals like copper, gold, and silver from e-waste.
- Environmental Protection Reducing pollution and conserving natural resources.

### The 3Rs in E-Waste Management

The 3Rs – Reduce, Reuse, and Recycle – are the pillars of effective e-waste management.

### a) Reduce

- Aim to minimize the generation of e-waste.
- Example: Encourage customers to use telecom devices responsibly, avoid unnecessary upgrades, and prefer energy-efficient products.
- For workers: Handle devices carefully during collection and transportation to prevent damage.

### b) Reuse

- Identify parts or devices that can be used again after minor repairs.
- Example: Mobile chargers, cables, and certain telecom accessories can be reused if they are in working condition.
- Promotes cost-saving and less waste creation.

### c) Recycle

- Process unusable e-waste to recover valuable raw materials.
- Example: Metals from circuit boards or plastics from casings can be recycled to manufacture new products.
- Recycling reduces the need for mining fresh resources and protects the environment.

### Why Circular Economy and 3Rs are Important for a Telecom E-Waste Handler

- Helps in safe handling and sustainable disposal of telecom waste.
- Reduces the negative impact of harmful substances like lead, mercury, and cadmium.
- Contributes to India's e-waste management goals and compliance with environmental regulations.
- Improves employment opportunities in the green jobs sector by promoting responsible recycling.
- Builds awareness among customers and communities about sustainable practices.

# 2.1.3 Applying Circular Economy Practices in Telecom E-Waste Management

### 1. Understand Circular Economy in E-Waste

- Instead of treating e-waste as "end-of-life," circular economy ensures:
  - o Reuse → Extend product life through repair/refurbishment.
  - o Recycle → Recover valuable materials (metals, plastics, glass).
  - o Reduce Hazard → Safely handle toxic parts to prevent environmental damage.

### 2. Step-by-Step Segregation for Reuse and Recycling

### **Step A: Initial Sorting at Collection Point**

- Separate telecom equipment into broad categories:
  - o Networking devices (routers, switches, BTS units)
  - o Power backup systems (UPS, batteries)
  - o Cables & accessories (fiber, copper wires, connectors)
  - o Displays and old telecom terminals

### Step B: Identify Items for Reuse

- Refurbishable Equipment → routers, switches, telecom servers that are still functional or need minor repairs.
- Re-deployable Accessories → antennas, racks, optical connectors in good condition.
- · Practice:
  - o Test functionality.
  - o Replace small defective parts instead of discarding.
  - o Send for certified refurbishment.

### **Step C: Segregate for Recycling**

- Valuable Materials for Recovery:
  - o PCBs  $\rightarrow$  gold, silver, palladium, copper.
  - o Wires & Cables → copper/aluminium after insulation stripping.
  - o Metallic Casings → steel, aluminium (scrap recycling).
  - o Plastics → ABS, PVC for pellet-making.
  - o Glass (fiber optics, safe LCD glass).
- Hazardous Materials for Safe Disposal:
  - o Lead solder (from PCBs).
  - o Batteries (Li-ion, NiCd, lead-acid).
  - o Plastics with brominated flame retardants.
  - o CRT glass (in old terminals).
  - o Capacitors with PCB oil.

### **Step D: Channel to Proper Streams**

- Reusable items → Refurbishment centers.
- Recyclables → Authorized e-waste recyclers for material recovery.
- Hazardous waste → Specialized treatment facilities.

### 3. Example Flow in Practice

- i. Collected Equipment: Old telecom switch.
- ii. Segregation:
  - PCB board → send for precious metal recovery.
  - Copper wires → send for recycling.
  - Metal rack → send to scrap metal recycler.
  - Battery inside → send to hazardous waste handler.
  - Plastic casing → recycling if safe, else controlled disposal.

### iii. Result: 80% reused/recycled, only 20% hazardous sent for safe treatment.

### iv. Benefits of Circular Economy Practices

- · Reduces landfill waste and pollution.
- Generates revenue from valuable recovered materials.
- Saves energy and resources by reusing existing equipment.
- Promotes safer workplaces by isolating hazardous materials early.

### 2.1.4 The Material Composition of Telecom E-Waste

Telecom e-waste, which includes discarded mobile phones, routers, cables, and other communication equipment, is a complex mixture of materials. As a skilled e-waste handler, you must understand the composition to effectively and safely dismantle and segregate the waste. Knowing what a device is made of helps you identify valuable components for recovery and hazardous materials that require special handling.

### 1. A typical telecom device, like a smartphone, is roughly composed of:

- Plastics (around 50% by weight): These make up the casing, circuit board, and other structural parts.
- Metals (around 20%): This is a mix of valuable and base metals.
- Glass and Ceramics (around 20%): Found in screens and some circuit components.
- Other materials (around 10%): Including batteries, rubber, and various adhesives.

### 2. Valuable Components and Materials in Telecom E-Waste

The true value of e-waste lies in the materials that can be recovered and sold. This process is often called "urban mining".

 Precious Metals: These are the most valuable materials, found in small quantities but with high economic worth.

- o Gold (Au): Used for its high conductivity and corrosion resistance. It's found in connectors, printed circuit boards (PCBs), and processor pins.
- o Silver (Ag): Has the highest electrical conductivity of any metal. It's used in solder, switches, and circuit board plating.
- o Platinum (Pt) and Palladium (Pd): Used in capacitors, connectors, and other high-performance components.
- Base Metals: While less valuable per gram than precious metals, they are present in much larger quantities.
  - o Copper (Cu): An excellent conductor, copper is found in wires, cables, and PCBs. It's one of the most widely recycled metals from e-waste.
  - o Aluminum (Al): Used for casings and heat sinks due to its lightweight and heat dissipation properties.
  - o Iron (Fe) and Steel: Found in the chassis, brackets, and other structural components.

#### 3. Hazardous Materials in Telecom E-Waste

E-waste also contains highly toxic materials that pose a serious risk to human health and the environment if not handled properly. Improper disposal, such as burning or dumping, can release these toxins into the air, water, and soil.

- Lead (Pb): Found in older electronic equipment's cathode ray tubes (CRTs), solder, and some batteries. It's a neurotoxin that can cause damage to the nervous system and kidneys.
- Mercury (Hg): A powerful neurotoxin found in switches, relays, and some flat-panel displays. It can contaminate water bodies and accumulate in the food chain.
- Cadmium (Cd): A known carcinogen used in batteries (especially older rechargeable ones) and some electronic components. Exposure can lead to lung and prostate cancer.
- Brominated Flame Retardants (BFRs): These are chemicals added to plastics and PCBs to
  prevent fire. When burned, they release highly toxic dioxins and furans, which are persistent
  organic pollutants.
- Arsenic (As): A highly toxic metalloid used in some semiconductor materials.
- Beryllium (Be): A lightweight, strong metal used in connectors and springs. Inhaling its dust can cause chronic beryllium disease, a serious lung condition.

As a handler, your primary responsibility is to safely segregate these hazardous materials and ensure they are sent for proper, environmentally sound treatment and disposal. Your work directly prevents harm to the planet and to people.

# 2.1.5 Environmental and Health Impacts of Improper E-Waste Handling

### **Effects of Improper Disposal of Telecom E-Waste**

Today, an average person owns three to four electronic devices. When these devices become obsolete, they are often disposed of with regular garbage. When electronic devices are not properly recycled, there have hazardous effects. Some of them are discussed below:

- Impact on the Soil: After you throw out e-waste, it often ends as a landfill. E-waste can take several years to decompose. During that time, it has a long-lasting damaging effect on the environment. As electronic components break down, they release toxic chemicals into the soil, contaminating plants and trees and reducing the soil quality. Some of the substances include lead from circuit boards and lithium from batteries. These toxic elements are also capable of making their way into human and animal food chains.
- Ground Water Contamination: Inappropriate disposal of e-waste can lead to toxins, including
  mercury, lead, cadmium, etc., contaminating the groundwater. Groundwater travels to streams,
  ponds, and lakes, water sources for animals, plants, and humans. Contaminated water risks
  compromising the food chain and can contribute to numerous health risks, including reproductive
  and developmental problems, cancer, immune system damage, infertility, etc.
- Air Pollution: When e-waste is not recycled, it is often burned in incinerators. Burning electronics
  may seem like an excellent solution to eliminate e-waste, but it is hazardous. Electronics are
  composed of metals, plastics, and glass, which produce harmful emissions when burnt. Such
  emissions do not just pose a direct threat to animals and humans. They also result in an increased
  rate of ozone depletion and greenhouse gasses, contributing to global warming and climate change.
- Marine Pollution: The ocean is another likely dumping area if your trash doesn't find itself in landfills
  or face the furnace. Millions of tons of trash, including e-waste, go into the ocean yearly. Since
  electronics are non-biodegradable, marine dumping is the worst idea. The result of marine disposal
  can be deadly for marine life, disturb biodiversity, and harms the ecosystem. In some cases, the
  presence of e-waste and associated toxins can damage ecosystems to the point where recovery is
  questionable, if not impossible.



Fig. 2.1.3: Soil degradation



Fig. 2.1.4: Groundwater contamination



Fig. 2.1.5: Air pollution caused by burning e-waste



Fig. 2.1.6: Marine pollution

# 2.1.6 Pricing and Economic Considerations in Telecom E-Waste Management

E-waste is not just waste—it is a resource with economic value when managed properly. In telecom e-waste, pricing depends on the material composition, demand for recovered materials, processing costs, and regulatory compliance. A Telecom E-Waste Handler must understand the economic aspects to support efficient collection, segregation, and recycling.

### 1. Factors Affecting the Price of Telecom E-Waste

### Type of Equipment:

- High-value items: mobile phones, printed circuit boards, telecom servers, routers.
- Low-value items: cables with low copper content, broken plastics.

### **Material Content:**

- Valuable metals (gold, copper, aluminium, silver, palladium) increase the resale value.
- Hazardous waste (lead, mercury, cadmium, plastics with flame retardants) may have negative value due to disposal cost.

#### **Condition of the Product:**

- Working or repairable devices → higher resale or reuse value.
- Completely damaged items → mostly for recycling with limited value.

#### **Market Demand:**

- International market prices of metals like copper, gold, and aluminium influence e-waste pricing.
- Higher demand = better returns for recyclers and handlers.

### **Quantity & Segregation:**

Bulk, well-sorted e-waste fetches better prices compared to mixed or contaminated waste.

### 2. Economic Benefits of Proper E-Waste Management

- Resource Recovery: Extracted metals reduce the need for mining, saving costs and energy.
- Revenue Generation: Authorized recyclers and refurbishers can generate income from recovered materials and refurbished devices.
- Job Creation: E-waste management creates employment in collection, dismantling, recycling, and logistics.
- Cost Savings for Companies: Extended product life through reuse reduces procurement costs.
- Compliance Benefits: Following government regulations avoids penalties and builds corporate reputation.

### 3. Costs Involved in Telecom E-Waste Management

- Collection and Transportation Costs: Moving e-waste safely from source to recycler.
- Segregation and Pre-processing Costs: Manual labor and equipment for sorting valuable vs. hazardous parts.
- Recycling Costs: Use of technology to recover metals and safely dispose of toxic substances.
- Compliance Costs: Licensing, audits, and certifications required by e-waste management rules.
- Awareness and Training Costs: Educating handlers and customers about safe practices.

### 4. Extended Producer Responsibility (EPR) and Pricing

In India, under E-Waste (Management) Rules, producers are responsible for collecting and channelizing e-waste.

- Producers often pay collection partners or handlers for proper disposal.
- Handlers may receive incentives, buy-back schemes, or service charges.
- Pricing thus depends not just on material recovery but also on policy-driven obligations.

## 2.1.7 Emergency Protocols Including Fire Safety and Spill Control

### **Methods of Reporting Safety Hazards**

Every organization, from every industry, has a standard reporting protocol, comprising the details of people in the reporting hierarchy as well as the guidelines to be followed to report emergencies. However, the structure of this reporting hierarchy varies between organizations, but the basic purpose behind the reporting procedure remains same.

### The general highlights of the Organizational Reporting Protocol, commonly known as the 6Cs, are:

- Communicate First
  - o The first source of information during emergency is the preferred source.
  - o Crises situations are time-bound and hence it is important to communicate promptly.
- Communicate Rightly
  - o Distortion of information due to panic must be avoided.
  - o Proper, accurate information must be provided to concerned authorities and this can save lives.
- Communicate Credibly
  - o Integrity and truthfulness must never be forgotten during emergencies.
- Communicate empathetically
  - o One must wear the shoes of the victims while communicating emergencies.
- Communicate to instigate appropriate action
  - o Communicating to the right authorities help in taking the necessary action.
- Communicate to promote respect
  - o Communicating with the victims with respect help in earning their trust and thus eases the disaster management process.

Hazards and potential risks / threats can be identified and then reported to supervisors or other authorized persons in the following ways:

While identifying and reporting a hazard / potential threat / potential risk, one must describe the following:

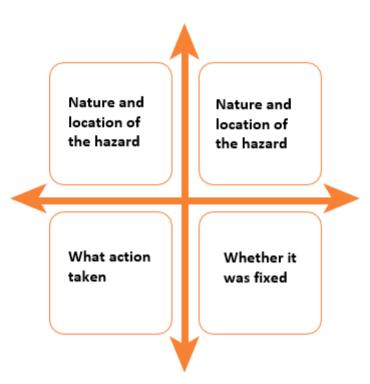


Fig. 2.1.7: Describing hazard matrix

### Part A: To be completed by the Worker Details Required:

- Name of Worker
- Designation
- Date of filling up the form
- Time of incident / accident
- Supervisor / Manager Name
- Work Location / Address
- Description of the hazard / what happened (Includes area, task, equipment, tools and people involved)
- Possible solutions to prevent recurrence (Suggestions)

### Part B: To be completed by the Supervisor / Manager Details Required:

• Results of Investigation (Comment on if the hazard is severe enough to cause an injury and mention the causes of the incident / accident)

### Part C: To be completed by the Supervisor / Manager Details Required:

Actions taken / Measures adopted (Identify and devise actions to prevent further injury, illness and casualty)

| Action | Responsibility | Completion Date |
|--------|----------------|-----------------|
|        |                |                 |
|        |                |                 |

Any job role and any occupation in this world have some hazards, in varying severity, associated with it. These are called Occupational Hazards. Occupational Hazard can be defined as "a risk accepted as a consequence of a particular occupation". According to the Collins English Dictionary, it is defined as "something unpleasant that one may suffer or experience as a result of doing his or her job". Occupational Hazards are caused by the following:

| Hazard Report Form           |       |
|------------------------------|-------|
| Name:                        | Date: |
| Location:                    |       |
| Tool/Equipment:              |       |
| Description of the hazard:   |       |
| Suggested correction action: |       |
| Signature:                   |       |
| Supervisor's remarks:        |       |
| Corrective Action taken:     |       |
| Signature of Supervisor:     | Date: |

Table 2.1.1: Sample form of reporting hazards

### 2.1.8 Maintaining Proper Documentation for Collected E-Waste

Proper documentation is a mandatory part of e-waste management. It ensures traceability, accountability, and compliance with the E-Waste (Management) Rules, 2022. For a Telecom E-Waste Handler, maintaining accurate records helps in safe handling, legal compliance, and smooth coordination with recyclers and producers.

### 1. Importance of Documentation

- Legal Compliance: Proves that e-waste has been collected and disposed of according to government rules.
- Transparency: Tracks the quantity, type, and movement of e-waste.
- Accountability: Helps identify who generated, transported, and received the waste.
- Audit & Reporting: Required during inspections by Pollution Control Boards or authorized agencies.
- Environmental Safety: Prevents illegal dumping or informal recycling.

### 2. Key Documents in E-Waste Handling

### **Collection Records:**

- Details of e-waste collected (type, weight, source).
- Name and address of generator (e.g., telecom shop, customer, company).
- Date and place of collection.

### **Transport Documents:**

- Manifest/consignment note for e-waste movement.
- Vehicle details and transporter information.
- Signatures of sender and receiver.

### **Storage Records:**

- Location and duration of temporary storage.
- Safety measures taken (fire safety, protective gear, segregation).

### Handover/Disposal Records:

- Name and authorization number of the recycler or dismantler.
- Acknowledgement receipt from the authorized facility.
- Quantity and type of e-waste handed over.

### **Registers and Logs:**

- Daily/weekly logbooks for tracking.
- Digital records where required by state/central authorities.

### **EPR-Linked Documentation:**

• Extended Producer Responsibility (EPR) records showing how much e-waste was collected on behalf of a telecom company or brand.

### 3. Steps to Maintain Proper Documentation

### **Use Standard Formats:**

• Follow the forms and templates prescribed under the E-Waste Rules (e.g., Form-2 for collection, Form-6 for manifest).

### **Record Accurately and Immediately:**

• Enter details at the time of collection/transport; avoid delays to prevent errors.

### **Segregate Data:**

 Keep separate records for different categories: mobile phones, batteries, cables, network equipment.

### **Digital Documentation:**

- Where possible, use online portals or apps for uploading e-waste records.
- Some producers provide apps to track collection under EPR obligations.

### **Maintain Copies and Backups:**

- Keep both physical (signed hard copies) and digital backups.
- Store records securely for at least 5 years, as required by law.

# 2.1.9 Personal Protective Equipment (PPE), Hazard Communication, and Workplace Safety in Telecom E-Waste Handling

Personal protective equipment (PPE) is protective clothing that consists of head protectors, masks, heavy shoes, and other equipment designed ergonomically to shield the user from possible injuries or infection. The threats mitigated by the protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter. The e-waste handler should be trained to use the PPE required for each specific task.

### 1. Significance of PPE (Personal Protective Equipment)

- Protection from Injuries: Gloves prevent cuts from sharp circuit boards; safety shoes protect from falling objects.
- Barrier Against Chemicals: Masks and goggles protect from dust, fumes, and toxic particles like lead or cadmium.
- Fire and Electrical Safety: Insulated gloves and safety gear reduce the risk of shocks or burns.
- Legal Requirement: E-waste rules and workplace regulations make PPE mandatory for handlers.

### **Components of PPE kit:**

- · Safety Helmets
- Ear Protection
- · Respirators and dust masks
- Safety Coveralls
- · Safety footwear
- Safety Eye protection
- Safety gloves

### **Safety Helmets:**

- Safety helmets protect the worker's head from injury caused by falling or flying objects.
- They come in various types depending on the task performed and the risk involved.



Fig. 2.1.8: Safety Helmets

### Ear Plug:

- Ear plugs are meant to protect the worker's ears from damage due to excessive noise levels at the workplace.
- They should be worn while performing a task where noise levels are above normal.



Fig. 2.1.9: Ear Plug

### **Respirators/Dust Masks:**

- Respirators/dust masks protect employees from inhaling harmful substances that
- may threaten their health, making them unproductive.
- Others protect the workers from inhaling dust/fumes that might cause severe respiratory problems.
- They come in various types and designs depending on the task being performed and the degree of the safety risk involved.



Fig. 2.1.10: Dust mask

### **Safety Coveralls:**

- In e-waste management, coveralls are meant to:
- Protect the e-waste handler from hazardous chemicals that are present in the waste.



Fig. 2.1.11: Safety Coveralls

### **Safety Boots:**

- Safety boots protect employees from foot injury due to sharp objects piercing through the soles or falling objects.
- They have reinforced soles and toe caps to enhance the safety of the worker's feet.
- Depending on the task and risks, they come in various types and designs.



Fig. 2.1.12: Safety Boots

### **Eye Protection:**

- Protect the eyes from sharp objects that might lead to severe injury and loss of eyesight.
- Protect from harmful chemicals from spilling into the eyes.
- Safety goggles come in various shapes, types and designs to suit different tasks and the risks involved.



Fig. 2.1.13: Safety goggles

### Safety gloves:

- In e-waste management operations, hand gloves are essential to protect the worker's hand from injury during the collecting, sorting and loading/unloading process.
- It also protects the hands from coming in contact with harmful chemicals
- Latex or rubber gloves are suitable for e-waste management operations.
- Leather gloves are used when handling sharp objects such as metal waste, glass, etc.



Fig. 2.1.14: Safety Gloves

#### 2. Hazard Communication

Hazard communication ensures that all workers are informed about potential risks of handling telecom e-waste.

- Labels & Signs: Hazardous materials should be clearly marked (e.g., "Toxic Lead," "Flammable Batteries").
- Safety Data Sheets (SDS): Provide details on handling chemicals, first aid, and emergency procedures.
- Training & Awareness: Workers should know how to read hazard symbols and follow instructions.
- Reporting: Unsafe practices, spills, or damaged PPE must be reported immediately.

### 3. Workplace Safety Practices

- Keep work areas clean and clutter-free to avoid accidents.
- Store hazardous e-waste (like batteries or CRTs) separately in labeled containers.
- Use mechanical aids (trolleys, lifts) instead of lifting heavy items manually.
- Follow fire safety protocols; keep extinguishers ready in storage and transport areas.
- Ensure ventilation in dismantling or storage rooms to prevent inhalation of toxic fumes.
- Never eat, drink, or smoke in e-waste handling areas.

### 4. Demonstrating the Use of PPE in E-Waste Handling

### **Step 1: Preparation**

- Inspect PPE for damage (e.g., holes in gloves, broken straps on goggles).
- Wear PPE before entering the e-waste collection/storage area.

### Step 2: While Handling E-Waste

- Use gloves when dismantling or carrying sharp objects.
- Wear a dust mask/respirator to prevent inhaling fine particles.
- Use safety shoes and helmets during transportation or loading operations.
- If lifting heavy items, use back support belts.

### **Step 3: After Handling**

- Remove PPE carefully to avoid contamination.
- Dispose of single-use items like masks or torn gloves safely.
- Clean and store reusable PPE (like goggles, helmets) properly.

# 2.1.10 Show How to Classify Telecom and Non-Telecom E-Waste Based on Material Composition and Reuse Potential

E-waste that originates from telecom products, equipment, and accessories used in communication networks.

### a) Material Composition

- Metals:
  - o Copper (from cables, connectors, PCB tracks)
  - o Aluminium (casings, heat sinks)
  - o Precious metals (gold, silver, palladium in PCB boards)
  - o Steel (racks, enclosures)
- Plastics:
  - o ABS, PVC, and polycarbonate (outer covers, insulation of wires)
- Glass/Ceramics:
  - o Display units, fiber optic components, ceramic substrates
- Hazardous substances:
  - o Lead solder, brominated flame retardants, lithium batteries

### b) Reuse Potential

- High Reuse Potential:
  - o Copper wires, optical fibers, antennas, routers, switches (can be refurbished/resold)
  - o Precious metals recovered from PCB boards
- Moderate Reuse Potential:
  - o Plastic housings and cable insulations (can be recycled into pellets)
  - o Racks and metallic structures (scrap value)
- Low Reuse Potential:
  - o Broken glass fiber ends, obsolete batteries, lead solder (need safe disposal)

### 3. Key Differentiation for Classification

| Criteria             | Telecom E-Waste   | Non-Telecom E-Waste                                    |
|----------------------|---|--|
| Source               | Routers, switches, base stations, towers, telecom accessories | Household appliances, IT devices, consumer electronics |
| High-value materials | Copper, gold, silver, palladium from PCBs, fiber optics       | Copper, aluminium, gold, silver from PCBs              |
| Hazardous parts      | Lead solder, lithium batteries,<br>brominated plastics        | Mercury lamps, cadmium batteries, refrigerants         |
| Reuse potential      | Network devices and cabling often reusable                    | IT equipment and appliances often refurbished          |

# 2.1.11 Demonstrate How to Identify Valuable and Hazardous Components in Telecom E-Waste

### **Detailed Identification Demonstration for Telecom E-Waste**

### **Step 1: Visual Inspection of Equipment**

- Open the outer casing carefully (using proper tools and PPE).
- Look for major internal parts like:
  - o PCBs (Printed Circuit Boards)  $\rightarrow$  flat green/brown boards with soldered chips and connectors.
  - o Wiring and Cables → bundles of insulated wires, copper or aluminum inside.
  - o Metallic Casings/Racks → steel or aluminium structures supporting equipment.
  - o Batteries → rectangular/cylindrical sealed units, sometimes heavy.
  - o Connectors/Optical Fibers → thin glass fibers, often covered in a protective sheath.
  - o Capacitors/Transformers → cylindrical or box-shaped units on boards or inside power supplies.
  - o Plastic Covers → hard, often glossy outer parts, sometimes marked with codes (ABS, PVC, FR).
  - o Displays/CRT Glass (in old telecom gear) → thick, heavy screens.

### **Step 2: Use Labels and Symbols**

- Batteries often have hazard symbols or recycling marks.
- Plastics may have material codes (ABS, PVC, or "FR" for flame retardant).
- PCBs sometimes carry codes like "Pb" (indicating lead solder).
- Fiber optic cables are marked with fiber ID numbers and color-coded.

### Step 3: Check by Weight, Texture, and Condition

- Heavy metallic parts (racks, casings, copper wires) → Valuable.
- Shiny circuit boards with multiple chips → Valuable (contain gold, silver, copper).
- Thin flexible wires with insulation → Valuable (copper/aluminium conductor inside).
- Oily, leaking capacitors or batteries → Hazardous (possible PCB oil, cadmium, or lead).
- Broken or cloudy glass fiber ends → Hazardous (tiny shards can injure skin/eyes).
- Hard, glossy, or blackened plastic casings → Hazardous if containing brominated flame retardants.
- Bulky old display glass (CRT) → Hazardous due to leaded glass and phosphor.

### **Step 4: Segregate into Two Bins**

### 1. Valuable Components (to be recovered/recycled):

- PCBs (precious metals: gold, silver, palladium, copper)
- Cables and Wiring (copper/aluminium conductor)
- Metallic Casings and Racks (steel, aluminium)
- Optical Fiber Connectors (reusable, glass/ceramic recovery)

### 2. Hazardous Components (to be safely handled/disposed):

- Lead Solder on PCBs (toxic if inhaled/ingested)
- Batteries (lithium-ion, lead-acid, NiCd risk of leakage/fire)
- Plastics with Brominated Flame Retardants (toxic on burning)
- CRT Glass (lead and phosphor hazard in old telecom displays)
- Capacitors/Transformers with PCB oil (toxic, carcinogenic)
- Broken Fiber Optic Glass (injury risk, not recyclable easily)

### **Step 5: Apply Safety Protocols**

- Always wear PPE: gloves, goggles, and masks while inspecting and separating.
- Never break or burn plastics, wires, or glass.
- Place hazardous parts in clearly labelled bins for safe storage and disposal.
- Valuable parts should be sent for refurbishment or material recovery.

# 2.1.12 Communicating Benefits of Responsible E-Waste Management

### 1. Key Benefits to Communicate

When talking to retailers, technicians, local communities, or small businesses, always emphasize:

- Environmental Protection → prevents soil, water, and air pollution.
- Economic Value → precious metals and reusable parts can generate income.
- Health & Safety → safe disposal prevents toxic exposure.
- Circular Economy → promotes reuse, repair, and recycling.
- Compliance → following government rules avoids penalties.

#### 2. Outreach Tools and Demonstration of Use

### A). Posters & Flyers:

- Use: Display in shops, collection centers, community halls.
- Message Example:
  - o "Don't throw away telecom waste Reuse, Recycle, Recover!"
  - o Add visuals: a green bin for recyclable items, a red bin for hazardous.
- Benefit Communicated: Easy-to-understand visuals show community how to segregate and why it matters.

### B). Community Meetings / Awareness Camps

- Use: Small talks or demonstrations with local groups, retailers, or vendors.
- Method:
  - o Show two bins: one with valuable e-waste (cables, PCBs) and one with hazardous parts (batteries, CRTs).
  - o Demonstrate how proper segregation leads to reuse and safety.
- Benefit Communicated: Hands-on understanding of why safe handling matters.

### C). Digital Outreach (Social Media / WhatsApp Groups)

- Use: Share short messages, videos, or infographics.
- Message Example:
  - o A 30-second video showing "From Old Telecom Device  $\rightarrow$  to Recycled Copper  $\rightarrow$  to New Wire."
- Benefit Communicated: People see direct economic and environmental value.

### D). Demonstration Kits/Exhibits

- Use: At training centers or awareness events, keep a sample kit of:
  - o Valuable parts (copper wire, PCB with gold plating).
  - o Hazardous parts (old batteries, capacitors).
- Method: Show side-by-side the economic gain and hazard risk.
- Benefit Communicated: Clear visual contrast motivates safe practices.

### E). Success Stories & Testimonials

- Use: Share examples of communities or businesses earning from e-waste recycling.
- Message Example:
  - o "This telecom shop collected 50kg of wires and earned ₹X by sending them to a recycler, while protecting the environment."
- Benefit Communicated: Builds trust and encourages participation.

### 3. Demonstration Script (Trainer → Community)

- 1. Show a flyer/poster with pictures of telecom e-waste.
- 2. Hold up two items: a copper cable and a leaking battery.
  - o Say: "This cable can be recycled for money. This battery, if thrown away, can poison soil and water."

- 3. Display a short video/infographic on phone or projector about recycling benefits.
- 4. Conclude with:
  - o "By giving e-waste to authorized collectors, you protect your health, earn extra income, and save the environment. Will you join this effort?"

### 2.1.13 Following Safety Guidelines & Legal Protocols in Telecom E-Waste Management

### 1. Personal Safety Guidelines (Worker-Level Practices)

### **Use PPE (Personal Protective Equipment):**

- Gloves → prevent cuts and chemical exposure.
- Goggles → protect from dust, shards, and sparks.
- Masks/Respirators → prevent inhalation of toxic fumes or dust.
- Safety shoes → prevent injury from heavy equipment.

### **Safe Handling Practices:**

- Use insulated tools when dismantling equipment.
- Never break or burn plastics, PCBs, or cables.
- Handle batteries with care → no puncturing, crushing, or short-circuiting.
- Avoid direct contact with leaking capacitors or oils.

### **Lifting & Transporting:**

- Use trolleys, carts, or lifts for heavy telecom racks and batteries.
- Do not drag or drop equipment.
- Store materials in stable stacks to avoid toppling.

### 2. Safe Storage Guidelines (At Collection/Storage Point)

### **Segregation Rules:**

- Separate valuable parts (PCBs, wires, metals) from hazardous parts (batteries, CRTs, BFR plastics).
- Label bins clearly: Reuse / Recycle / Hazardous Disposal.
- Store lithium and lead-acid batteries in fireproof, ventilated areas.

### **Storage Environment:**

- Keep storage area clean, dry, and well-ventilated.
- Avoid storing e-waste near food, water, or flammable items.
- Maintain spill kits, fire extinguishers, and first-aid supplies nearby.

### **Temporary Storage Duration:**

• Store e-waste only until it is sent to authorized recyclers — do not accumulate indefinitely.

### 3. Legal Protocols in India (Applicable to Telecom E-Waste)

### E-Waste (Management) Rules, 2022:

- Collect and store e-waste only in compliance with CPCB/SPCB guidelines.
- Do not sell to informal/unregistered scrap dealers.
- Channel e-waste only to Authorized E-Waste Recyclers/Collection Centers.

### **Documentation Required:**

- Main-Quantity and type of e-waste collected.
- o Date of storage and dispatch.
- o Name of authorized tain records of:
- o recycler/disposal facility.
- Use Form-2 (Collection & Storage Records) and provide to Pollution Control Board if required.

### **Extended Producer Responsibility (EPR):**

- Telecom companies (producers) are legally bound to take back and ensure safe disposal.
- Handlers must cooperate with producer's collection systems.

#### **Prohibited Practices:**

- Open burning, acid-leaching, dumping in open fields or landfills.
- Exporting e-waste without government clearance.

### 4. Demonstration: Safe Handling & Legal Compliance in Action

### **Example Scenario: Handling an Old Telecom Router with Battery**

- 1. Worker wears PPE  $\rightarrow$  gloves, goggles, mask.
- 2. Router dismantled safely using insulated tools.
  - o PCB separated → kept in "Valuable for Recycling" bin.
  - o Battery removed → placed in "Hazardous Batteries" bin, stored upright in fireproof cabinet.
  - o Plastic casing → checked for recycling mark; placed in "Plastics Recyclable" bin.
- 3. Storage  $\rightarrow$  all bins labeled and kept in dry, ventilated store room.
- 4. Documentation → entry made in e-waste register (date, weight, type, next dispatch schedule).
- 5. Dispatch  $\rightarrow$  collected items sent to an authorized e-waste recycler with proper receipt.

### 2.1.14 Transportation of E-Waste

The e-waste generated at a particular site often requires transport to an approved treatment, storage, or disposal facility. Governmental agencies give transport special attention as a potential threat to public safety and the environment.

In addition to the rare accidental spill, hazardous e-waste has, in the past, been intentionally abandoned at random locations, in practice called "midnight dumping." Such incidents have been greatly curtailed by laws requiring proper labelling, transport, and tracking of all e-wastes.

### **Transport Vehicles:**

- E-waste is generally transported by truck over public highways. Highway cargo is the most common because road vehicles can access most industrial sites and approved treatment, storage, or disposal facility. E-wastes can be transported in large cargo trucks made of steel and aluminium alloy, with capacities of 10 to 25 tons.
- In case of a leakage or accidental spill of e-waste during its transport, the transporter must take prompt and appropriate actions, including notifying local authorities. An area may have to be sealed to contain the e-wastes, and efforts must be undertaken to remove the wastes and reduce environmental and public health hazards.
- E-waste transporters are individuals or entities that move the waste from one site to another by highway, rail or water. E-waste transporters play an integral role in the e-waste management system by delivering hazardous waste from its point of generation to its ultimate destination.
- Hazardous e-waste should be packed separately in air-tight closed containers. This secures the surroundings from spilling harmful toxins and keeps the environment safe while transporting.
- Proper securing measures must be employed for massive or palletised shipments. The banding types can include nylon, steel, polyester (PET), and polypropylene. Metal is more suited for heavier solid items, whereas highly durable nylon and PET are recommended for boxes and lighter items.





Fig. 2.1.15: Cargo trucks used for transporting e-waste

Fig. 2.1.16: Securing cargo during transportation

Verify waste is compatible with container type. Inspect to verify that the bungs are sealed tightly, the ring gasket is secure, and the vent cap is closed. Inspect to ensure the absence of creases, ridges, excess rust, dents or crumples.

### Pallet Box:

A pallet box is a unit load's structural foundation, allowing handling, storage and shipping efficiencies. Goods or shipping containers are generally placed on a pallet secured with strapping, stretch wrap or shrink-wrap and shipped.

Generally, three types of pallets are used for e-waste handling:



Table 2.1.2: Different types of pallets used during E-waste transportation

### Different ways of stacking pallets are:

- Column Stack
- Interlocking Stack
- Pyramid Stack
- Overhang Stack

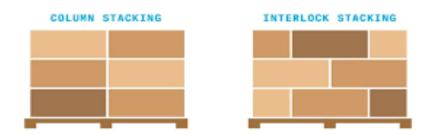


Fig. 2.1.17: Column and Interlock Stacking

### **Essentials of Good Packaging**

Large or palletised pieces must be suitable for transportation where goods are handled through trucks. Mentioned below are the four key handling requirements that you should consider when packing e-waste:

- Stackable: Ensure your piece is packaged to enable it to be stacked or have items stacked upon it.
- Forkable: A forklift will handle larger pieces; the pieces must be loaded to a pallet or a fork-movable base to ensure safe and damage-free handling.
- Tilting: Ensure your item is secure and stable on a pallet and within the packaging. Goods will tilt during loading and unloading.
- Shock & Vibration: Vibrations and minor shocks can occur while under mechanical handling. Ensure your items are sufficiently packaged.

# $oxed{2.1.15}$ Tools and Equipment to Dismantle and Segregate E- $oxed{2.1.15}$ Waste

The e-waste generated at a particular site often requires transport to an approved treatment, storage, or disposal facility. Governmental agencies give transport special attention as a potential threat to public safety and the environment.

In addition to the rare accidental spill, hazardous e-waste has, in the past, been intentionally abandoned at random locations, in practice called "midnight dumping." Such incidents have been greatly curtailed by laws requiring proper labelling, transport, and tracking of all e-wastes.

| Tool/ Equipment                          | Purpose/Use  | Demonstration/<br>Process  | Safety<br>Precautions   | Images                      |
|--|--|--|---|-----------------------------|
| Screwdrivers<br>(Flat/Phillips/<br>Star) | To open casings and remove screws from telecom devices, computers, and accessories | Select correct size, apply firm grip, turn anticlockwise to remove screws      | Wear<br>gloves to<br>avoid cuts;<br>avoid<br>excessive<br>force to<br>prevent<br>slippage |                             |
| Pliers & Cutters                         | To cut wires, remove connectors, and hold small components                         | Grip wire firmly,<br>cut cleanly; use<br>pliers to pull out<br>pins/connectors | Use insulated handles; keep fingers clear of blades                                       | PLIER LONG NOSE WIRE CUTTER |

| Spudgers/ Plastic        | To open  | Insert gently into  | Avoid metal  |  |
|--------------------------|--|---|--|--|
| Pry Tools                | delicate plastic<br>casings<br>without<br>damage                   | seam, twist slowly<br>to pry open casing                                      | tools on<br>sensitive<br>boards;<br>apply<br>gentle<br>pressure      | ENDONNEER  |
| Tweezers (Antistatic)    | To pick up small components and segregate parts                    | Hold tweezers at midpoint, gently lift and place component in segregation bin | Use ESD-<br>safe<br>tweezers to<br>avoid<br>damaging<br>chips        |  |
| Electric/Manual<br>Drill | To remove riveted or rusted fasteners                              | Position bit<br>correctly, drill<br>slowly to loosen<br>fastener              | Use goggles<br>for eye<br>protection;<br>handle<br>carefully         |  |
| Hammer/Rubber<br>Mallet  | To dislodge<br>stuck parts or<br>break non-<br>reusable<br>casings | Strike gently on<br>targeted areas to<br>loosen                               | Wear safety<br>goggles and<br>gloves;<br>avoid<br>excessive<br>force | The second secon |

| ESD Mat & Wrist<br>Strap                | To prevent electrostatic damage during dismantling      | Place device on<br>mat, wear wrist<br>strap connected<br>to ground                | Always<br>check<br>grounding<br>before use                          |  |
|---|---|---|---|--|
| Segregation<br>Bins/Containers          | For separating metals, plastics, PCBs, hazardous parts  | Place each<br>component in its<br>labeled bin<br>immediately after<br>dismantling | Label bins clearly; avoid mixing hazardous with non-hazardous waste |  |
| Magnifying<br>Glass/Illuminated<br>Lamp | To examine small circuit components for reuse/recycling | Hold magnifier<br>above PCB,<br>identify valuable<br>or damaged parts             | Ensure<br>stable<br>lighting to<br>avoid strain<br>on eyes          |  |

Table 2.1.3: Tools and equipment to dismantle and segregate e-waste

### -2.1.16 Categorization of E-Waste by Type & Value

| Category                 | Examples  | Valuable<br>Components  | Hazardous/Low-<br>Value Components                                | Reuse/Recycling<br>Potential                                   |
|--------------------------|---|---|---|--|
| Telecom<br>Equipment     | Mobile phones,<br>routers, servers,<br>telecom switches | Precious metals<br>(gold, silver,<br>palladium in PCBs),<br>reusable chips,<br>connectors,<br>batteries | Lead solder, mercury<br>in switches, flame-<br>retardant plastics | High – due to PCBs,<br>rare metals, and<br>refurbishing scope  |
| Consumer<br>Electronics  | TVs, radios, audio systems                              | Copper wires,<br>aluminum frames,<br>glass panels, PCBs   | CRTs (lead glass),<br>cadmium coatings,<br>plastics with BFR      | Moderate – depends<br>on age; plastics<br>recycling limited    |
| IT & Office<br>Equipment | Computers,<br>laptops, printers,<br>copiers             | HDD magnets,<br>RAM/CPU chips,<br>copper, aluminum<br>casings   | Toner powder, ink cartridges, plastic housings                    | Very High – high-<br>value chips and<br>reusable<br>components |

| Large<br>Household<br>Appliances   | Refrigerators,<br>washing<br>machines, ACs | Copper coils, aluminum frames, motors, compressors  | Refrigerant gases<br>(CFCs, HCFCs), oils,<br>foams  | Moderate – metals<br>have good value, but<br>disposal is tricky     |
|------------------------------------|--|---|---|---|
| Small<br>Household<br>Appliances   | Mixers, irons, vacuum cleaners             | Small copper<br>windings, motors,<br>aluminum parts | Low-grade plastics,<br>adhesives, mixed<br>waste    | Low – only selective<br>parts can be<br>salvaged                    |
| Lighting<br>Equipment              | CFLs, LED bulbs,<br>tube lights            | LED chips,<br>aluminum heat<br>sinks                | Mercury in CFLs,<br>phosphor powder                 | Low to Moderate –<br>LEDs recyclable; CFLs<br>hazardous             |
| Medical &<br>Industrial<br>Devices | Diagnostic<br>machines,<br>control systems | Stainless steel,<br>precision motors,<br>sensors    | Radioactive parts,<br>lead shielding,<br>biohazards | Low to High –<br>depends on device<br>type and safety<br>compliance |
| Batteries &<br>Power<br>Storage    | Lithium-ion, Ni-<br>Cd, Lead-acid          | Lithium, cobalt,<br>nickel, lead                    | Electrolytes, toxic cadmium, flammable materials    | High – battery recycling market is growing fast                     |

Table 2.1.4 Categorization of E-Waste by Type & Value

### -2.1.17 Labelling and Packaging the Segregated E-Waste

Labelling e-waste is very useful for convenient storage, transportation, and recycling. The e-waste can be divided into many categories and labelled accordingly. Labelling helps organise loads of e-waste and makes it more convenient for the e-waste collector to access them and keep everything safe. Below are the points which should be considered while labelling different types of e-waste containers:

It is vital to ensure that any container used to accumulate hazardous waste is properly labelled to meet regulatory guidelines and assure the safety of people.

There are various types of e-waste like major and small appliances, computers and telecommunication, lighting device, electrical and electronic, monitoring devices, medical devices etc. They should be sorted into various categories and labelled accordingly. This is also helpful while recycling, as similar categories, can be treated together.

- The label should be attached in a visible place and clearly display information. In case of very small equipment, it should be kept inside a zip-lock bag, and the bag should then be labelled.
- Labels must be placed on the container and be visible for inspection.



Fig. 2.1.18: Hazardous Waste Label

- Writings on the 'Hazardous Waste Label' must be readable. It is recommended that entries should be made with a permanent marker. Do not use ballpoint pens, or pencils, with water-soluble ink for filling the hazardous waste Labels.
- The hazardous waste label should be fastened to an area of the container that is easily visible for inspection and emergency response purposes.
- A "Waste Electronics" Label must be affixed to the pallet on a least two sides or for containers on one side.
- Electronic Wastes must not be placed in general refuse containers or roll-off boxes.
- Promptly report any spill, release or breakage of E-Waste.



Fig. 2.1.19: Labels for different types of e-waste

### **Exercise**



### **Short Questions:**

- 1. Explain how to use tools and equipment safely while dismantling telecom e-waste.
- 2. Describe the process of segregating telecom e-waste for recycling and reuse.
- 3. What are the benefits of responsible e-waste management for the environment and economy?

### True/False:

- 1. PPE is optional while handling e-waste if the worker is experienced.
- 2. Circuit boards in telecom devices may contain hazardous substances like lead and cadmium.
- 3. Segregating e-waste into telecom and non-telecom categories is not necessary for recycling.
- 4. Outreach and awareness programs help in increasing the collection of e-waste responsibly.

### Multiple Choice Questions (MCQs):

- 1. Which of the following is considered hazardous in telecom e-waste?
  - a) Plastic casing
  - b) Circuit boards with heavy metals
  - c) Copper wires
  - d) Packaging cardboard
- 2. What is the primary purpose of PPE while handling telecom e-waste?
  - a) To make handling faster
  - b) To protect workers from chemical, electrical, and physical hazards
  - c) To identify valuable components
  - d) To increase the resale value of e-waste
- 3. Which of the following is not a part of circular economy practices in e-waste management?
  - a) Segregation for recycling
  - b) Reuse of components
  - c) Dumping e-waste in open land
  - d) Proper documentation of collected e-waste
- 4. The most valuable part of telecom e-waste for resale is usually:
  - a) Plastic casing
  - b) Circuit boards and metal components
  - c) Packaging materials
  - d) Rubber gaskets
- 5. Telecom e-waste should be classified based on:
  - a) Color and size
  - b) Material composition, reuse potential, and hazard level
  - c) Brand and model only
  - d) Age of the device

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|   |   |   |   |   |



### Scan the QR Code to watch the related videos



www.youtube.com/ watch?v=zB1nML5GMxw

Effects of Improper Disposal of Telecom E-Waste



www.youtube.com/ watch?v=aUwFXDLOFO0

Collection and Processing of E-waste from Telecom Site



www.youtube.com/ watch?v=vb9QFjkEmAU

**Health and Safety Measures** 



youtu.be/blUf9WRHt7w

E-Waste Recycling



www.youtube.com/ watch?v=a1Co8a8GuT4

Providing Certificates to Stakeholders after Collecting E-waste



www.youtube.com/ watch?v=ljzAe-SQtzk

Maintain Personal Hygiene



youtu.be/6i96r8LGUXU

Responsibilities Assigned to Various Stakeholders for Disposal of Telecom E-Waste



www.youtube.com/ watch?v=nWd-H7XqmsM

How should e-waste be processed?



www.youtube.com/ watch?v=QEB7wE-YFXg

Personal Protective Equipment (PPE) while Telecom Handling E-waste



www.youtube.com/ watch?v=1k19eXJ3dH4

Safety Guidelines for Collecting E-Waste



www.youtube.com/ watch?v=UIKS\_A7Xg1E

Fire Safety



www.youtube.com/ watch?v=ntEVHTqsq6A

Causes of accidents while Handling E-Waste













# 3. Establishment and Management of Telecom E-Waste Collection Centre

Unit 3.1 - Establishment and Management of Telecom E-Waste Collection Centre



### - Key Learning Outcomes 🏻 🗘



### By the end of this module, the paricipants will be able to:

- Show how to identify compliance requirements for setting up a telecom e-waste collection
- Explain various transport and logistics solutions for compliant e-waste movement. 2.
- Demonstrate how to arrange the infrastructure for safe e-waste handling and storage.
- 4. Show how to implement hygiene and sanitation measures at the facility.
- 5. Discuss basic financial and entrepreneurial concepts for managing an e-waste centre.
- Demonstrate how to monitor finances and identify revenue opportunities. 6.
- 7. Elucidate marketing and outreach strategies to build a steady network of e-waste generators.
- 8. Show how to recruit and train staff in safety, operations, and communication.
- 9. Describe how to identify and reach under-served areas for collection expansion.
- 10. Demonstrate how to develop and manage an inventory system for tracking e-waste.
- 11. Show how to organize secure storage for collected e-waste.
- 12. Determine the key national and international telecom e-waste regulations.
- 13. Show how to identify compliance requirements for setting up a telecom e-waste collection centre.

### **UNIT 3.1: Establishment and Management of Telecom E-Waste Collection Centre**

### Unit Objectives | ©



### By the end of this unit, the participants will be able to:

- 1. Show how to identify compliance requirements for setting up a telecom e-waste collection centre.
- 2. Explain various transport and logistics solutions for compliant e-waste movement.
- 3. Demonstrate how to arrange the infrastructure for safe e-waste handling and storage.
- 4. Show how to implement hygiene and sanitation measures at the facility.
- 5. Discuss basic financial and entrepreneurial concepts for managing an e-waste centre.
- 6. Demonstrate how to monitor finances and identify revenue opportunities.
- 7. Elucidate marketing and outreach strategies to build a steady network of e-waste generators.
- 8. Show how to recruit and train staff in safety, operations, and communication.
- 9. Describe how to identify and reach under-served areas for collection expansion.
- 10. Demonstrate how to develop and manage an inventory system for tracking e-waste.
- 11. Show how to organize secure storage for collected e-waste.
- 12. Determine the key national and international telecom e-waste regulations.
- 13. Show how to identify compliance requirements for setting up a telecom e-waste collection centre.

### 3.1.1 Compliance Requirements for a Telecom E-Waste **Collection Centre**

### 1. Legal & Regulatory Approvals

- Authorization from State Pollution Control Board (SPCB) or Pollution Control Committee (PCC):
  - o Mandatory under the E-Waste (Management) Rules, 2022.
  - o Application to be submitted with site details, facility layout, and waste management plan.
- Consent to Establish (CTE) and Consent to Operate (CTO):
  - o Issued by SPCB/PCC under the Water Act, 1974 and Air Act, 1981.

### 2. Extended Producer Responsibility (EPR) Compliance

- Collection centres often operate on behalf of producers/brands to fulfill their EPR obligations.
- Must be registered on the Central Pollution Control Board (CPCB) EPR Portal.
- Maintain proper records of e-waste collected, transferred, and processed.

### 3. Site & Infrastructure Requirements

- Adequate covered storage space for e-waste to prevent exposure to weather.
- Fire safety measures (extinguishers, alarms, exits).
- Segregation area for telecom vs. non-telecom e-waste.
- PPE provision and signage for worker safety.

### 4. Health, Safety & Environmental Protocols

- Implementation of Occupational Health & Safety (OHS) measures.
- Workers must be trained in safe handling, dismantling, and hazard communication.
- Mandatory use of PPE (gloves, goggles, masks, safety shoes).
- Spill kits and first-aid facilities to be available.

### 5. Documentation & Record Keeping

- Form-2 Registers for e-waste received, stored, and sent to recyclers.
- Annual returns filed to SPCB/CPCB.
- Records of transportation (manifest, labels, authorization of transporter).

### 6. Compliance with Storage & Transport Rules

- Storage period: Not exceeding 180 days (unless extended by SPCB for specific reasons).
- Transport must comply with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Proper labeling and packaging of e-waste during transit.

# **3.1.2** Compliance Checklist – Telecom E-Waste Collection Centre

| Category                    | Compliance<br>Requirement       | Details / Actions Needed   |
|-----------------------------|---------------------------------|--|
| 1. Legal &<br>Regulatory    | SPCB/PCC<br>Authorization       | Apply under E-Waste (Management) Rules, 2022 with site plan, ownership/lease papers, manpower details. |
| Approvals                   | Consent to Establish (CTE)      | Mandatory under Water Act, 1974 and Air Act, 1981.   |
|                             | Consent to Operate (CTO)        | Obtain before starting operations.   |
|                             | CPCB EPR Portal<br>Registration | Register centre as part of producer network or independent collection facility.                        |
| 2. Site &                   | Secure Location                 | Fenced/covered site with restricted entry.   |
| Infrastructure Requirements | Storage Area                    | Covered, weather-protected space for telecom e-waste.  |
|                             | Segregation Zones               | Separate areas for telecom e-waste, non-telecom e-waste, and hazardous fractions.                      |
|                             | Fire & Safety<br>Equipment      | Fire extinguishers (foam/CO <sub>2</sub> ), alarms, exits, spill kits, firstaid box.                   |
|                             | Utilities                       | Proper ventilation and lighting for safe handling.   |
|                             | Signage                         | Warning boards, hazard signs, safety instructions.   |

| 3. Worker<br>Health &               | PPE Provision          | Gloves, goggles, masks, safety shoes, aprons for all handlers.               |
|-------------------------------------|------------------------|--|
| Safety                              | Safety Training        | Induction + periodic training on safe handling and hazard communication.     |
|                                     | Medical Check-ups      | Regular health monitoring for exposure to hazardous substances.              |
|                                     | Emergency Information  | Display hospital/fire/SPCB contacts.   |
|                                     | Labour Practices       | Ensure no child labour or untrained handling.                                |
| 4. Waste<br>Handling &              | Storage Limit          | Store e-waste max 180 days (SPCB approval needed for extension).             |
| Storage                             | Segregation            | Hazardous and non-hazardous waste stored separately.                         |
|                                     | Labeling               | Containers/storage areas labeled "E-Waste" + hazard warnings.                |
|                                     | Inventory              | Maintain categorized list (type, weight, condition) of collected e-waste.    |
| 5.<br>Transportation<br>& Logistics | Authorized Transporter | Use vehicles licensed for e-waste transport.                                 |
|                                     | Packaging              | Proper sealed containers/boxes to prevent spillage or damage.                |
|                                     | Labeling               | CPCB-approved labels: "E-Waste: Handle with Care".                           |
|                                     | Documentation          | Carry transport manifest/consignment note during movement.                   |
|                                     | Delivery Proof         | Maintain records of e-waste handed over to authorized dismantlers/recyclers. |
| 6.<br>Documentatio                  | Registers              | Maintain Form-2 register (e-waste received, stored, dispatched).             |
| n & Reporting                       | Annual Returns         | Submit Form-3 to SPCB/CPCB before June 30 each year.                         |
|                                     | Authorization Records  | Keep copies of permits, consents, recycler agreements.                       |
|                                     | Training Records       | Maintain log of worker safety training sessions.                             |
|                                     | MIS/Logbook            | Keep details of telecom vs. non-telecom e-waste collected.                   |
| 7. EPR<br>(Extended                 | Producer Partnerships  | Tie-ups with brands/producers/distributors for channelized collection.       |
| Producer<br>Responsibility)         | Compliance Reporting   | Share monthly collection data with producers/EPR portal                      |

Table 3.1.1 Compliance Checklist – Telecom E-Waste Collection Centre

# **3.1.3 Transport and Logistics Solutions for Compliant E-Waste** Movement

The storage of the e-waste waiting to be recycled weighs tons. Metal boxes and stillages are made of solid mesh, so they protect the transported goods and enable stacking, i.e. stacking pallets or containers on top of each other. This helps in optimal utilisation of space. The major advantage of using metal pallet collars for storage transport is their durability, and metal is usually much stronger than plastic and other materials.



Fig. 3.1.1: Metal boxes used for storing e-waste

The Wire Mesh Containers, on the other hand, help to maximise the storage space thanks to their folding function. You can use the metal mesh containers for long-term storage and transfer of your stock of recovered products. Because these containers are made of metal mesh, you can always easily check the contents of the container without opening it.



Fig. 3.1.2: Wire Mesh Containers used for storing e-waste

Every manufacturer, producer, bulk consumer, dealer, collection centre, refurbisher, dismantler, and recycler may store the e-waste for a period not exceeding 180 days and shall maintain a record of collection, sale, transfer, and storage of the e-wastes and make these records available for inspection.

# **3.1.4 Basic Financial and Entrepreneurial Concepts for Managing an E-Waste Centre**

# 1. Financial Concepts (Money Matters)

- Starting Money (Capital Investment):
  - Money needed at the beginning  $\rightarrow$  rent/land, licenses, storage space, tools, safety items, and maybe a small vehicle.
- Running Costs (Operating Expenses):
  - Regular spending every month  $\rightarrow$  staff salary, electricity, water, transport, packaging, safety training.
- Earnings (Revenue):
  - o Selling collected e-waste to authorized recyclers.
  - o Payments from producers (under EPR Extended Producer Responsibility).
  - o CSR or government-supported awareness programs.
- Record-Keeping:

Always maintain accounts of income, expenses, and collected e-waste weight. This helps in profit calculation and is also required for SPCB/CPCB reporting.

#### 2. Entrepreneurial Concepts (Business Skills)

- Business Plan:
  - Decide → Will the centre only collect e-waste or also dismantle/refurbish?
  - o Choose location near telecom hubs, shops, or offices where more e-waste is generated.
- Marketing & Outreach:
  - Spread awareness: posters, local ads, social media.
  - o Tie up with mobile shops/service centres for collection.
  - o Offer incentives: e.g., small discounts or coupons for returning old devices.
- Sustainability:

Encourage reuse and repair before recycling. Example: old but working routers can be refurbished and resold.

- Managing Risks:
  - o Problem: Low collection or penalties for non-compliance.
  - Solution: Partner with telecom companies, keep all compliance documents, and diversify services (collection + awareness + resale).

# **3.1.5** Monitoring Finances and Identifying Revenue Opportunities

| Skill Area             | What to Do (Action)                        | Tools / Examples                              | Outcome (Skill Gained)              |
|------------------------|--|---|-------------------------------------|
|                        | Maintain daily record of expenses & income | Cashbook, Excel sheet, accounting apps        | Ability to track money flow clearly |
| Monitoring             | Compare monthly income vs. expenses        | Prepare simple profit & loss sheet            | Skill to calculate profit or loss   |
| Finances               | Set and follow a budget                    | Estimate salaries, rent, transport, packaging | Skill to control overspending       |
|                        | Keep documents for compliance              | Save invoices, receipts, SPCB/CPCB reports    | Skill to stay audit-ready           |
|                        | Sell collected e-waste                     | Authorized recyclers/dismantlers              | Ability to generate steady income   |
|                        | Partner with producers under EPR           | Agreements with telecom companies             | Skill to earn service payments      |
| Identifying<br>Revenue | Refurbish and resell working items         | Mobiles, routers, accessories                 | Skill to create extra income        |
| Opportunities          | Build partnerships                         | Tie-ups with shops, corporates, NGOs          | Skill to expand collection network  |
|                        | Conduct awareness drives                   | CSR/Govt. supported campaigns                 | Skill to diversify revenue streams  |
|                        | Sell sorted scrap fractions                | Plastics, metals, cables                      | Ability to maximize resource value  |

# **3.1.6** Marketing and Outreach Strategies for an E-Waste Collection Centre

# 1. Marketing Strategies (Promoting Your Centre)

| Strategy                              | How to Implement   | Outcome / Skill Gained                   |
|---------------------------------------|--|--|
| Tie-ups with<br>Producers & Retailers | Partner with telecom companies, mobile shops, service centres to collect old devices | Ensures a steady supply of e-<br>waste   |
| Local Advertising                     | Posters, banners, flyers in communities, shops, offices                              | Increases local visibility and awareness |
| Social Media & Online<br>Campaigns    | Promote collection drives on WhatsApp,<br>Facebook, Instagram                        | Reaches younger & tech-savvy audience    |
| Incentive Programs                    | Discounts, coupons, small rewards for customers returning devices                    | Encourages regular participation         |
| Branding of Collection<br>Points      | Clearly label collection bins, use centre logo, attractive designs                   | Builds trust and recognition             |

# 2. Outreach Strategies (Engaging Generators)

| Strategy                                | How to Implement  | Outcome / Skill Gained                       |
|---|---|--|
| Community Awareness<br>Campaigns        | Conduct workshops, school/college drives, corporate sessions  | Educates people on safe disposal of e-waste  |
| Door-to-Door or On-Site<br>Collection   | Organize collection drives in neighborhoods or offices        | Makes collection convenient and regular      |
| Partnership with NGOs / Local<br>Bodies | Collaborate for collection drives in urban and rural areas    | Expands reach to more e-waste generators     |
| Reverse Logistics Network               | Customers return old devices to shops or collection hubs      | Ensures continuous inflow of e-waste         |
| Participation in Events                 | Join tech fairs, environmental expos, or government campaigns | Increases credibility and network visibility |

#### **Key Takeaways:**

- · Combine offline (shops, communities) and online (social media) marketing for maximum reach.
- Incentives and convenience motivate people to hand over e-waste regularly.
- Partnerships with producers, NGOs, and corporates create a reliable network.
- Continuous awareness and engagement help maintain steady collection volumes.

# 3.1.7 Recruiting and Training Staff for an E-Waste Collection Centre

### 1. Recruitment of Staff

- Define Roles Identify positions like collection staff, store handlers, transporters, and admin/support staff.
- Set Qualifications & Skills Minimum education, willingness to follow safety rules, basic computer skills for records.
- Advertise & Reach Out Use local job boards, social media, and community centers to attract candidates.
- Interview & Screen Conduct interviews, practical tests, and reference checks.
- Hiring Issue appointment letters and explain roles, salary, and code of conduct.

# 2. Staff Training

# **Safety Training**

- Teach proper use of PPE: gloves, goggles, masks, safety shoes.
- Train on handling hazardous e-waste (batteries, circuit boards, chemicals).

• Explain fire safety and emergency response procedures.

# **Operations Training**

- Segregate telecom vs. non-telecom e-waste.
- Proper storage and labeling of materials.
- Maintain inventory and documentation (Form-2 registers).
- Follow collection and transport protocols safely.

#### **Communication & Customer Interaction**

- Explain the collection process clearly to customers.
- Handle queries politely and professionally.
- Report issues to supervisors promptly.

#### **Compliance Awareness**

- Teach rules under E-Waste (Management) Rules, 2022.
- Explain SPCB/CPCB reporting requirements and legal obligations.

# 3. Training Methods

- Classroom Sessions Teach safety, operations, and compliance theory.
- Demonstrations Show PPE usage, segregation, and tool handling.
- On-the-Job Training Supervised practice in real operations.
- Refresher Training Regular updates on safety, compliance, and operational improvements.

# 3.1.8 Identifying and Reaching Under-Served Areas

| Step                         | Action   | Example / Tool                       | Outcome / Skill Gained                            |
|------------------------------|--|--------------------------------------|---|
| 1. Identify<br>Coverage Gaps | Map current collection points and track e-waste inflow                         | GIS maps, simple location charts     | Ability to spot under-served areas                |
| 2. Analyze<br>Demographics   | Identify areas with high population, telecom shops, offices, or rural clusters | Census data, telecom<br>network info | Skill to prioritize areas with potential e-waste  |
| 3. Collect<br>Feedback       | Conduct surveys or ask customers about collection gaps                         | Door-to-door survey,<br>online poll  | Ability to understand local needs and challenges  |
| 4. Consult<br>Partners       | Work with telecom<br>companies, retailers,<br>NGOs to find unserved<br>areas   | Partner reports,<br>meetings         | Skill to leverage existing networks for expansion |

| -  |  |   |   |
|--|--|---|---|
| 5. Set Up<br>Collection<br>Points            | Install bins or mini-<br>collection centres in<br>accessible locations | Shops, offices, community centres               | Ensures physical access for e-<br>waste generators      |
| 6. Organize<br>Mobile Drives                 | Deploy vans/trucks to collect e-waste periodically                     | Scheduled route maps, social media announcement | Ability to reach remote or scattered areas              |
| 7. Collaborate<br>with Local<br>Stakeholders | Partner with NGOs, schools, or community leaders                       | Awareness campaigns, volunteer programs         | Builds trust and engagement in the community            |
| 8. Awareness & Incentives                    | Run educational campaigns and offer small rewards                      | Flyers, social media,<br>discount coupons       | Encourages regular participation and collection         |
| 9. Use<br>Technology                         | Share collection points,<br>schedules, and pick-up<br>requests online  | WhatsApp, apps, social media platforms          | Skill to reach tech-savvy users and improve convenience |

# 3.1.9 Demonstrate How to Develop and Manage an Inventory – System for Tracking E-Waste

As a small entrepreneur, your focus is on efficiency and compliance without a big budget. Your system needs to be easy to use and maintain.

#### Phase 1: Setting Up Your System

# 1. The Core Tool: A Simple Spreadsheet

Forget expensive software. Start with a simple, well-organized spreadsheet (Google Sheets is excellent because it's free and can be accessed on any device). Create the following columns:

- Item ID: Assign a unique, simple ID to each item. Use a sequential number (e.g., EWASTE-001, EWASTE-002, etc.).
- Item Type: (e.g., Laptop, Monitor, Phone, Printer). Be specific.
- Manufacturer/Model: (e.g., Dell Latitude 7420, HP LaserJet Pro M15w).
- Serial Number: Always log this. It's the unique identifier from the manufacturer.
- Date Received: When the item arrived at your facility.
- Condition: (e.g., Working, Broken, For Parts).
- Data Bearing Device? (Yes/No). This is critical.
- Data Destruction Method: (e.g., Wiped, Shredded, Degaussed, N/A).
- Date of Destruction: When the data was erased.
- Disposition: (e.g., For Refurbishing, Sent to Recycler, For Parts).
- Date of Transfer: When the item was sent to the end processor.
- Recipient: Name of the certified recycler or refurbisher.
- Certificate ID: The unique ID from the Certificate of Destruction/Recycling you receive.

# 2. Physical Tracking: Simple Tagging

Don't overcomplicate this. Use a simple, durable method to label each item with its Item ID from the spreadsheet.

- Durable Tags: Use simple paper tags with string, or stick-on labels. Write the Item ID clearly with a permanent marker.
- Barcode Scanner (Optional but Recommended): For just a few hundred rupees, you can get a
  basic USB barcode scanner. Print a simple barcode sticker with the Item ID and stick it on each
  item. This makes scanning and updating your spreadsheet a breeze, reducing manual errors.

#### 3. Streamlined Workflow:

Your process needs to be very clear for one or two people to manage.

- Receiving & Logging: When a customer drops off e-waste, immediately log it in your spreadsheet and tag it with the next available Item ID.
- Secure Staging: Place the tagged items in a designated, secure area in your facility. This ensures nothing is misplaced before processing. Keep items with data separate from those without.
- Processing & Data Destruction: Once you have a batch of items ready for data destruction, perform
  the task and immediately update the spreadsheet. Log the date and method. This step is nonnegotiable for compliance and liability.
- Transfer & Documentation: When your authorized recycler comes for pickup, scan or manually check each item's ID against your spreadsheet. Create a simple pickup sheet (or manifest) that lists the Item IDs being transferred. Have the driver sign this sheet. This is your first official record of transfer.
- Final Confirmation: Once the recycler sends you the official Certificates of Destruction/Recycling, log the certificate ID in your spreadsheet next to the corresponding items. File these certificates securely.

#### Phase 2: Management & Maintenance

### 1. Simplicity is Key

- One Person, One System: As an entrepreneur, you're likely the one managing this. Keep the system simple enough for you to manage alone.
- Regular Updates: Make it a habit to update your spreadsheet at the end of each day or week. This prevents a large backlog of data entry.

#### 2. Compliance for the Small Business

- The Chain of Custody: Your spreadsheet and the signed pickup sheets form your "chain of custody." This is your legal proof that you handled the e-waste responsibly.
- Proof of Destruction: The Certificates of Destruction are your final, irrefutable proof. Always get them and always link them to your records.
- Know Your Partner: Partner only with a certified and licensed e-waste recycler. Do your homework. Ask for their certifications and references.

# 3. Reporting and Audits

- Simple Reporting: Use your spreadsheet's filter function to quickly answer questions. "How many laptops did we process this month?" "Which items went to Recycler X?" This helps you monitor your progress and provides data for any potential audits.
- Easy Audits: When an auditor asks to see your records, you can simply pull up your spreadsheet. It's clear, simple, and shows the entire lifecycle of each item in your care.

By focusing on these core, simplified steps, a small entrepreneur can create a compliant, efficient, and low-cost e-waste inventory system that protects their business and the environment without the need for complex, expensive solutions.

# **3.1.10** Key National & International Telecom E-Waste Regulations

# 1. National Regulations (India)

| Regulation / Authority  | Key Points   | Relevance for Telecom E-Waste   |
|---|--|---|
| E-Waste (Management)<br>Rules, 2022 – Ministry of<br>Environment, Forest &<br>Climate Change (MoEFCC) | Defines responsibilities for producers, collectors, and recyclers. Mandates Extended Producer Responsibility (EPR). Requires authorization of collection, dismantling, and recycling facilities. | Ensures telecom companies and collection centres handle e-waste legally and safely. |
| Central Pollution Control<br>Board (CPCB) Guidelines  | Monitoring and reporting requirements. Standards for storage, transport, and disposal.   | Helps collection centres maintain compliance and proper documentation.              |
| Hazardous and Other<br>Wastes (Management &<br>Transboundary<br>Movement) Rules, 2016                 | Controls hazardous components of e-waste. Prevents illegal import/export of hazardous e-waste.   | Relevant for telecom devices with batteries, CRTs, or heavy metals.                 |
| Occupational Safety &<br>Health Guidelines<br>(Factories Act, 1948 /<br>Local Labour Laws)            | PPE usage, workplace safety, and training requirements.  | Protects staff handling telecom e-waste.  |

# 2. International Regulations

| Regulation/Authority              | Key Points   | Relevance for Telecom E-Waste                                    |
|-----------------------------------|--|--|
| Basel Convention<br>(1989)        | Controls transboundary movement of hazardous wastes. Requires prior informed consent for exports/imports.                | Prevents illegal shipment of telecom e-waste to other countries. |
| EU WEEE Directive<br>(2012/19/EU) | Waste Electrical and Electronic Equipment (WEEE) recycling target. Producer responsibility for collection and recycling. | Guides best practices for collection, recycling, and reporting.  |
| RoHS Directive<br>(2011/65/EU)    | Restricts hazardous substances (lead, mercury, cadmium) in electronic devices.   | Ensures safer manufacturing and disposal of telecom electronics. |
| EPA e-Waste Rules<br>(USA)        | Federal and state-level regulations for collection, recycling, and disposal. Certification for recyclers.                | Reference for safe handling and recycling standards globally.    |

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# 4. Sustainability Practices in Telecom Operations

Unit 4.1 - Identification and Categorization of Recyclable, Reusable, and Disposable Components

Unit 4.2 - Adherence to Environmental Standards

Unit 4.3 - Sustainable Repair Practices

Unit 4.4 - Adherence to Organizational Protocols



# **Key Learning Outcomes**



# By the end of this module, the paricipants will be able to:

- 1. Explain the relevant environmental laws and regulations for the telecom sector.
- 2. Describe the different recyclable and hazardous components in telecom equipment.
- 3. Demonstrate how to identify telecom components that can be recycled, refurbished, or reused during repair and maintenance.
- 4. Discuss the relevant tools and techniques that support sustainable repair practices.
- 5. Elucidate the safe handling, storage, and disposal of hazardous materials.
- 6. Demonstrate how to follow guidelines for the safe handling, storage, and disposal of hazardous and non-hazardous materials.
- 7. Show how to sort and evaluate dismantled parts into recyclable, reusable, and hazardous waste categories for proper disposal.
- 8. Explain the process of e-waste recycling through certified vendors.
- 9. Describe the documentation required for sustainability and waste disposal.
- 10. Show how to maintain compliance with environmental regulations and record all e-waste disposal and recycling activities as per company policies.
- 11. Determine the proper waste segregation and sorting guidelines in the telecom industry.
- 12. Discuss the industry's best practices for reducing environmental impact.
- 13. Show how to label and segregate hazardous materials for specialized disposal, ensuring compliance with safety regulations.
- 14. Demonstrate the correct use of protective equipment when handling hazardous waste to prevent environmental contamination.
- 15. Show how to conduct regular audits of waste management processes to ensure alignment with sustainability standards.

# **UNIT 4.1: Identification and Categorization of Recyclable, Reusable, and Disposable Components**

# **Unit Objectives**



# By the end of this unit, the participants will be able to:

- 1. Explain the difference between recyclable, reusable, and disposable components.
- 2. Identify common materials and components that can be recycled, reused, or need disposal.
- 3. Categorize waste materials appropriately during and after repair activities.
- 4. Demonstrate proper segregation techniques as per material type and disposal category.

# **4.1.1 Identification of Telecom Components**

Adhering to sustainability practices begins with a fundamental understanding of what can and cannot be salvaged from a telecom device or component. Here, we focus on the ability to identify and categorize components for recycling, refurbishment, or reuse, which reduces waste and conserves resources.

# 1. Reusable Components:

These are components that can be salvaged from a faulty device and used as a direct replacement in another, similar device, without requiring significant repair.

- Motherboards/Logic Boards: A motherboard from a device with a cracked screen, but a perfectly functional board, can be reused.
- **Displays:** A display from a device with a logic board fault can be reused.
- Cameras, Speakers, and Microphones: These are often modular and can be easily salvaged.
- Chassis and Housings: The outer plastic or metal casing of a device can be reused if it is in good cosmetic condition.
- Connectors and Flex Cables: A functional connector or cable from a faulty device can be salvaged.

# 2. Refurbishable Components:

These are components that are faulty but can be restored to a functional state through repair. This is often more cost-effective and environmentally friendly than replacing them.

- **Motherboards with Minor Faults:** A motherboard with a short circuit on a specific power rail or a faulty IC can be repaired at the component level.
- Connectors: A charging port that has a single broken pin can be repaired.
- **Software Issues:** A device with a "bricked" operating system can be refurbished through software flashing.

### 3. Recyclable Components:

These are components that cannot be reused or refurbished but contain materials (metals, plastics, glass) that can be extracted and reused in a new manufacturing process.

- **Scrapped Motherboards:** A severely water-damaged or physically broken motherboard cannot be repaired but contains valuable materials like gold, silver, and copper.
- **Old Batteries:** Batteries that have reached the end of their life cycle cannot be reused or refurbished and must be recycled.
- Plastic and Metal Parts: Broken plastic housings and metal brackets can be sent for recycling.
- **Displays:** A physically damaged display can be recycled for its glass, plastic, and metal content.

# How to Identify:

- Visual Inspection: Look for physical damage, cracks, or burnt components.
- Functional Test: A quick functional test can determine if a component is working.
- Diagnosis: Use a multimeter or a diagnostic tool to check for electrical faults.

By correctly identifying these categories, a technician can make informed decisions that promote a circular economy in telecom repair.

# 4.1.2 Sort Materials Into Recyclable, Reusable, and Hazardous Waste Categories

After identifying a component's potential for reuse, refurbishment, or recycling, the next step is to physically sort it into the correct waste streams. Proper segregation is crucial for a smooth and compliant disposal process.

# 1. The Three Categories:

- Reusable/Refurbishable: This category contains all the components that can be reused in a future repair or restored to a working state. These are valuable assets and should be treated as part of the company's inventory, not as waste.
- **Recyclable:** This category contains components that are no longer usable but can be recycled for their material content.
- **Hazardous Waste:** This category contains components that pose a risk to the environment or human health. These require specialized handling and disposal.

# 2. Segregation Protocols:

- Labeling: Use clearly labeled bins or containers for each category. Examples:
  - "Salvaged Parts Reusable"
  - o "E-Waste Recyclable Components"
  - o "Hazardous Waste Batteries"
  - o "Hazardous Waste LCDs/OLEDs"
- Container Specifications:
- **Reusable Components:** Store in clean, organized bins or shelves. Use anti-static bags for sensitive components like motherboards.
- **Recyclable Components:** Store in a designated e-waste collection bin.

- **Hazardous Waste:** Use specific containers for hazardous materials. For example, a fire-resistant container for batteries.
- **Workplace Organization:** Place these bins in a dedicated area of the workspace, away from the active repair bench.

#### 3. Common Hazardous Materials in Telecom:

- **Lithium-ion Batteries:** Can be a fire and safety hazard if punctured or damaged.
- Circuit Boards: Contain heavy metals like lead and cadmium.
- **Displays (older LCDs):** May contain small amounts of mercury.
- Chemicals: Spent cleaning solvents, flux removers, and other chemical waste.

By sorting materials correctly from the outset, you ensure that valuable resources are not lost and that hazardous materials are handled safely.

# **4.1.3. Examing Faulty Components for Potential Refurbishment**

Before a faulty component is sent to the recycling or hazardous waste bin, it should be examined for potential refurbishment. This process turns a piece of waste into a reusable asset, which is a core tenet of sustainability in repair.

# 1. The Refurbishment Assessment:

- **Visual Inspection:** Use a magnifying glass or a microscope to inspect the faulty component for signs of repairability. Look for:
- **Minor Physical Damage:** A motherboard with a few broken traces can be repaired with micro-soldering. A charging port with a single broken pin can be replaced.
- **Software-Related Faults:** A component that is non-functional due to corrupted firmware can be repaired by flashing the firmware.
- **Cleanliness:** A component with light water damage can be cleaned with an ultrasonic cleaner and a solvent.
- **Diagnosis:** Use a multimeter or other diagnostic tools to confirm the specific fault. For example, a multimeter can be used to check for a short circuit on a power rail of a motherboard.

# 2. Documentation:

- **Refurbishment Log:** Maintain a separate log for components that have been identified as candidates for refurbishment.
- **Key Findings:** Document the following:
- **Component:** The name and model of the component.
- **Fault:** The specific fault identified (e.g., "Short circuit on Vbat rail," "Broken trace," "Corrupted firmware").
- **Repair Feasibility:** A "yes" or "no" for whether the component is repairable, along with a brief reason.
- **Estimated Repair Cost:** A quick estimate of the time and parts required to refurbish the component.
- **Supervisor Approval:** In some cases, a supervisor's approval may be required before investing time and resources into refurbishing a component.

# Importance:

This process helps the company build a stock of refurbished parts, which reduces procurement costs and contributes to a more sustainable business model.

# 4.1.4. Labelling and Segregation of Hazardous Materials for Specialized Disposal

Hazardous materials require specialized handling to protect both the technician and the environment. Here, we focus on the crucial steps of labeling and segregating these materials for specialized disposal.

#### 1. The "Hazardous Materials" Label:

- Clear Identification: Use clear, standardized labels on all containers for hazardous materials.
- Information: The label should include:
- Material Type: "Lithium-ion Batteries," "Damaged LCD Panel," "Circuit Boards," "Chemical Waste."
- Warning: "Hazardous Material Do Not Dispose in General Waste."
- Date: The date the material was placed in the container.

### 2. Segregation and Storage:

- **Dedicated Containers:** Use separate, dedicated containers for each type of hazardous material.
- **Battery Disposal:** Store all batteries (even seemingly dead ones) in a fire-resistant container. Do not mix them with other waste. Tape the terminals of the batteries to prevent accidental short circuits.
- Circuit Boards: Store all circuit boards in a separate container.
- **Chemicals:** Store spent cleaning solvents and other chemical waste in a dedicated container.
- Specialized Disposal:
- **Certified Recyclers:** Hazardous materials must be sent to certified e-waste recyclers who have the proper equipment and licenses to safely process them.
- Never in the Trash: Never dispose of any hazardous material in general waste or recycling bins.

# Importance:

Proper labeling and segregation are essential for a safe working environment and for ensuring compliance with all environmental regulations.

# **4.1.5** Evaluation of Dismantled Parts for Recycling or Safe Disposal

The final step in the component-handling process is to make a final judgment call on the fate of each dismantled part. Here, we focus on evaluating a component to determine if it can be recycled for its material content or if it requires specialized, safe disposal due to hazardous materials.

#### 1. The Final Evaluation:

- **Refurbishment Status:** First, check the refurbishment log to see if the part was deemed un-refurbishable.
- Material Content:
  - **Recyclable:** If the part is made of metal, plastic, or glass and does not contain hazardous materials, it can be sent to a standard e-waste recycling stream.
  - **Hazardous:** If the part is a battery, a circuit board, or an LCD/OLED panel, it must be treated as hazardous waste.
- **Documentation:** Document the final disposition of each part in the repair log.

# 2. Examples of Final Disposition:

- Motherboard:
  - o **Un-refurbishable:** Goes into the "E-Waste Recyclable" bin.
  - o Severely damaged/burnt: Goes into the "E-Waste Hazardous" bin.
- Plastic Housing:
  - o **Un-reusable:** Goes into the "E-Waste Recyclable" bin.
- Battery:
  - o Always: Goes into the "Hazardous Waste Batteries" bin.

# Importance:

This final evaluation ensures that all parts are handled in an environmentally responsible manner and that the company is in full compliance with all e-waste regulations.

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# **UNIT 4.2: Adherence to Environmental Standards**

# **Unit Objectives**



# By the end of this unit, the participants will be able to:

- 1. Identify different waste types and follow appropriate handling and storage practices, including segregation of materials, and placement in secure, ventilated areas.
- 2. Differentiate between hazardous and non-hazardous waste, and ensure safe, certified disposal through authorized recycling partners.
- 3. Maintain accurate records of e-waste disposal and recycling.
- 4. Select and use safety gear correctly to prevent injury and contamination while handling batteries, circuit boards, and chemicals.
- 5. Prevent environmental contamination through containment measures.
- 6. Participate in regular waste management audits and improvements

# 4.2.1 Safe Handling, Storage, and Disposal of Waste

Safe handling and storage are the foundation of responsible waste management. This involves understanding the nature of different materials and following established guidelines to prevent accidents and environmental contamination.

#### 1. Handling Procedures:

- Hazardous Materials: Always wear appropriate personal protective equipment (PPE) such as gloves and safety glasses when handling hazardous materials like damaged batteries or circuit boards. Avoid puncturing or bending batteries, as this can lead to a fire hazard.
- Non-Hazardous Materials: While less dangerous, materials like plastic housings and metal frames should still be handled with care to avoid cuts and to prevent them from becoming contaminated.
- Storage Guidelines:
  - o Segregation is Key: Store hazardous and non-hazardous materials in separate, clearly labeled containers.
  - Dedicated Containers:
  - o Hazardous Waste: Store damaged batteries in a fire-resistant container. Store circuit boards and other electronic waste in a designated e-waste bin.
  - o Non-Hazardous Waste: Use separate bins for materials like cardboard packaging or non-contaminated plastics.
  - o Secure Location: Store all waste bins in a secure, well-ventilated area away from the main repair bench and any heat sources.

# 3. Disposal Guidelines:

- **Hazardous Waste:** Ensure that all hazardous materials are sent to a certified e-waste recycling facility that is equipped to handle them safely.
- **Non-Hazardous Waste:** Dispose of non-hazardous waste according to standard recycling or waste management protocols.

By following these guidelines, you ensure a safe working environment and maintain a clear chain of custody for all materials.

# **4.2.2** E-Waste Management Regulations

Compliance with environmental regulations is a non-negotiable part of modern telecom operations. A technician must be aware of and actively follow all rules and regulations governing the handling and disposal of e-waste to avoid legal penalties and environmental harm.

# 1. Understanding Relevant Regulations:

- Local and National Laws: Be aware of the specific e-waste regulations in your region. These laws often dictate how electronic waste must be categorized, stored, and disposed of.
- Manufacturer Directives: Many manufacturers have their own take-back programs or specific guidelines for the disposal of their products.
- RoHS and WEEE: Understand the basic principles of the European Union's RoHS (Restriction of Hazardous Substances) and WEEE (Waste Electrical and Electronic Equipment) directives, as they influence global standards for e-waste.

# 2. Practical Compliance Actions:

- **Proper Segregation:** Always sort waste into the correct categories as per company policy.
- **Use Certified Partners:** Ensure that all e-waste is collected and processed by certified and legally compliant recycling partners.
- **Documentation:** Record all disposal activities to provide a verifiable paper trail for compliance audits.

By maintaining strict compliance, you not only protect the environment but also the company's reputation and legal standing.

# 4.2.3 Recording E-Waste Disposal and Recycling Activities

Accurate and consistent record-keeping is a vital part of a sustainable workflow. It creates a verifiable history of all e-waste disposal and recycling activities, which is essential for audits and for tracking a company's environmental impact.

### 1. The E-waste Disposal Log:

- Purpose: The log serves as a formal record of every disposal event.
- Information to Record: The log should include:
- Date of Disposal: The date the waste was transferred for disposal.
- Material Type and Quantity: The type of material (e.g., "Lithium-ion Batteries," "Circuit Boards") and its weight or count.
- Recipient of Waste: The name of the certified e-waste recycler.
- **Disposal Certificate:** The log should reference the disposal certificate provided by the recycler.
- **Technician's Name:** The name of the technician who initiated the disposal.

### 2. Company Policies:

- Frequency: Follow company policy on how often to update the log (e.g., weekly, monthly).
- **System:** Use the designated company system (e.g., an electronic database or a physical logbook) for all record-keeping.
- Audits: The disposal log is the primary document used during internal and external audits to verify compliance.

By meticulously recording all disposal activities, you ensure a transparent and auditable process.

# 4.2.4 Use of PPE While Handling Hazardous Waste

The use of appropriate protective equipment is the primary defense against injury and environmental contamination when handling hazardous waste. Here we focus on identifying and using the correct PPE for specific tasks.

### 1. Personal Protective Equipment (PPE) for E-waste:

- Gloves: Use heavy-duty, puncture-resistant gloves (e.g., nitrile) to protect your hands from hazardous chemicals, sharp edges on circuit boards, and the contents of batteries.
- Safety Glasses: Wear safety glasses to protect your eyes from chemical splashes or flying debris, especially when handling components with pressurized or liquid content.
- Fume Extractor/Mask: Use a fume extractor when soldering and a respirator mask when handling any waste that may produce hazardous dust or fumes.

# 2. Preventing Environmental Contamination:

- Spill Kits: Have a spill kit readily available for any accidental chemical spills.
- **Containment:** Store all hazardous waste in closed, leak-proof containers to prevent spills or leaks into the environment.

• **Proper Disposal:** Ensure that waste is disposed of through certified channels to prevent it from ending up in landfills and contaminating soil and water.

By using the correct PPE and following containment procedures, you create a safe environment and prevent a negative impact on the ecosystem.

# **4.2.5 Regular Audits of Waste Management Processes**

A robust waste management system requires a continuous cycle of implementation and verification. This often is performed by a senior technician or a supervisor, focuses on the auditing process that ensures all waste management activities align with the company's sustainability goals and regulatory standards.

# 1. The Purpose of an Audit:

- Compliance Verification: An audit is a systematic check to ensure that all waste handling and disposal activities are in compliance with local regulations and company policies.
- **Process Improvement:** It identifies weaknesses or inefficiencies in the waste management process and provides an opportunity for improvement.
- **Accountability:** It verifies that all technicians are following established procedures for segregation, storage, and documentation.

### 2. The Auditing Process:

- Regular Schedule: Audits should be conducted on a regular schedule (e.g., quarterly).
- Checklist: Use a standardized audit checklist that includes:
- Waste Segregation: Verify that all waste is correctly sorted into the designated bins.
- **Container Integrity:** Check that all hazardous waste containers are properly labeled, sealed, and in good condition.
- **Documentation:** Review the e-waste disposal log to ensure it is complete and up-to-date.
- **Recycling Certificates:** Verify that the company has received a certificate of disposal from the recycling partner for all waste transferred.
- **PPE Availability:** Check that all necessary protective equipment is available and in good condition.
- **Reporting:** Document the findings of the audit, including any non-compliances, and create an action plan for remediation.

#### 3. The Technician's Role in an Audit:

- **Follow Procedures:** The most important role of a technician is to consistently follow all established waste management procedures.
- Maintain Records: Ensure that all documentation is accurate and up-to-date.
- **Cooperate:** Cooperate fully with the audit process and be prepared to answer questions about your waste management practices.

By participating in and supporting regular audits, you contribute to a transparent, compliant, and continuously improving waste management system.

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# **UNIT 4.3: Sustainable Repair Practices**

# **Unit Objectives 6**



### By the end of this unit, the participants will be able to:

- 1. Apply appropriate repair techniques to reduce waste and energy consumption.
- 2. Select and use energy-efficient and eco-friendly spare parts.
- 3. Assess, test, and catalog reusable parts for future use, reducing procurement and material waste.
- 4. Minimize the use of single-use materials in repairs.
- 5. Follow a systematic diagnosis process using appropriate tools and documentation to prevent the wastage of functional components.

# 4.3.1 Repair Techniques to Minimize Waste Generation and Energy Consumption

Sustainable repair techniques are a combination of efficient workflow, careful execution, and the use of eco-friendly tools. By adopting these methods, a technician can significantly reduce their environmental footprint.

#### 1. Minimizing Waste Generation:

- Component-Level Repair: Instead of replacing an entire motherboard for a faulty IC, a sustainable technician will attempt a component-level repair. This extends the life of the board and reduces e-waste.
- Salvage and Reuse: Prioritize salvaging functional components from discarded devices. This reduces the need to purchase new parts and minimizes waste.
- Consumable Management: Use consumables like isopropyl alcohol and solder flux sparingly and only when necessary.

### 2. Reducing Energy Consumption:

- Energy-Efficient Tools: Use modern, energy-efficient repair stations. Many soldering stations and hot air guns now come with auto-sleep or low-power modes that automatically activate when the tool is not in use.
- LED Lighting: Use LED lighting in the workspace, which consumes significantly less energy than traditional fluorescent or incandescent bulbs.
- Efficient Procedures: Optimize the repair process to minimize the time the device and tools are powered on. For example, pre-diagnose the issue before powering up the device, and only turn on the hot air station or soldering iron when you are ready to begin the repair.

By being mindful of these practices, you can make a significant positive impact on the environment during your daily work.

# 4.3.2 Energy-Efficient and Eco-Friendly Spare Parts For Repairs

The choice of spare parts has a direct impact on a device's energy efficiency and environmental footprint. A sustainable technician considers more than just functionality when selecting a replacement component.

### 1. Energy-Efficient Parts:

- Batteries: When replacing a battery, select one with a high energy density and a long life cycle. A higher-quality battery will have a longer lifespan, reducing the frequency of replacement.
- **Displays:** Opt for displays with efficient backlights or those that use technologies like OLED, which consume less power than traditional LCDs.
- Power Adapters: For laptop and accessory repairs, choose power adapters that are certified as energy-efficient (e.g., have an "Energy Star" rating). These adapters are designed to minimize power draw when the device is not charging.

# 2. Eco-Friendly Parts:

- **Recycled Materials:** When possible, source replacement parts that are made from recycled materials.
- Refurbished Parts: Prioritize using refurbished components from discarded devices.
- **Lead-Free Components:** Ensure that all new components are RoHS-compliant and lead-free, especially for older devices.

#### 3. Procurement Practices:

- **Authorized Suppliers:** Work with authorized and ethical suppliers who adhere to environmental and labor standards.
- **Bulk Ordering:** Order parts in bulk to reduce packaging waste and the carbon footprint associated with shipping.

By making conscious choices about the parts you use, you can contribute to a more sustainable supply chain.

# 4.3.3 Optimizing Material Usage

A key tenet of a circular economy is to reduce waste by giving functional components a second life. A sustainable technician is skilled at salvaging and reusing parts from devices that are beyond repair.

### 1. The Salvage Process:

- Initial Assessment: When a device is deemed Beyond Economic Repair (BER), conduct a final assessment to identify any components that are still functional.
- **Component Identification:** Identify the following components as potential candidates for salvage:
- Motherboards: If a device is BER due to a cracked screen, the motherboard is a valuable asset.
- Cameras, Speakers, Microphones: These modular components are often in good condition.

- Internal Cables and Connectors: Functional flex cables and connectors can be salvaged.
- Screws and Brackets: Small hardware can be reused.
- **Testing and Verification:** Before placing a salvaged component into inventory, perform a quick functional test to ensure it is in working condition.

### 2. Integrating into Inventory:

- **Separate Storage:** Store all salvaged parts in a separate, clearly labeled area of the inventory.
- **Documentation:** Document the salvaged parts, including the part number, the device they came from, and their condition. This makes it easy for other technicians to find and use these parts.

By actively salvaging and reusing components, you reduce both the environmental impact of e-waste and the company's procurement costs.

# 4.3.4 Minimizing the use of Single-Use Materials

Repair and maintenance tasks often rely on single-use materials like adhesive strips, swabs, and cleaning wipes. Minimizing their use and finding reusable alternatives is a simple but impactful way to improve a repair shop's environmental footprint.

#### 1. Identifying Single-Use Materials:

- Adhesive: Many repairs require new adhesive strips for screens or back covers.
- Cleaning: Isopropyl alcohol (IPA) wipes, cleaning swabs, and lint-free cloths.
- Packaging: The plastic bags and foam that parts are shipped in.

#### 2. Strategies for Minimizing Use:

- Adhesive: For some repairs, a technician can apply liquid adhesive from a reusable tube instead of using pre-cut adhesive strips.
- **Cleaning:** Use reusable lint-free cloths and a spray bottle for IPA instead of single-use wipes.
- **Rechargeable Tools:** Use rechargeable dust blowers instead of single-use canned air, which often contains harmful propellants.
- **Bulk Consumables:** Purchase consumables like IPA, solder, and flux in bulk to reduce the amount of packaging waste.

#### 3. Best Practices:

- **Cleanliness:** Keep the workbench clean to reduce the need for excessive cleaning materials.
- **Reusability:** Clean and reuse plastic opening picks and other tools instead of discarding them after every repair.
- **Recycle Packaging:** Ensure that all cardboard and recyclable plastic packaging from new parts is sorted and sent for recycling.

By adopting these practices, you can significantly reduce the amount of waste generated from each repair.

# 4.3.4 Minimizing the use of Single-Use Materials

Accurate diagnosis is not just about a successful repair; it is a fundamental sustainability practice. A misdiagnosis can lead to the unnecessary replacement of a perfectly functional component, which creates e-waste and wastes valuable resources.

# 1. The Link Between Diagnosis and Sustainability:

- **Misdiagnosis Example:** A technician diagnoses a laptop's inability to charge as a faulty battery and replaces it. However, the true fault was a faulty charging port. The original battery, a valuable and functional component, is now unnecessarily discarded, and the new battery might also degrade from an ongoing charging issue.
- Accurate Diagnosis: A technician who accurately diagnoses the faulty charging port replaces only that part. The original battery is saved, and a new component is not wasted.

### 2. Strategies for Accurate Diagnosis:

- **Systematic Process:** Always follow a systematic diagnostic process, starting with the simplest and most likely causes.
- **Use the Right Tools:** Use the correct diagnostic tools (multimeter, diagnostic software) for the fault. Do not rely on assumptions.
- **Documentation:** Document every diagnostic step and its outcome in the repair log . This helps confirm the root cause and provides a record to prevent unnecessary replacements.
- **Consult Manuals:** Use service manuals and schematics to guide the diagnostic process.

# Importance of Accuracy:

By ensuring an accurate diagnosis, you not only perform a more efficient repair but also contribute directly to waste reduction, making every repair a sustainable one.

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# **UNIT 4.4: Adherence to Organizational Protocols**

# Unit Objectives (%)



# By the end of this unit, the participants will be able to:

- 1. Follow organizational sustainability policies in repair operations.
- 2. Coordinate with certified recyclers for safe e-waste disposal.
- 3. Document waste transfers for compliance and traceability
- 4. Participate in sustainability and environmental training programs.
- 5. Promote sustainability awareness among colleagues and customers.

# 4.4.1 Organizational Sustainability Policies

An organization's sustainability policy is the guiding document that outlines its commitment to environmental responsibility. This ensures that a technician's daily actions are in direct alignment with this policy, creating a unified and compliant approach to sustainable repair.

### 1. Understanding the Policy:

- Policy Review: Familiarize yourself with the company's official sustainability policy. This document typically covers areas such as e-waste management, energy consumption, and responsible sourcing.
- Key Principles: The policy will outline key goals, such as reducing the company's carbon footprint, achieving a specific e-waste diversion rate, or implementing a circular economy model.

# 2. Practical Compliance in Daily Work:

- E-waste Management: Consistently follow the established procedures for segregating and disposing of waste. This is the most visible and direct way to follow the policy.
- Energy Efficiency: Actively use energy-efficient tools and minimize the use of electricity in the workspace.
- Responsible Sourcing: Prioritize the use of salvaged or refurbished parts as mandated by the policy.
- Documentation: Ensure all repairs and waste management activities are meticulously documented to provide evidence of compliance.

### 3. Accountability:

- **Reporting:** Report any non-compliance or potential improvements to your supervisor.
- Continuous Improvement: Be proactive in suggesting new ways to improve sustainability practices.

By following the organizational policy, you become an active and accountable participant in the company's commitment to a more sustainable future.

# **4.4.2** Coordination with Certified Recyclers for Disposal of Non-Recyclable Waste

The final stage of the e-waste management process involves the physical transfer of waste from the repair facility to a certified recycling agency. Here, we focus on the technician's role in preparing this waste and coordinating its pickup or transfer.

### 1. Preparation of Waste for Transfer:

- Categorization: Ensure all waste is correctly sorted and stored in the appropriate containers.
- Final Check: Before the waste is transferred, perform a final check of all bins to ensure that no hazardous materials (e.g., batteries) have been misplaced in non-hazardous waste.
- Weight and Volume: Log the approximate weight or volume of the waste to be transferred.

# 2. Coordination Process:

- **Recycler Contact:** Use the company's designated contact for the certified recycler to schedule a pickup or delivery.
- **Information Exchange:** Provide the recycler with all the necessary information, including the type and quantity of waste.
- **Transfer Documentation:** Complete all necessary transfer documentation, such as a waste manifest form, before the waste leaves the premises.

# 3. Follow-up:

- **Receipt and Certificate:** Ensure that a receipt or a certificate of disposal is provided by the recycling agency.
- **Record-Keeping:** File the certificate of disposal as part of the official records.

By actively participating in this coordination, you ensure that the e-waste is handled safely and responsibly by a certified partner.

# 4.4.3 Documentation of Waste Transfer to Recycling or Disposal Agencies

Documentation of waste transfer is a legal and auditable requirement that validates a company's commitment to responsible e-waste management. Here, we focus on the technician's role in meticulously completing and filing all necessary paperwork.

# 1. Waste Manifest Forms:

- **Purpose:** A waste manifest is a legal document that tracks hazardous waste from its point of generation to its final disposal.
- Information: The manifest includes information such as:
  - o The type and quantity of waste being transferred.
  - The name and address of the waste generator (the repair facility).
  - o The name and address of the waste transporter and the disposal facility.
- **Procedure:** The technician is responsible for completing their portion of the manifest form and ensuring it is signed by the waste transporter upon pickup.

# 2. Certificate of Disposal:

- Purpose: A certificate of disposal is a document provided by the recycling agency that
  confirms that the waste was received and disposed of in an environmentally sound
  manner.
- **Procedure:** Ensure that a certificate is provided for every waste transfer.
- **Filing:** File the certificate with the company's official records, linked to the e-waste disposal log.

By ensuring that all waste transfer documentation is accurate and complete, you provide a verifiable paper trail that is essential for regulatory compliance.

# 4.4.4 Participation in Training Programs on Environmental Conservation and Sustainability

The field of environmental conservation and sustainability is constantly evolving. A technician can ensure her/his knowledge is up-to-date by actively participating in training programs.

# 1. The Purpose of Training:

- **Knowledge and Skills:** Training programs provide the latest information on environmental regulations, best practices for waste management, and new sustainable repair techniques.
- **Policy Updates:** They ensure that all technicians are aware of any changes to the company's sustainability policies.
- **Personal Development:** They provide an opportunity for a technician to expand their skillset and contribute more effectively to the company's sustainability goals.

# 2. Participation:

- **Required Training:** Actively participate in all mandatory training programs on environmental conservation and sustainability.
- **Certifications:** Pursue relevant certifications that demonstrate a commitment to sustainable repair practices.
- **Continuing Education:** Stay informed on the latest developments in the field by reading industry publications and attending workshops.

By engaging in these training programs, you ensure that your skills and knowledge are aligned with the latest sustainability standards.

# 4.4.5 Promoting Awareness of Sustainable Practices

Sustainability is a collective effort. This final competency focuses on the technician's role as a leader and a promoter of sustainable practices within the workplace and among customers.

### 1. Internal Awareness (Team Members):

- **Lead by Example:** Consistently follow all sustainability protocols (e.g., proper waste segregation, energy-efficient practices).
- **Educate Colleagues:** Share knowledge and best practices with team members to ensure everyone is on the same page.
- **Foster a Culture of Sustainability:** Encourage a culture where sustainability is a shared value and a common topic of conversation.

# 2. External Awareness (Stakeholders/Customers):

- **Customer Communication:** When recommending a repair, explain the benefits of sustainable practices. For example, explain how component-level repair reduces e-waste and is a more eco-friendly option.
- **BER Communication:** When a device is Beyond Economic Repair (BER), explain the process of responsible disposal and encourage the customer to let the company handle the e-waste.
- **Transparent Practices:** Be transparent with customers about the company's commitment to sustainability, for example, by mentioning that faulty batteries will be sent to a certified recycler.

By promoting awareness, you help to create a more sustainable mindset, not only within your team but also in the wider community.

# **Exercise**



# **Multiple Choice Question:**

# 1. What is the main purpose of refurbishing components?

- a. To generate e-waste
- b. To turn a piece of waste into a reusable asset
- c. To make the repair process more difficult
- d. To save time during repairs

# 2. Which of the following is considered a hazardous material in electronic waste?

- a. Plastic casings
- b. Glass
- c. Lithium-ion batteries
- d. Metal screws

#### 3. What is the purpose of a waste manifest?

- a. To track a device's repair history
- b. To track hazardous waste from its point of generation to its final disposal
- c. To log a customer's personal information
- d. To verify a component's functionality

# 4. Why should lead-free solder be used in repairs?

- a. It is easier to use than leaded solder.
- b. It has a lower melting point.
- c. It reduces lead contamination and is required by many regulations.
- d. It makes a stronger solder joint.

#### 5. What is the purpose of regular audits of waste management processes?

- a. To check for compliance with regulations and identify areas for improvement
- b. To punish technicians for mistakes
- c. To increase the amount of e-waste produced
- d. To reduce the time spent on repairs

### Fill in the Blanks:

| 1. | A motherboard with a short circuit on a specific power rail can be considered a                      |
|----|--|
|    | component.   |
| 2. | A component that cannot be reused or refurbished but contains materials that can be extracted and    |
|    | reused in a new manufacturing process is considered  |
| 3. | Before a salvaged component is placed into inventory, a should be performed to ensure                |
|    | it is in working condition.  |
| 4. | The primary tool for managing hazardous waste is a, which is a legal document that                   |
|    | tracks hazardous waste from its point of generation to its final disposal.                           |
| 5. | A technician's most direct way to follow a company's sustainability policy is to consistently follow |
|    | established procedures for segregating and disposing of  |
|    |  |

#### **Short Questions:**

- 1. What are the three categories of salvaged materials?
- 2. Name a hazardous material found in batteries.
- 3. Why is it important to use a fume extractor when soldering?
- 4. How can a technician reduce energy consumption during repairs?
- 5. What are the benefits of using refurbished parts instead of new ones?
- 6. What is the purpose of keeping a log of all e-waste disposal and recycling activities?

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# Scan the QR Code to watch the related videos



https://youtu.be/8v60jWtecrQ

Effective Telephone Tips from Successfully Speaking



youtu.be/K5qQ77cmNPs

Types of Communication?



youtu.be/wnzwgExFRR4

Communication with Customer and Colleagues













## 5. Employability Skills (30 Hours)

It is recommended that all training include the appropriate. Employability Skills Module. Content for the same can be accessed



















## 6. Annexure

Annexure I - QR Codes - Video Links



## Annexure-I

## **QR Codes –Video Links**

| Module No. | Unit No.   | Topic Name   | Page<br>No | Link for QR Code (s) | QR code (s)   |
|------------|--|--|------------|----------------------|---|
|            |  | 1.1.1 Intro-<br>duction to the<br>Telecom Sector<br>in India           | 21         | youtu.be/Cag-bcbivtM | Introduction to the Telecom Sector in India             |
|            | UNIT 1.1: Introduction to the Telecom Industry in India  1.Introduction to FMCG  UNIT 1.2: Introduction to E-Waste | 1.1.3 Indian<br>Handset Market   | 21         | youtu.be/mcHW-EBh4Iw | Indian Handset Market                                   |
| duction to |  | 1.1.4 Top Hand-<br>set Manufactur-<br>ers in India                     | 21         | youtu.be/0O8UoLcYYbI | Top Handset Manufacturers in India                      |
|            |  | 1.1.5 Regulatory<br>Authorities in<br>the Telecom<br>Industry in India | 21         | youtu.be/VeoHhkjV6qo | Regulatory Authorities in the Telecom Industry in India |
|            |  | Introduction 1.2.1 What is   | 21         | youtu.be/pb0O_gR7fQo | What is Waste?  |

| Module No. | Unit No. | Topic Name   | Page<br>No | Link for QR Code (s) | QR code (s)                                     |
|------------|----------|--|------------|----------------------|---|
|            |          | 1.2.2 Electronic<br>Waste                            | 21         | youtu.be/dq7bBZUFR14 |   |
|            |          |  |            |                      | Electronic Waste                                |
|            |          | 1.2.3 Break-up<br>of e-waste Gen-<br>erated in India | 21         | youtu.be/dI-DEBygfRg | Break-up<br>of e-waste<br>Generated in<br>India |
|            |          | 1.2.4 E-Waste<br>Awareness                           | 21         | youtu.be/aHaySL8EL6g | E-Waste<br>Awareness                            |
|            |          | 1.2.5 E-Waste<br>Problems                            | 21         | youtu.be/bEw34DyFBS4 | E-Waste<br>Problems                             |
|            |          | 1.2.6 E-Waste<br>Recycling in<br>India               | 21         | youtu.be/blUf9WRHt7w | E-Waste<br>Recycling in India                   |

| Module No.                                   | Unit No.  | Topic Name  | Page<br>No | Link for QR Code (s)                           | QR code (s)   |
|--|---|---|------------|--|---|
|  |   | 1.2.8 General Guidelines for Collection and Storage of E-Waste                          | 21         | youtu.be/E-JixTdyCoQ                           | General<br>Guidelines<br>for Collection<br>and Storage of<br>E-Waste              |
| N €  |   | 2.1.1 Effects of<br>Improper Dis-<br>posal of Telecom<br>E-Waste                        | 60         | <u>www.youtube.com/</u><br>watch?v=zB1nML5GMxw | Effects of Improper Disposal of Telecom E-Waste                                   |
|  | UNIT 2.1:<br>Need for Prop-<br>er E-Waste<br>Disposal | 2.1.2 E-Waste<br>Recycling  | 60         | youtu.be/blUf9WRHt7w                           | E-Waste<br>Recycling  |
| Module 2:<br>Handling<br>E-Waste<br>Properly | Handling<br>E-Waste                                   | 2.1.5 Responsibilities Assigned to Various Stakeholders for Disposal of Telecom E-Waste | 60         | youtu.be/6i96r8LGUXU                           | Responsibilities Assigned to Various Stakeholders for Disposal of Telecom E-Waste |
|  |   | 2.2.1 Collection<br>and Processing<br>of E-waste from<br>Telecom Site                   | 60         | <u>www.youtube.com/</u><br>watch?v=aUwFXDLOFO0 | Collection and Processing of E-waste from Telecom Site                            |

| Module No. | Unit No.   | Topic Name  | Page<br>No | Link for QR Code (s)                           | QR code (s)  |
|------------|--|---|------------|--|--|
|            |  | 2.2.3 Providing<br>Certificates to<br>Stakeholders<br>after Collecting<br>E-waste | 60         | www.youtube.com/<br>watch?v=a1Co8a8GuT4        | Providing Certificates to Stakeholders after Collecting E-waste    |
|            | UNIT 2.3<br>Collection,<br>Transportation<br>& Storage of<br>E-waste | 2.3.1 Safe Transportation of the E-Waste  | 60         | <u>www.youtube.com/</u><br>watch?v=nWd-H7XqmsM | How should e-waste be processed?                                   |
|            | UNIT 2.4<br>Warehouse<br>Etiquettes                                  | 2.3.4 Disposal<br>of Hazardous<br>E-Waste   | 60         | <u>www.youtube.com/</u><br>watch?v=vb9QFjkEmAU | Health and<br>Safety Measures                                      |
|            | UNIT 2.5   | 2.5.2 Maintain<br>Personal Hy-<br>giene   | 60         | <u>www.youtube.com/</u><br>watch?v=ljzAe-SQtzk | Maintain<br>Personal Hygiene                                       |
|            | Organisational Safety and Hygiene Practices                          | 2.5.2 Maintain<br>Personal Hy-<br>giene   | 60         | www.youtube.com/<br>watch?v=QEB7wE-YFXg        | Personal Protective Equipment (PPE) while Telecom Handling E-waste |

| Module No.   | Unit No.  | Topic Name  | Page<br>No | Link for QR Code (s)                           | QR code (s)   |
|--|---|---|------------|--|---|
|  |   | 2.5.4 Causes<br>of accidents<br>while Handling<br>E-Waste | 60         | <u>www.youtube.com/</u><br>watch?v=ntEVHTqsq6A |   |
|  |   | L-Waste   |            |  | Causes of<br>accidents<br>while Handling<br>E-Waste |
|  |   | 2.5.6 Safety<br>Guidelines<br>for Collecting<br>E-Waste   | 60         | <u>www.youtube.com/</u><br>watch?v=1k19eXJ3dH4 | Safety Guidelines<br>for Collecting<br>E-Waste      |
|  |   | 2.5.7 Fire Safety   | 60         | www.youtube.com/<br>watch?v=UIKS_A7Xg1E        |   |
| 3.Organize<br>Work and<br>Resourc-<br>es as per<br>Health and<br>Safety Stan-<br>dards | UNIT 3.2: Dif-<br>ferent Types<br>of Health<br>Hazards  | 3.1.2 First Aid<br>Techniques                             | 90         | youtu.be/GrxevjEvk_s                           | Fire Safety  First Aid at Work Place                |
|  | UNIT 3.3:<br>Importance of<br>Safe Working<br>Practices | 3.3.1 Basic Hygiene Practices                             | 90         | https://youtu.be/IsgLivAD2FE                   |   |
|  |   |   |            |  | How to properly wash your hands                     |

| Module No.                                | Unit No.   | Topic Name                             | Page<br>No | Link for QR Code (s)         | QR code (s)  |
|---|--|--|------------|------------------------------|--|
|   | UNIT 3.3:<br>Importance of<br>Safe Working<br>Practices                  | 3.3.3 Safe Work-<br>place Practices    | 90         | https://youtu.be/qzdLmL4Er9E | How to give CPR to an Adult, a Child or an infant            |
|   | UNIT 3.5: time<br>Management   | 3.5.6 Escalation<br>Matrix             | 90         | youtu.be/ccAZ9nCZSLc         | Escalation Matrix PowerPoint Presentation Slides             |
|   | UNIT 3.9:<br>Waste Man-<br>agement                                       | 3.9.6 E-waste<br>Management<br>Process | 90         | youtu.be/dq7bBZUFR14         | E-Waste<br>Recycling and<br>Management                       |
| 4. Communication and Interpersonal Skills | UNIT 4.1:<br>Interaction<br>with Supervi-<br>sor, Peers and<br>Customers | 4.1.3 Effective<br>Communication       | 106        | https://youtu.be/8v60jWtecrQ | Effective<br>Telephone Tips<br>from Successfully<br>Speaking |
|   | UNIT 4.1:<br>Interaction<br>with Supervi-<br>sor, Peers and<br>Customers | 4.1.5 Types of<br>Communication        | 106        | youtu.be/K5qQ77cmNPs         | Types of Communication?                                      |

| Module No.           | Unit No.   | Topic Name                                      | Page<br>No | Link for QR Code (s)                                      | QR code (s)                                |
|----------------------|--|---|------------|---|--|
|                      | UNIT 4.1:<br>Interaction<br>with Supervi-<br>sor, Peers and<br>Customers | 4.1.8 Communication with Colleagues & Customers | 106        | youtu.be/wnzwgExFRR4                                      | Communication with Customer and Colleagues |
| Employability Skills |  |   |            | https://<br>www.skillindiadigital.gov.<br>in/content/list |  |













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