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Business Model Toolbox for Setting Up E-waste Recycling Facility in India

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Handbook

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Contents

Abbreviations

BFR	Brominated Flame Retardant
CCC	Common Collection Centre
CFC	Chloro Fluro Carbon
CFL	Compact Fluorescent Lamp
CPCB	Central Pollution Control Board
CRT	Cathode Ray Tube
CTE	Consent to Establish
CTO	Consent to Operate
DRS	Deposit Refund Scheme
EEE	Electrical Electronic Equipment
EoL	End of Life
EPR	Extended Producer Responsibility
EST	Environmentally Sound Technology
HCFC	Hydro Chloro Fluro Carbon
HW (M)	Hazardous Waste (Management)
IT& TE	Information Technology & Telecommunication Equipment
IEC	Importer/Exporter Code
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MoEFCC	Ministry of Environment, Forest and Climate Change
MT	Metric Ton
NGOs	Non-Governmental Organisation
PAN	Permanent Account Number
PCB	Printed Circuit Board
PCBs	Polychlorinated Biphenyls
PCC	Pollution Control Committees
PCTs	Polychlorinated Terphenyls
PRO	Producer Responsibility Organisation
PWB	Printed Wire Board
RoHS	Reduction of Hazardous Substances
RWAs	Resident Welfare Associations
SPCB	State Pollution Control Board
TIN	Taxpayer Identification Number
TSDF	Treatment, Storage & Disposal Facility
TV	Television

Executive Summary

This publication was prepared under the Indo-German development cooperation project 'Setting Up Innovative Value Chain for E-Waste Management (E-Safai)'. The project is implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH together with Reverse Logistics Group India. It is funded through the develoPPP programme that GIZ implements on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ).

The toolbox is aimed at building awareness and capacity building of entrepreneurs interested in e-waste recycling and intends to facilitate formalising of informal sector stakeholders indulged in e-waste management. Recognising the rapidly emerging and serious issue of e-waste, this business model toolbox on e-waste handling has been prepared as a guidance document to support, develop and implement e-waste management systems by setting up recycling and dismantling facilities. This business model toolbox has been prepared based on data from secondary sources including publications from Central Pollution Control Board (CPCB), State Pollution Control Board (SPCB) and Pollution Control Committees (PCC) reports and other sources.

The business model toolbox has five sections including guidelines for dismantlers and setting up of a dismantling facility, guidelines for recyclers and for setting up of e-waste recycling facility, the requirements to set up dismantling and recycling facilities and various authorisations required to set up an e-waste facility.

Review of current practices of e-waste in India provides an understanding of policies/laws/regulations and institutional framework for e-waste management. Institutional mechanisms for the collection system and the role of e-waste Management rules 2016 also have been included. Regulatory policy and technical guidelines will be useful in supporting setting up recycling and dismantling facility for e-waste management chain. E-waste management chain covers collection, transportation and treatment including material recovery and disposal.

This toolbox titled 'Business Model Toolbox of E-waste Recyclers' provides a detailed overview of setting up an e-waste management system. It also offers a snapshot of various Acts and Rules in India that deals with waste management and pollution control. The toolbox will help waste management executives to manage their waste in an environmentally responsible manner.

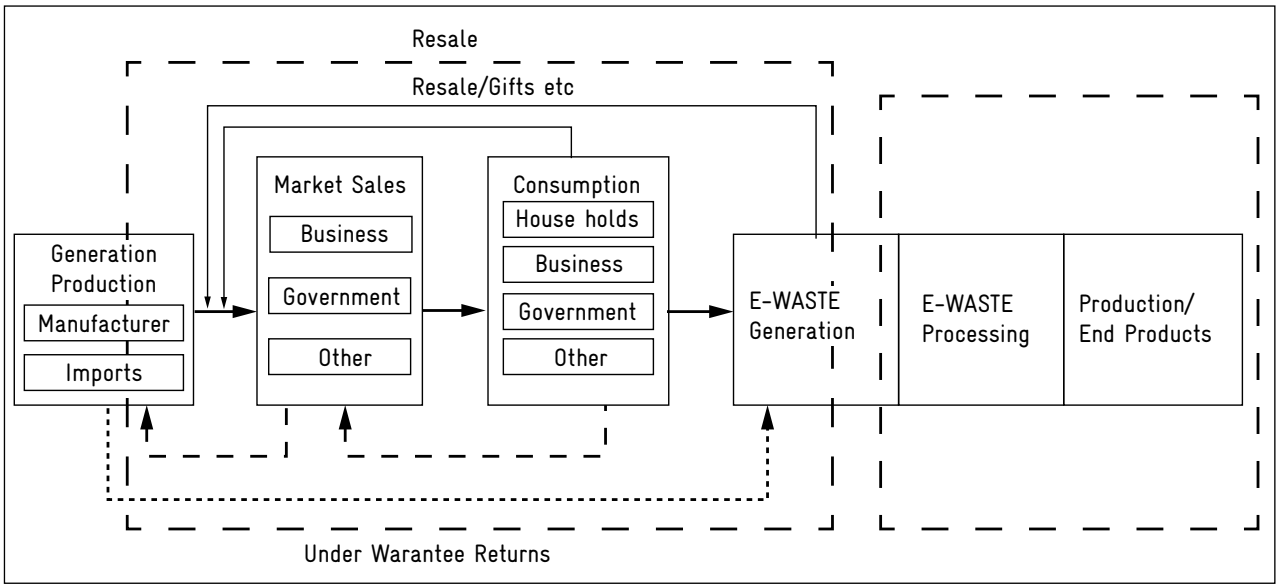
1 Introduction

About 50 million tonnes of e-waste was produced globally in 2018, which was expected to multiply in the near future. (UN, 2019) 95% of the total e-waste generated in India ends up in the informal sector where it's disposed in an unhealthy way. According to a report released by the World Economic Forum, India ranks 168 amongst 180 countries and is amongst the bottom five countries on the Environmental Performance Index 2020. (World Economic Forum, 2020) Only 20% of global e-waste is recycled each year, which means that 40 million tonnes of e-waste is either burned or illegally traded and treated in an unsound manner. In India, e-waste is increasing at the rate of 5-10% per annum.

E-waste recycling facility is by itself an industrial operation requiring clearances from various authorities for the establishment and operations of the facility. Among the various clearances the environmental clearances are very significant as they help ensure control of environmental pollution. This business model toolbox will help to establish new dismantling and recycling facilities under the organised sector. In addition, the activities presently operating in the informal sector need to be upgraded or dovetailed to provide a support system for the integrated facility. It will also benefit from using this business model toolbox. This would enable to bring the informal sector in the mainstream of the e-waste management activities and facilitate to ensure environmental compliances. The proposed mechanism for the e-waste facility is only an illustrative model and specific details have to be analyzed while developing such facilities.

The process of dismantling is an important stage in -waste management. It involves breaking of end-of-use equipment into its components and segregating them for the convenience of recycling. However, it does not end there, as some of the dismantlers also recycle the e-waste to recover the valuable materials like plastic, iron and precious metals. Some dismantlers export the components containing valuable materials for recycling in the facilities abroad.

These guidelines are prepared with a view to facilitating the entrepreneurs to set up world-class formal e-waste recycling facilities in India. These provide guidance on the general procedures and the regulatory requirement for establishing and operating such a facility. However, the specific requirements need to be in accordance with those specified by the State Government in which the unit is located.

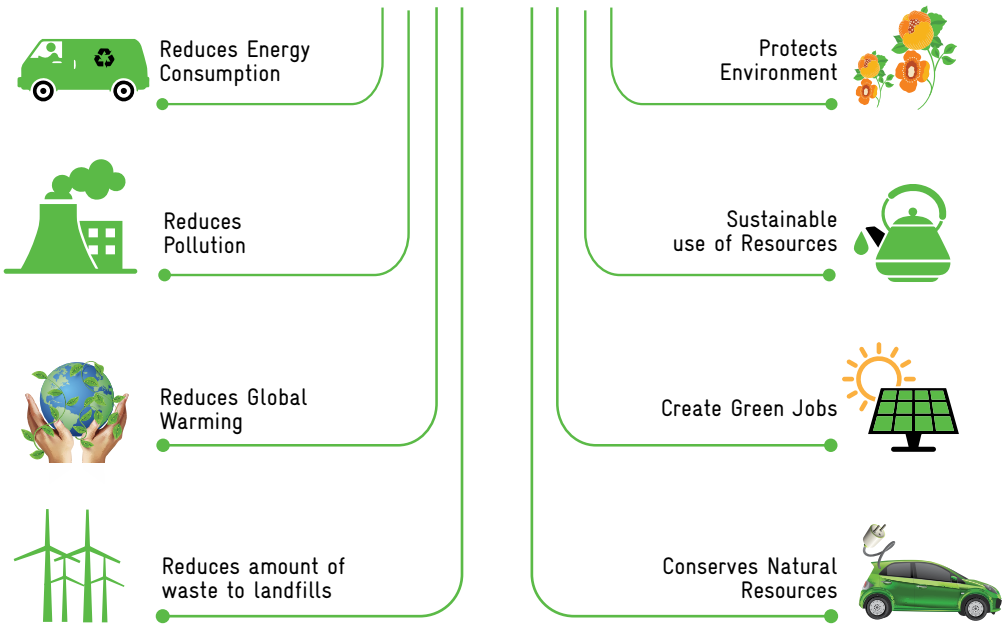


Source: Amit Jain and Rajneesh Sareen; E-waste assessment methodology and validation in India, Journal of Material Cycles and Waste Management, Volume 8, Number 1/March, 2006, Springer-Verlag.

2 Objectives & Scope of Guidelines

The objective of this business model toolbox is to provide the support to entrepreneurs and informal sector aiming at establishing dismantling and recycling facilities including the guidance on the procedures and authorisations required to establish and operate such facilities.

The business model toolbox only provides information on the base requirements and the requirements for establishing such a facility. All obligations are to be in accordance with the laws and the rules applicable at the time of processing the application.



3 Guidelines for Environmentally Sound Dismantling of E-waste

This section provides guidance on setting up of a dismantling facility.

3.1 Guidelines for Dismantler

Any person or organisation or registered society or a designated agency or a company or an association can engage in dismantling of e-waste into their components by obtaining authorisation from the respective SPCBs/PCCs. Dismantlers may set up their collection centre, details of which shall be entered in their authorisation. These collection centres shall not require separate authorisation. The following conditions should also be met:

i. A dismantler shall be connected to either producers or PRO or e-waste exchange or take-back system or authorised recycler.

ii. A dismantler has to obtain consent to establish from SPCBs/PCCs under the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981. [Guidelines to apply for consent]

iii. A dismantler has to obtain consent to operate from SPCBs/PCCs under the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981. [Guidelines to apply for consent]

iv. A dismantler has to obtain authorisation from SPCBs/PCCs under E Waste (Management) Rules, 2016, provided that any person authorised/registered under the provisions of the Hazardous Wastes (Management, Handling and Transboundary Movements) Rules, 2008, and the E-waste (Management & Handling) Rules, 2011 prior to the date of coming into force of these rules shall not be required to make an application for authorisation till the period of expiry of such authorisation/registration.

v. A dismantler should have a weighing bridge and other appropriate weighing equipment for weighing each delivery received by it and maintain a record in this regard.

vi. The unloading of e-waste/end of life products should be carried out in such a way that there should not be any damage to health, environment and to the product itself. Unloading of Cathode Ray Tubes (CRT), Liquid Crystal Display (LCD)/Light Emitting Diode (LED)/Plasma TV, refrigerator, air conditioners and fluorescent and other mercury containing lamps should be carried out under supervision in such a way to avoid breakage.

vii. A dismantler should have facilities for destroying or permanently deleting data stored in the memory of end-of-life products (hard disk, telephones, mobile phones) either through hammering or through data eraser.

3.2 Guidelines for Dismantling Process

Dismantling operation is essentially manual operation for segregating various components/ parts and sending them to respective users/recyclers. Directly usable components can be sent only to an authorised refurbisher. The other parts can be sent to recyclers having valid CTO/authorised e-waste recyclers depending upon the nature of the e-waste component. For example, steel or aluminium component which contains no hazardous constituents can be sent to respective recyclers. Other parts which may contain hazardous constituents have to be sent to authorised e-waste recyclers.

i. Dismantlers may perform the following operations

   a. De-dusting

   b. Manual dismantling

Step 1

- Remove the CU casing to get access to the internal components by unscrewing all screws. Use an automatic screw driver where applicable to save time.
- Put the cover aside.

Step 2

- Now remove the screws holding the internal components to be able to remove them all.
- Unplug all the cables and wires by pulling them straight out or releasing them by applying pressure to the clip in case they have a locking clip.

Step 3

- Once all wires and cables have been disconnected the drives (floppy drive, CD drive and hard disk drive, etc.) can be removed. Also remove the power supply.

Step 4

- To remove the motherboard, it is necessary to remove all other components first from the computer case. Along with the motherboard all other PWBs can be removed.
- The number of mounting screws attaching the motherboard to the case will vary from 3-10 depending upon design. Some will be held in place with plastic clips rather than screws. For removal of plastic clips, simply pry them off with a screwdriver.
- The motherboard contains some components that can be removed such as RAM, Cmos battery, NIC (network interface card) and the CPU (central processing unit).
- Put any batteries in a separate box for adequate disposal!

Step 5

- After removing the motherboard, the casing should be completely blank.

Step 6

- Separate the remaining materials according to their type (e.g. aluminium, ferrous metals, plastic, further PWBs, etc.).
- Make sure the plastic parts are completely free of metal pieces.
- For information about storage and handling refer to chapter 3 (Output Fractions).

Example: Manual Dismantling Process of a CPU

ii. Dismantling operation shall comprise of physical separation and segregation after opening the electrical and electronic equipment into the component by manual operations.

iii. Dismantler may use screwdrivers, wrenches, pliers, wire cutters, tongs and hammers etc. for dismantling. The dismantled components should be sent to authorised e-waste or recyclers having valid consent to operate (CTO).

Manual dismantling operations should be carried out over the dismantling table with space de-dusting system so as to maintain desirable work zone air quality as per the Factories Act as amended from time to time. The de dusting system should consist of suction hood over dismantling table connected with a cyclone, bag filter and venting through a chimney of three-meter height above roof level.

iv. Collection boxes should be placed near dismantling table for keeping the dismantled components.

v. The workers involved in dismantling operation should have appropriate equipment such as screwdrivers, wrenches, pliers, wire cutters, tongs and hammers etc. for dismantling the e-waste.

Robust Gloves

Protective Goggles

Safety Helmet

Protective Shoes

vi. During dismantling operations, the workers should use proper personal protective equipment such as goggles, masks, gloves, helmet and gumboot etc.

vii. The following dismantled items and components must be removed from end-of-life products and stored in a safe manner for transportation to recyclers:

   a. Batteries

   b. Printed Circuit Boards (PCBs) of EEE

   c. Toner cartridge plastic

   d. External electrical cables

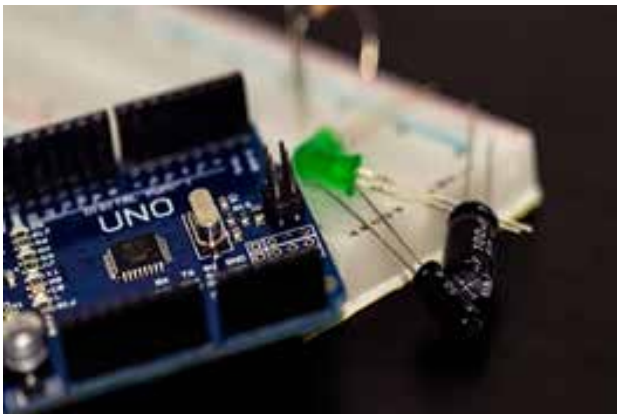
   Volume/size reduction may be carried out after dismantling operations of the components like steel/aluminium/plastic, for ease of transportation. Dismantled and segregated plastic from e-waste shall only be given to registered plastic recyclers having registration under Plastic Waste (Management) Rules, 2016.

viii. During the volume/size reduction of dismantled steel/aluminium/plastic parts, the dismantlers should have arrangements for dust and noise controls. These operations should be under acoustic enclosure for noise reduction.

ix. Dismantlers shall not carry out shredding/ crushing/fine grinding/wet grinding/enrichment operations and gravity/magnetic/density/eddy current separation of printing circuit board or the components attached with the circuit board.

x. Dismantlers shall not be permitted for dismantling of fluorescent and other mercury containing lamps, CRT/LCD/Plasma TV.

Circuit Board



Capacitors

Batteries

Image Source: Unsplash

xi. Dismantlers shall not be permitted for chemical leaching or heating process or melting the material.

xii. In case of dismantling refrigerators and air conditioners, only skilled manpower having required tools and personal protective equipment (PPEs) must be deployed to manually separate compressors. Prior to dismantling the compressors, adequate facilities should be provided for collection of coolant/refrigerant gases and compressor oil.

xiii. Dismantled circuit boards, capacitors, batteries, capacitors containing PCBs (Polychlorinated biphenyls) or PCTs (Polychlorinated terphenyls) etc. shall not be stored in open.

xiv. Dismantlers should have adequate facilities for managing leakage of compressor oils, coolant/ refrigerant gases such as Chlorofluorocarbons (CFCs)/Hydrofluorocarbons (HCFCs) and Mercury from end of life fluorescent and other mercury containing lamp etc. Spills involving broken fluorescent lamps, oil spills should first be contained to prevent the spread of the material to other areas. This may involve the use of dry sand, proprietary booms/absorbent pads, stabilising chemicals etc. for subsequent transfer to hazardous waste Treatment, Storage & Disposal Facilities (TSDFs).

xv. The premise for dismantling operation should fulfil the following requirements:

a. Water proof roofing and impermeable surfaces.

b. Storage space for dissembled spare parts.

c. Separate containers for storage of batteries, capacitors containing PCBs (Polychlorinated biphenyls) or PCTs (Polychlorinated terphenyls)

3.3 Requirements for Dismantling Facility

This section gives an overview of requirements for settling up a dismantling facility.

3.3.1 Project Planning and Consent to Establish Application

E-waste dismantling facility is any organisation engaged in dismantling of e-waste into its components by obtaining authorisation from the respective SPCBs/PCCs. A dismantler needs space for storage of electrical and electronic equipment up to 180 days, for the process of dismantling and volume reduction and space for storage of dismantled and segregated material and free space for movement and office/administration and other utilities. It is estimated that a minimum of 300 square meter area for a dismantling capacity of 1T/day is required for storage of raw material, segregated material, dismantling operations and office/administration & other utilities.

3.3.2 Environmental Clearance & Authorisation to be Obtained

- A covering requisition letter mentioning the status of the industry and activities clearly.
- Copy of attested sale deed/lease deed or any other relevant documents as proof to ensure possession of the site/factory for which application is made by the applicant.
- Copy of attested Memorandum of Articles in case of public/private sectors or registered partnership deed in case of partnership company.
- Layout plan showing the location of various process equipments, utilities like boiler, generator etc. effluent treatment plant, outlet location, nonhazardous and hazardous waste storage yard.
- Schematic diagram showing the distance of water bodies, roads, existing/proposed residential areas, agricultural lands, important religious locations, educational institutions, ancient monuments, archaeological places and other sensitive areas for 2 kms. radius from the units.
- Detailed manufacturing process for each product along with detailed process flow chart.
- Details of water balance and wastewater balance for process.
- Details of material balance for each product and process.

- Land use classification certificate as obtained from the competent authority of the Uttar Pradesh.
- Auditor's Certificate with break up details for the proposed gross fixed assets duly certified by a Chartered Accountant along with the financial provisions for pollution control measures.
- Consent fee under Water and Air Acts payable to the Board.
- Ground water clearance obtained from the competent authority (If applicable).
- Sewage Treatment Plant (STP) proposal which must contain details of design characteristics of sewage, treatment methodology, mode of disposal, design criteria for various units, detailed drawing of STP and its layout, diagram showing the hydraulic profile and mode of disposal of treated sewage and its adequacy (If applicable).
- Effluent Treatment Plant (ETP) proposal which must contain details including breakup quantity of water requirement with sources, breakup quantity of trade effluent, sources of trade effluent, characteristics of wastewater, treatment methodology, mode of disposal, design criteria for various units, detailed drawing of ETP and its layout, diagram showing the hydraulic profile and mode of disposal of treated effluent and its adequacy, complete details of land in case of on land disposal (If applicable).
- Air pollution control (APC) measures proposal which must contain the details regarding fuels used, sources of emission, characteristics, concentration and quality of pollutant, proposal along with design criteria and drawing for the proposed APC measures, adequacy of APC measures and stack, odour/noise causing operations and its specific odour/noise control measures (If applicable).
- In case of hazardous chemicals used as raw materials, the Material Safety Data Sheets (MSDS) should be enclosed for each and every item. If the quantity of the hazardous chemicals handled is more than the threshold limit, the unit shall furnish any one or combination of the following documents as required under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016, risk assessment report/onsite emergency preparedness plan/off site emergency preparedness plan. (If applicable).
- In case of transport of hazardous chemicals, details of chemicals transported, method of transport and its safety measures (If applicable).
- Industries attracting EIA Notification shall submit Environmental Clearance obtained from the MOEF/SEIAA along with the Environmental Impact Assessment Report (If applicable).
- Statutory clearances obtained from the competent authority regarding eco sensitive zones, forest Area or TTZ area etc. (If applicable).
- Proposal for installation of online monitoring system for effluent and or emissions as applicable.

3.3.3 Consent for Operation (CFO) / Consent to Operate (CTO) for Dismantling Facility

The Consent for Operation (CFO) / Consent to Operate (CTO) is obtained 45 days prior to commissioning of the unit. To apply for consent to operate application is submitted via Form I and Form XIII to the concerned Pollution Control Board alongside the below-listed documents:

3.3.4 CTO under Water and Air Act

- A covering requisition letter stating the status of the industry and activities clearly.
- Details of production capacity, actual products manufactured in month wise during the last two financial years.
- Details of changes if any in the quantity of sewage/trade effluent generated and mode of disposal of the same indicated against in the original consent order (If applicable).
- Details of changes if any in the quantity of emission and number and height of chimney/ stacks indicated against in the original consent order (If applicable).
- Details of changes if any in the name or in the management/Board of Directors of the company (If applicable).
- Latest analysis report of the treated sewage/trade effluent samples (If Applicable).

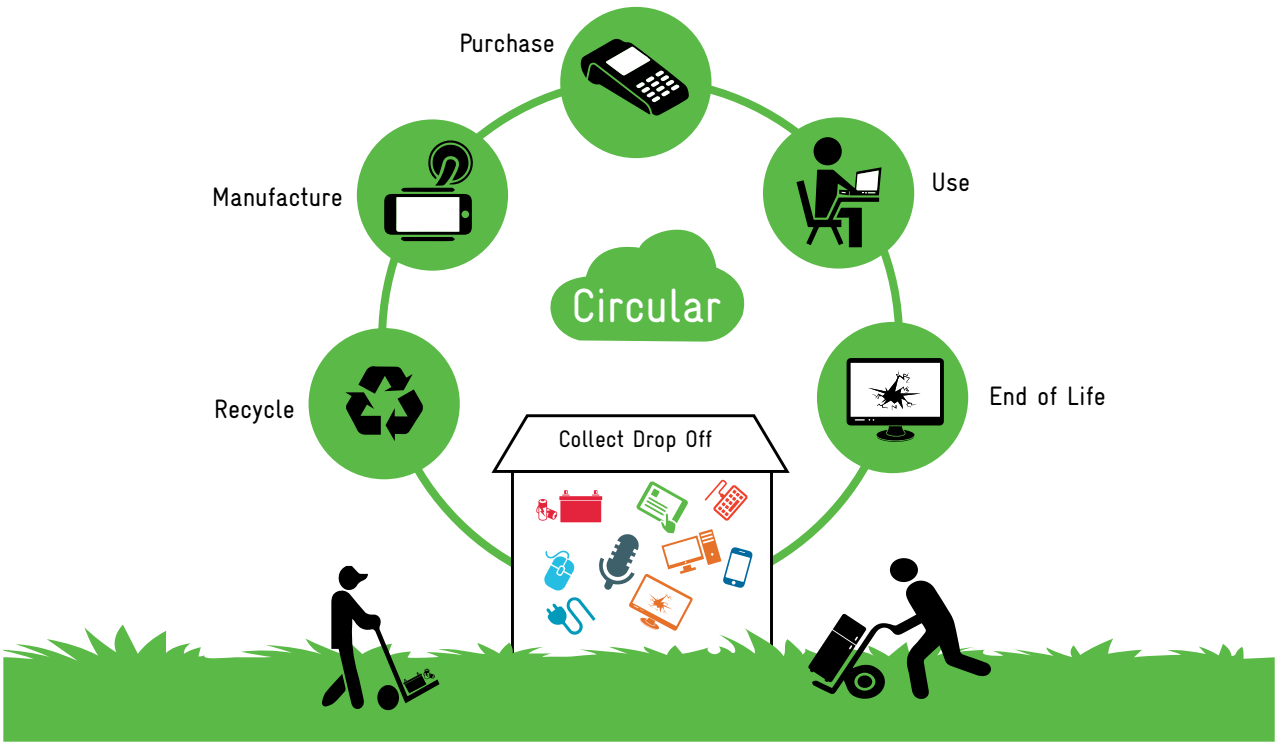
- Latest analysis report of the stack monitoring, AAQ and noise level (As applicable).
- Compliance report on the conditions of latest Hazardous Waste Authorisation/Biomedical Waste Authorisation issued to the unit (If applicable).
- Compliance report on the latest consent/renewal of consent order conditions stipulated under Water & Air Acts issued to the unit.
- The latest audited balance sheet/auditor's certificate shows the fixed assets, current assets and current liabilities.
- Details and mode of payment of consent fee under Water and Air Act.
- Status of water cess payment along with the details of last bill (If applicable).
- Details of online monitoring system installed for effluent and or emissions as applicable.
- Complete details of systems adopted for ZLD and details of land in case of on land disposal along with the photographs (If applicable)
- Environmental Statement affidavit on Rs.100 stamp paper.
- Prescribed consent fee in the form of DD

3.3.5 E-waste Authorisation

E-waste has been included as a waste category in the Hazardous Wastes (Management and Handling) Rules amendments 2008. Provisions have been made for the registration of all e-waste recyclers with the Central Pollution Control Board (CPCB) in Chapter III, Rules 8-10. E-waste category has been listed in Schedule IV of these rules under the categories of hazardous recyclable wastes. According to these rules all those engaged in recycling of e-waste to go through the cumbersome procedure of registration including those involved in dismantling activity. The application for registration should be made in Form 5 placed at Appendix IV

3.4 Space Requirement for Dismantling Facility

A dismantler needs space for storage of electrical and electronic equipment up to 180 days for the process of dismantling and volume reduction, space for storage of dismantled and segregated material, free space for movement, office/administration and other utilities. It is estimated that a minimum of 300 square meter area for a dismantling capacity of 1T/ day is required for storage of raw material, segregated material, dismantling operations and office/ administration & other utilities.



4 Guidelines for Environmentally Sound Recycling of E-waste

This section provides the details of guidelines for recyclers and for setting up an e-waste recycling facility.

4.1 Guidelines for Recycler

i. As per the e-waste management and handling rules 2016 any person who is engaged in recycling and reprocessing of electrical and electronic equipment waste or assemblies or their component is a recycler. Recyclers may set up their collection centres, details of which shall be entered in their authorisation. These collection centres shall not require separate authorisation. Recyclers can obtain raw material such as electrical and electronic waste, assemblies or components or used components from producers/PRO/e-waste exchange/dismantlers and consumers/bulk consumers.

ii. The product of recyclers has to be sent or sold to users or other recyclers having valid CTO from SPCBs/PCCs. Any hazardous waste generated during the recycling processing will be sent to Treatment Storage and Disposal Facility (TSDF).

iii. A recycler should be part of producer's channelisation system.

iv. A recycler has to obtain consent to establish from SPCBs/PCCs under the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981

v. A recycler has to obtain consent to operate from SPCBs/PCCs under the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981

vi. A recycler has to obtain authorisation from SPCBs/PCCs under E Waste (Management) Rules, 2016, provided that any person authorised/registered under the provisions of the Hazardous Wastes (Management, Handling and Transboundary Movements) Rules, 2008, and the E-waste (Management & Handling) Rules, 2011 prior to the date of coming into force of these rules shall not be required to make an application for authorisation till the period of expiry of such authorisation/registration.

vii. A recycler should have a weighing bridge and other appropriate weighing equipment for weighing each delivery received by it and maintain a record in this regard.

viii. The unloading of end-of-life product should be carried out in such a way that there should not be any damage to health, environment and to the product itself. Unloading of Cathode Ray Tubes (CRT), LCD/LED/Plasma TV, refrigerator, air conditioners and fluorescent and other mercury containing lamps should be carried out under supervision in such a way to avoid breakage.

ix. A recycler should have facilities for destroying or permanently deleting data stored in the memory of end of life products (hard disk, telephones, mobile phones) either through shredding or grinding or through data eraser.

4.2 Guidelines for Recycling Process

The functions of the recyclers include dismantling along with recovery operation. There shall be no restriction on degree of operations that can be permitted for recyclers provided they have requisite facilities. The following processes should be employed by recyclers:

a. **Manual/semi-automatic/automatic dismantling operations:** Manual dismantling is the pre-treatment technique that ensures best proper depollution of equipment and leads to the highest recovery rates in the subsequent recycling and recovery steps.

b. **Shredding/crushing/fine grinding/wet grinding/enrichment operations, gravity/ magnetic/density/eddy current separation:** The purpose of crushing and grinding is to reduce the size of the potential ore particles. Eddy current separation technique is used for separating metals from nonmetal component; for example, aluminum from glass.

c. **Pyro metallurgical operations:** Smelting furnace: Smelting is a method of obtaining refined goods from raw materials by heating in a furnace, blast furnace, or smoker.

d. **Hydro metallurgical operations:** Hydrometallurgy is the extraction of metal from ore by preparing an aqueous solution of a salt of the metal and recovering the metal from the solution.

e. **Electro-metallurgical operations:** Electrometallurgy involves metallurgical processes that take place in some form of electrolytic cell. Extractive metallurgy: The practice of removing valuable metals from an ore and refining the extracted raw metals into a purer form.

f. **Chemical leaching:** Leaching is the process of a solute becoming detached or extracted from its carrier substance by way of a solvent. Leaching is a naturally occurring process which scientists have adapted for a variety of applications with a variety of methods.

g. **CRT/LCD/Plasma processing:** Plasma processing is a plasma-based material processing technology that aims at modifying the chemical and physical properties of a surface.

h. **Toner cartridge recycling:** Cartridge Recycling Toner recycling is the latest raw material to make its way into the recycling chain. From paper to rubber, to tin — the practice of recycling materials back into their raw state originated hundreds of years, prior to The Revolutionary War.

i. **Melting, casting, moulding operations (for metals and plastics):** Melt is poured or forced under pressure into a mould made of sand or metal, and then solidified there by cooling. Casting is a process in which a liquid metal is somehow delivered into a mold (it is usually delivered by a crucible) that contains a hollow shape (i.e., a 3-dimensional negative image) of the intended shape.

i. A recycling facility may accept e-waste and even those electrical and electronic assemblies or components not listed in Schedule- I for recycling, provided that they do not contain any

Manual tools for dismantling
Image Source: Pixabay

Waste Shredder
Image Source: Indiamart

Smelting Furnace
Image Source: Picryl

Toner Cartridge Recycling
Image Source: Flickr

Melting and Moulding Operations
Image Source: Flickr

radioactive materials and same shall be declared while taking the authorisation from concerned SPCBs/PCCs;

Carbon Filters

Image Source: Wikimedia

ii. The recycling facilities shall comply with the requirements as specified for dismantlers in the guidelines for dismantling in section 6.0.

iii. A recycling facility shall install adequate wastewater treatment facilities for treating the waste water generated and air pollution control equipment (off gas treatment, wet/alkaline/packed bed scrubber and carbon filters) depending on types of operations undertaken.

iv. De dusting equipment such as a suction hood shall be installed where manual dismantling is carried out.

v. Fume hoods connected with bag dust collectors followed by wet (chemical) scrubbers and carbon filters shall be installed for control of fugitive emissions from furnaces or reactors.

vi. Noise control arrangement for equipment like crusher, grinder and shredder needs to be provided.

vii. The discharges from the facility shall comply with general standards under E (P) Act, 1986 for discharge of wastewater. Discharge standard are mentioned in Annexure IV.

viii. In case of air emissions, the unit shall comply with emission norms prescribed under Air (Prevention and Control of Pollution) Act, 1981. In case of furnace, a minimum stack height of 30 meter shall be installed depending on emission rate of SO2. Emission standards are mentioned in Annexure V.

ix. The workers involved in recycling operations shall use proper personal protective equipment such as goggles, masks, gloves, helmet and gumboot etc.

x. Adequate facilities for onsite collection and storage of bag filter residues, floor cleaning dust and other hazardous material shall be provided and sent to secure landfill by obtaining membership of Treatment, Storage and Disposal Facility (TSDF)

xi. The CRT/LCD/Plasma TV should be processed only at a recycler's facility.

xii. For recycling of CRT monitor and TVs care should be taken to contain release of harmful substances. The steps for processing of CRT are as below:

1. CRT monitors and TVs should be manually removed from plastic/wooden casing. The CRT should be split into funnel and panel glass using different splitting technology such as Ni-Chrome hot wire cutting, Diamond wire method or Diamond saw separation in a closed chamber under low vacuum conditions (650 mm of Hg).

2. The funnel section is then lifted off from the panel glass section and the internal metal gasket is removed for facilitating the removal of internal phosphor coating.

3. The internal phosphor coating from the inner side of panel glass is removed by using an abrasive wire brush with suction arrangement under low pressure as given above at (i). The extracted air is cleaned through a high efficiency bag-filter system and collected in appropriately labelled containers and then disposed at an authorised TSDF.

4. Manual shredding, cutting, and segregation operations for CRTs should be carried out in low vacuum (650 mm of Hg) chambers where the dust is extracted through cyclones, bag filters, Induced Draft fan and a suitable chimney.

5. Segregated CRTs can also be shredded in mechanical/automatic shredding machines connected with dust control systems. The mixed shredded glass is separated into leaded glass and glass cullet using electro-magnetic field or by density separation.

6. For LCD and Plasma TV a recycler should have sealed vacuum dismantling platform for dismantling of LCD/Plasma panels. The LCD/Plasma TV should be dismantled piece by piece, starting with the removal of the plastic backing shell, printed circuit boards, aluminium or steel frame, screen, PET plastics, LCD Panel and backlight. The metal frame, wire, other metallic material and plastic backing cabinet may be sent to recyclers with valid CTO. Printed Circuit Board and LCD panel may be recycled or in case of recycling facility is not available then sent to respective authorised recycling facility.

7. The user of the products obtained in the recycler facility should be identified and an agreement may be entered with them for selling of the products obtained in these recycling facilities. This is for tracking the product of recycling, to ascertain where the products are going.

xiii. Recovery of resource and particularly of precious metals present in the e-waste should be given importance.

xiv. For fluorescent and other mercury containing lamp recycling, the unit shall have at least the following systems:

a. Mechanical feeding system.

b. Mercury spill collection system.

c. Lamp Crushing System, under vacuum, for separation of mercury-contaminated phosphor powder & mercury vapour from other crushed components, so as not to cause release of any pollutant, including mercury vapor.

d. System for segregation of mercury vapour from the phosphor powder through a distillation system for separation & recovery of mercury.

e. Air pollution control system (APCS) which shall include HEPA (High Efficiency Particulate Arrestor) filter system or activated carbon filter system or any other equivalent efficient system for separation/ removal of mercury vapor from mercury-contaminated phosphor powder'

f. Arrangement for disposal of mercury contaminated filter pads to TSDF.

g. On line mercury monitoring system, to have check on emission of mercury, which has to be in compliance to the consented norms.

xv. The fluorescent and other mercury containing lamp recycling unit shall have following obligations:

a. The emission outlet shall comply with the norms for mercury prescribed in the consent document. The norm for mercury emission is 0.2 mg/m^3 (Normal) as prescribed under E (P) Act, 1986 for mercury emission from other category of industries.

b. For discharge of effluent the limit for mercury as (Hg) should be less than equal to 0.01mg/ litre as prescribed under E (P) Act, 1986.

c. The unit shall have trained/skilled manpower to handle hazardous substances such as mercury mixed phosphor in respect of treatment/recycling.

d. The unit shall dispose of all the unrecoverable wastes from the treatment site to a TSDF

e. The unit shall maintain record of used fluorescent and other mercury containing lamps collected & recycled, recovery of mercury and other components. It shall, also, maintain the records pertaining to the generation, storage, transport and disposal of the wastes generated in the process.

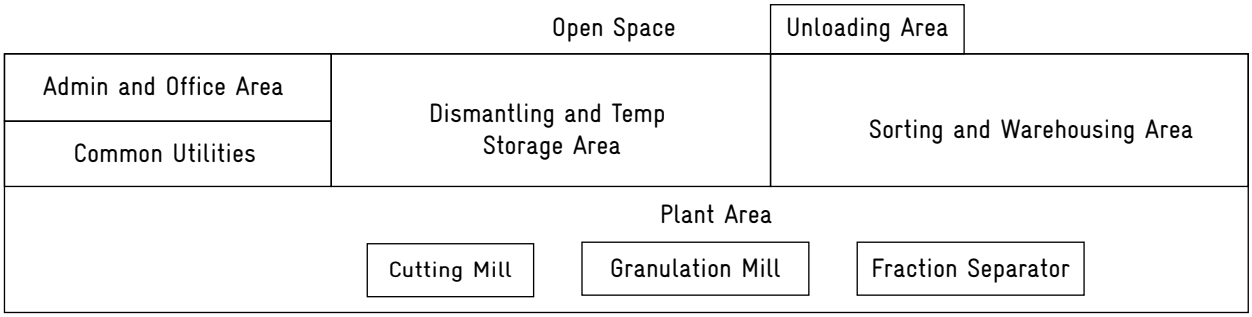
f. The unit shall take up ambient air quality monitoring, particularly, in reference to mercury levels with a frequency of once in a month through a recognised laboratory, for third party verification.

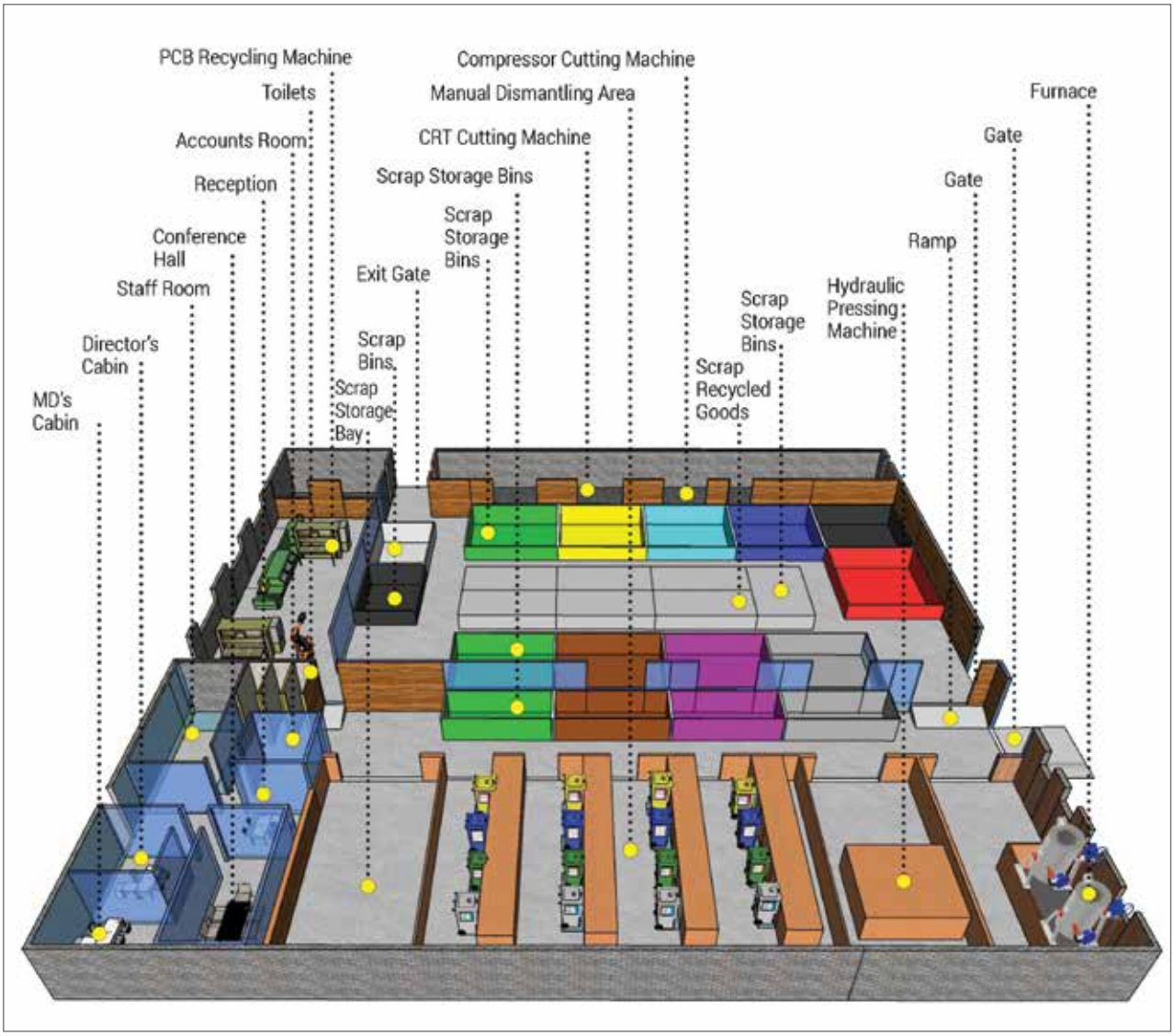
4.3 Space Requirement for Recycling Facility

As a general rule a recycler of capacity of 1 T/day shall require a minimum of 500 square meters area. Authorisation to recyclers may be preferred if they have minimum operational capacity of 5 MT/day with an area of about 2500 square meter.

4.4 List of Machinery Required to Establish Dismantling Unit

Ideal Floorplan for E-waste Facility





5 Requirements for Recycling Facility

This section provides the details of the requirements for a recycling facility.

5.1 Project Planning and CTE Application

As per these rules, any person who is engaged in recycling and reprocessing of waste electrical and electronic equipment or assemblies or their component is a recycler. A recycler needs space for storage of electrical and electronic equipment up to 180 days, for the process of recycling and space for storage of dismantled and segregated material and free space for movement and office/administration and other utilities. It is estimated that a minimum of 500 square meter area for a dismantling capacity of 1T/ day is required for storage of raw material, segregated material, dismantling & recycling operations and office/administration & other utilities.

5.2 Environmental Clearance & Authorisation to be Obtained

1. A covering requisition letter stating the status of the industry and activities clearly.
2. Copy of attested sale deed/lease deed or any other relevant documents as proof to ensure possession of the site/factory for which application is made by the applicant.
3. Copy of attested Memorandum of Articles in case of public/private sectors or registered partnership deed in case of partnership company.
4. Layout plan showing the location of various process equipments, utilities like boiler, generator etc, effluent treatment plant, outlet location, nonhazardous and hazardous waste storage yard.
5. Schematic diagram showing the distance of water bodies, roads, existing/proposed residential areas, agricultural lands, important religious locations, educational institutions, ancient monuments, archaeological places and other sensitive areas for 2 KM. radius from the units.
6. Detailed manufacturing process for each product along with detailed process flow chart.
7. Details of water balance and wastewater balance for process.
8. Details of material balance for each product and process.
9. Land use classification certificate as obtained from the competent authority of Uttar Pradesh.
10. Auditor's Certificate with break up details for the proposed gross fixed assets duly certified by a Chartered Accountant along with the financial provisions for pollution control measures.
11. Consent fee under Water and Air Acts payable to the board.
12. Groundwater clearance obtained from the competent authority (If applicable).
13. Sewage Treatment Plant (STP) proposal which must contain details of design characteristics of sewage, treatment methodology, mode of disposal, design criteria for various units, detailed drawing of STP and its layout, diagram showing the hydraulic profile and mode of disposal of treated sewage and its adequacy (If applicable).
14. Effluent Treatment Plant (ETP) proposal which must contain details including breakup quantity of water requirement with sources, breakup quantity of trade effluent, sources of trade effluent, characteristics of wastewater, treatment methodology, mode of disposal, design criteria for various units, detailed drawing of ETP and its layout, diagram showing the hydraulic profile and mode of disposal of treated effluent and its adequacy, complete details of land in case of on land disposal (If applicable).

15. Air pollution Control (APC) measures proposal which must contain the details regarding fuels used, sources of emission, characteristics, concentration and quality of pollutant, proposal along with design criteria and drawing for the proposed APC measures, adequacy of APC measures and stack, odour/noise causing operations and its specific odour/noise control measures (If applicable).
16. In case of hazardous chemicals used as raw materials, the Material Safety Data Sheets (MSDS) should be enclosed for each and every item. If the quantity of the hazardous chemicals handled is more than the threshold limit, the unit shall furnish any one or combination of the following documents as required under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules 2016, risk assessment report/ onsite emergency preparedness plan/off site emergency preparedness plan. (If applicable).
17. In case of transport of hazardous chemicals, details of chemicals transported, method of transport and its safety measures (If applicable).
18. Industries attracting EIA Notification shall submit Environmental Clearance obtained from the MOEF/SEIAA along with the Environmental Impact Assessment Report (If applicable).
19. Statutory clearances obtained from the competent authority regarding eco-sensitive zones, forest Area or TTZ area etc. (If applicable).
20. Proposal for installation of online monitoring system for effluent and/or emissions as applicable.

5.2.1 Consent for Operation (CFO) / Consent to Operate (CTO) for Recycling Facility

The Consent for Operation (CFO) / Consent to Operate (CTO) is obtained 45 days prior to commissioning of the unit. To apply for consent to operate application is submitted via Form I and Form XIII to the concerned Pollution Control Board alongside the below-listed documents:

1. Form I and Form XIII. (Appendix I)
2. Audited balance sheet.
3. Environmental Statement affidavit on Rs.100 stamp paper.
4. Prescribed consent fee in the form of DD

5.2.2 CTO under Water and Air Act

1. A covering requisition letter stating the status of the industry and activities clearly.
2. Details of production capacity, actual products manufactured month wise during the last two financial years.
3. Details of changes if any in the quantity of sewage/ trade effluent generated and mode of disposal of the same indicated against in the original consent order (If applicable).
4. Details of changes if any in the quantity of emission and number and height of chimney/ stacks indicated against in the original consent order (If applicable).
5. Details of changes if any in the name or in the management/Board of Directors of the company (If applicable).
6. Latest analysis report of the treated sewage/trade effluent samples (If Applicable).
7. Latest analysis report of the stack monitoring, AAQ and noise level (As applicable).
8. Compliance report on the conditions of latest Hazardous Waste Authorisation/Biomedical Waste Authorisation issued to the unit (If applicable).
9. Compliance report on the latest consent/renewal of consent order conditions stipulated under Water & Air Acts issued to the unit.
10. The latest audited balance sheet/auditor's certificate showing the fixed assets, current assets and current liabilities.
11. Details and mode of payment of consent fee under Water and Air Act.
12. Status of water cess payment along with the details of last bill (If applicable).

13. Details of online monitoring system installed for effluent and or emissions as applicable.
14. Complete details of systems adopted for ZLD and details of land in case of on land disposal along with the photographs (If applicable)
15. Environmental Statement affidavit on Rs.100 stamp paper.
16. Prescribed consent fee in the form of DD

5.3 E-waste Authorisation

E-waste has been included as a waste category in the Hazardous Wastes (Management and Handling) Rules amendments 2008. Provisions have been made for the registration of all e-waste recyclers with the Central Pollution Control Board (CPCB) in Chapter III, Rules 8-10. E-waste category has been listed in Schedule IV of these rules under the categories of hazardous recyclable wastes. According to these rules all those engaged in recycling of e-waste to go through the cumbersome procedure of registration including those involved in dismantling activity. The application for registration should be made in Form 5 placed at Appendix IV

5.4 Transboundary Movement of E-waste

Any transboundary movement (import and export) of e-waste shall be in accordance with the procedures given in Chapter IV of the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules 2008 and the requirements under the Basel Convention on the Control of Transboundary Movement of Hazardous Waste. As e-waste has been classified as hazardous wastes under the hazardous wastes rules as also under the Basel Convention since it is known to contain various hazardous constituents, such as cadmium, lead, mercury, brominated flame retardants and polychlorinated biphenyls etc. The waste electrical and electronic assemblies or scraps have been included in Schedule III, Part A of these rules. That e-waste containing the hazardous constituents to an extent that they exhibit hazard characteristics indicated in Schedule III, Part B of these rules are included in List A (A 1180), which is similar to Annex VIII of the Basel Convention, thus requiring a prior informed consent (PIC) in writing from the importing country. The e-waste not containing or contaminated with the hazardous constituents are placed in B 1110, which is similar to Annex IX of the Basel Convention that would not attract PIC unless the national law requires. In India, the transboundary movement of all e-waste requires PIC. The application for seeking permission for export/import of e-waste is to be submitted in Forms 7 & 8 along with a full cover insurance policy to the Central Government, Ministry of Environment & Forests. All shipments should be accompanied by form 9 provided in these rules.

5.5 Authorisation for Handling Hazardous Wastes for Recycling Facility

Hazardous Waste authorisation means permission for generation, handling, collection, reception, treatment, transport, storage, reuse, recycling, recovery, pre-processing, utilisation including co-processing and disposal of hazardous wastes. Every occupier of the facility who is engaged in handling, generation, collection, storage, packaging, transportation, use, treatment, processing, recycling, recovery, pre-processing, co-processing, utilisation, offering for sale, transfer or disposal of the hazardous and other wastes shall be required to make an application to the State Pollution Control Board and obtain an authorisation from the State Pollution Control Board The application for authorisation contains details regarding quantity and category of hazardous waste generated, collected, received, storage, transported, treated, processed and disposed.

E-waste has been included as a waste category in the Hazardous Wastes (Management and Handling) Rules amendments 2008, as e-waste contains hazardous constituents. Moreover, the processing of e-waste involves hazardous operations. Under these rules, all those who handle e-waste are required to seek authorisation by submitting the application form (Form-I) given in Appendix III.

6 References

1. Guidelines for environmentally Sound Management of e-waste, published by Ministry of Environment & Forests and Central Pollution Control Board, March 2008.
2. National Environment Policy, Government of India, Ministry of Environment & Forests, 1986.
3. The Water (Prevention and Control of Pollution) Act, 1974 and the rules framed thereunder.
4. The Air (Prevention and Control of Pollution) Act, 1981 and the rules framed thereunder.
5. The Environment (Protection) Act, 1986.
6. The Hazardous Wastes (Management and Handling) Rules, 1989 as amended in 2008.
7. Raveendra, G.V. and Dev Kishore Aradhya, Steps towards Authorisation for Recyclers.
8. www.envfor.nic.in
9. www.cpcb.nic.in
10. www.mpcb.gov.in
11. www.appcb.ap.nic.in
12. wwpw.kspcb.kar.nic.in
13. Section 6.0 Guidelines for dismantler
14. The Global Competitiveness Report SPECIAL EDITION 2020- How Countries are Performing on the Road to Recovery: World Economic Forum 2020

    Retrieved from: http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2020.pdf
15. UN Report: Time to Seize Opportunity, Tackle Challenges of e-waste

    Retrieved from: https://www.unep.org/news-and-stories/press-release/un-report-time-seize-opportunity-tackle-challenge-e-waste

Notes

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