Affiliated to Tribhuvan University

Koteshwor MULTIPLE CAMPUS

Accredited by University Grants Commission (UGC) Nepal, 2023

Jadibuti, Kathmandu

Standard Operating Procedure (SOP)

on

E- waste Management for HEIs

2024

Table of Contents

Acronyms and Abbreviation

CPU	Central Processing Unit
DLIs	Disbursement Linked Indicators
EHS	Environmental Health and Safety
EPA	Environment Protection Act
EPR	Environment Protection Regulations
ESCP	Environmental and Social Commitment Plan
HEIs	Higher Education Institutions
HWM	Hazardous Waste Management
ICT	Information and Communication Technology
IPF	Interplanetary File System
NEHEP	Nurturing Excellence in Higher Education Program
NHEP	National Higher Education Program
OHS	Occupational Health Safety
PCBs	Polychlorinated Bi-Phenyls
PPE	Personal Protective Equipment
PPP	Polluter Pays Principle
RBF	Results-Based Financing
SOP	Standard Operating Procedure
SWM	Solid Waste Management
WEEE	Waste Electrical and Electronic Equipment

1. Background

The Nurturing Excellence in Higher Education initiative operates as a hybrid Program for Results (PforR) with an Investment Project Financing (IPF) component. The PforR approach strategically supports specific aspects of the government's National Higher Education Program (NHEP) for the period 2021/22 to 2025/26. This support is facilitated through Results-Based Financing (RBF) and technical assistance. The Disbursement Linked Indicators (DLIs) are designed to incentivize the achievement of prioritized reforms.

This Standard Operating Procedure (SOP) for electronic waste (E-waste) management plays a crucial role in implementing and monitoring an Environmental and Social Commitment Plan (ESCP) for Higher Education Institutions (HEIs) in Nepal. The primary aim is to enhance the institutions' capabilities in this regard. The ESCP constitutes a significant segment of the Nurturing Excellence in Higher Education Project (NEHEP), a collaboration between the University Grants Commission and the World Bank.

The core objectives of NEHEP include enhancing the relevance and quality of higher education to align with labor market needs, fostering collaborative research and innovation, ensuring equitable access for marginalized and disaster-affected groups and digitalization of the higher education institutions. It strategically supports the National Higher Education Program of the Government of Nepal across four key result areas: (1) Improving employability, entrepreneurship, and collaborative research, (2) Strengthening the governance and financial aspects of higher education, (3) Expanding access to quality higher education, and (4) Advancing the digitalization of higher education.

2. Definition of Terms

- Electronic waste (E-waste): Discarded electronic devices, equipment, and components that have reached the end of their useful life. E-waste includes items such as computers, mobile phones, televisions, printers, batteries and other electronic gadgets, WEEE.
- Electronic Waste Management: The organized handling, collection, transportation, recycling, disposal, and other processes involved in managing electronic waste generated within the higher education institution.
- Environmental Impact: The effects that improper E-waste management can have on the environment, including pollution, resource depletion, and health hazards, underscoring the importance of proper E-waste management practices.
- E-waste Audit: An assessment process conducted within the institution to determine the quantity, types, sources, and potential impacts of E-waste generated, facilitating effective management planning.
- E-waste Awareness: Educational initiatives and programs aimed at raising awareness among the institution's community about the significance of e-waste, its management, and the role individuals can play in reducing its impact.
- E-waste Disposal: The responsible and compliant methods of disposing of E-waste that cannot be effectively recycled, such as through authorized recycling facilities or waste management centers.
- E-waste Recycling: The process of recovering valuable materials from E-waste through techniques such as dismantling, extracting metals, and reusing components to reduce environmental impact and conserve resources.
- E-waste Regulations: The legal frameworks and guidelines established by governmental and environmental authorities that dictate how E-waste should be managed, recycled, and disposed of to minimize environmental harm.
- Higher Education Institution: An establishment offering post-secondary education, such as universities, colleges, research institutions, or other educational entities beyond the secondary level.
- Responsible Producer: Manufacturers and suppliers of electronic products who adhere to regulations, promote eco-friendly designs, and take responsibility for the proper end-of-life management of their products to minimize e-waste.
- Standard Operating Procedure (SOP): A documented set of instructions and guidelines that outline specific steps and processes to be followed for a particular task or operation. In this context, it refers to the systematic approach for managing electronic waste (E-waste) within a higher education institution.
- Waste Collection: The organized gathering of E-waste from various sources within the institution, which is a critical step in the E-waste management process.
- Waste Electrical and Electronic Equipment (WEEE): It refers to discarded or obsolete electronic and electrical devices that have reached the end of their useful life and are intended for disposal or recycling.
- Waste Handling: The systematic and safe procedures for the collection, sorting, and temporary storage of E-waste within the institution's premises.
- Waste Identification: The process of identifying and categorizing different types of waste, particularly E-waste, generated within the institution. This helps determine appropriate management methods for different E-waste materials.

3. Introduction

3.1 E-waste Identification

Proper management of E-waste is vital for protecting university, community, and environmental well-being (see Annex-I). However, ensuring responsible E-waste utilization and disposal is a challenging task for educational institutions due to the potential harm it poses. E-waste contains hazardous components, as seen in laptops, phones, and televisions, with metals and substances that can harm human health. Particularly concerning is the release of toxic chemicals when E-waste is buried.

E-waste is categorized based on its composition, including ferrous and nonferrous metals, glass, plastics, pollutants, and potentially harmful metallic elements. It holds toxic chemicals like lead, cadmium, mercury, and organic compounds such as flame retardants, chlorofluorocarbons, and various other harmful substances.

E-waste Types

Generally, E-waste is classified into 3 types, they are:

Type 1- Major appliances (refrigerators, washing machines, dryers ETC.)
Type 2 – Small appliances (vacuum cleaners, irons, blenders, fryers etc.)
Type 3 – Computer and telecommunication appliances (laptops, PCs, batteries, telephones, mobile phones etc.)

The European Parliament and Council's Directive 2002/96/EC Annex IA outlines ten categories of Waste Electrical and Electronic Equipment (WEEE).

Table: WEEE categories

No.	Category	Label
1	Large household appliances	Large HH
2	Small household appliances	Small HH
3	IT and telecommunications equipment	ICT
4	Consumer equipment	CE
5	Lighting equipment	Lighting
6	Electrical and electronic tools (with the exception of large-scale stationary industrial tools)	E & E tools
7	Toys, leisure and sports equipment	Toys
8	Medical devices (with the exception of all implanted and infected products)	Medical equipment
9	Monitoring and control instruments	M & C
10	Automatic dispensers	Dispensers

Source: EU WEEE Directives, 2002

Most of the studies on E-waste are concentrated on the first four categories, ICT i.e. Computer and its peripherals, CE i.e. television were used to represent WEEE.

3.2 Applicability

According to the Environment Protection Act (EPA) 2076, Environment Protection Regulations (EPR) 2077, and Solid Waste Management Act 2068 (2011), the management of electronic waste (E-waste) is the responsibility of the organization generating it. Therefore, higher education institution must manage properly all types of waste originating from their premises. HEIs are obligated to adhere to both federal and state regulations that govern the storage, collection, and disposal of regulated E-waste materials produced on their premises.

With this purpose, this Standard Operating Procedure (SOP) is formulated to guide and assist HEIs in effectively managing E-waste. However, the current scenario doesn't allow HEIs to comprehensively manage E-waste independently, as there is currently no officially designated body, institute, or organization responsible for E-waste collection, proper disposal, and management in Nepal. The establishment of such an entity is yet to materialize and be envisioned in the country. This SOP aims to contribute to the future development of such businesses or entrepreneurs in Nepal.

It is imperative that all E-waste generated by HEIs undergoes a thorough lifecycle management process following the principles of Solid Waste Management (SWM). This process includes stages such as generation, identification, segregation, proper handling, treatment, storage, and eventual disposal.

3.3 Principle of E-waste Management

This SOP aligns with the **Precautionary Principle** and the **Polluter Pays Principle (PPP)**. The Precautionary Principle entails taking proactive measures to mitigate potential harm to human health and the environment in the absence of scientific certainty. This is achieved by addressing potential risks associated with E-waste and prioritizing protective actions such as responsible handling, disposal, and recycling practices. On the other hand, the PPP asserts that all waste producers bear legal and financial responsibility for the safe handling and environmentally sound disposal of their waste. This accountability encourages waste producers to reduce production, practice effective segregation, and enhance institutional commitment to proper waste management. The SOP also incorporates the principles of waste minimization and the **3R** (**Reduce, Reuse, Recycle**) approach from SWM. It is intended to serve as a guideline outlining the minimum requirements for the proper handling, safe storage, and management of hazardous waste from HEIs.

3.4 Separation of E-waste

The separation of E-waste is a crucial process to manage and recycle the various components of discarded electronic devices. E-waste contains a mixture of valuable materials and hazardous substances, making proper separation and disposal essential for environmental protection and resource conservation (see Annex-II).

4. Purpose and Scope

4.1 Purpose

This procedure aims to establish effective E-waste management from activities conducted within the HEI premises by management, faculties, students, and laboratory assistants, ensuring responsible handling and disposal. The primary objective is to guarantee the appropriate management of E-waste generated in the HEI premises through the involvement of management, faculties, students, and laboratory assistants.

4.2 Scope

This procedure applies to all E-waste disposal activities within the education institute. This SOP covers E- wastes generated within the HEIs, that may include but not limited to the followings:

- Electronic devices used to monitor air quality, noise levels, surveillance cameras, motion sensors, batteries from solar power, computers and electronic access control systems used for security and monitoring on construction sites.
- Medical E-waste (diagnostic equipment's, patient monitoring systems, infusion pumps, defibrillators, and more).
- Toxic substances found in E-Waste. (see Annex-III)
- Industrial electronic waste (Industrial Robots and Automation Equipment)

E-waste can also encompass certain positive aspect, for example:

Ceramic and composite central processing units (CPUs) from computer circuit boards can be utilized for the extraction of gold through a comprehensive hydrometallurgical process, across six distinct stages: initial CPU grinding, nitric acid leaching, subsequent aqua-regia leaching, meticulous removal of residual nitric acid, proficient gold extraction, and subsequent gold deposit purification through rigorous washing procedures.

5. Institutional Arrangement

5.1 HEI Facility

HEI facility mentioned in this SOP includes any defined space of the HEI-s / University, including a room, IT lab, building, or controlled outdoor area.

- Any E-waste remaining in the facility must either be transferred to a facility where it can be used, or it must be disposed of as E-waste prior to the departure of the occupant. EHS staff can provide guidance regarding the proper disposal of any E-waste present.
- Safety factors that are to be taken in account. (see Annex-IV)
- EHS may conduct periodic, unannounced inspections of University facilities.

5.2 Contact Person

The Environmental Health and Safety (EHS) facility/unit manager of HEIs holds the crucial duty of supervising E-waste management and serves as the key person in charge of ensuring its proper handling. The Contact person is responsible for assuring that federal and state regulations on the use, storage, and disposal of E-waste.

6. Use, Storage and Disposal of E-waste

6.1 Process of E-waste Management

The process of E-waste management system is designed based on the process flow as illustrated in the flow chart, mentioned in Annex-V.

6.2 Storage and Disposal

For the storage and disposal of the E-waste following points are to be considered:

- Only use appropriate containers for the storage of E-waste materials.
- Properly label all E-waste containers. (see Annex-VI)
- Keep waste containers closed. Maintain a record book for the waste generated (type and quantity) at HEIs. (see Annex-VII)
- During the storage and disposal of E-waste, safety measures are to be taken. (see Annex-VIII)

7. Inspection and Monitoring

All the activities related with E-waste management within the HEI/ University premises by EHS facility/unit manager of HEIs should be;

- Periodically monitored as per requirement.
- Frequent audits and maintain precise records.

8. Capacity Buildings

HEIs/ University should conduct regular trainings/orientations regarding E-waste management to all including teaching and non-teaching staffs, students, and professional service providers.

9. Miscellaneous

Unaddressed matters within this SOP should be handled in accordance with the legal regulations of the country. The respective HEIs or university has the authority to establish supplementary guidelines as needed.

Annex-I: E-waste Management Practices in HEIs

Precautions and steps should be undertaken.

A. Electrical and Electronic Goods Purchasing plan:

All HEI should have electrical and electronic goods purchasing plan base upon Principle of Waste Minimization. The HEI is aimed to minimize the waste generation for the keeping the environment green and sustainable. To achieve the goal to minimize the volume of waste, the HEI urges all of the research labs to follow the practices mentioned below:

- Keep a record of electrical and Electronic goods (listing name, date of expiry, available quantity) in the HEIs/its institutions.
- Do source reduction by simply ordering the smallest quantity of electrical and electronic goods materials required for your research.
- Reduce the scale of laboratory experiments to reduce the volume of waste being produced whenever possible.
- Follow protocols which generates less amount of wastes and requires a smaller number of electrical and electronic goods (if possible).
- Substitute electrical and electronic goods with mechanical whenever possible
- Share surplus electrical and electronic goods with other labs.
- Avoid storing unused electrical and electronic goods in the HEIs/its institutions.

B. Waste minimization

Due to growing quantities of e-waste and health and environmental hazards involved in e-waste handling, immediate action from all concerned is required to curb the risk and improve the current situation in HEIs The manufacturers of electronic goods, who have benefited from sales of their products, should take responsibility for them from production through to the end of their lives. To prevent an e-waste crisis, manufactures must design clean electronics with longer lifespan, that are safe and easy to recycle and will not expose workers and the environment to hazardous chemicals. Electronics manufacturers must stop using hazardous materials (Greenpeace). There is a need for focusing on reduction and subsequent phasing out of toxic materials and use alternate materials (Sinha et al., 2007). Manufacturers should take full life cycle responsibility for their products and, once they reach the end of their useful life, take their goods back for re-use, safe recycling or disposal (Greenpeace). Illegal imports of WEEE should be banned into the country. HEIs will follow hierarchy of prevention, reduce and mitigation/corrective action for the E-waster minimization.

Purchase fewer items, organize your possessions, Donate or give away your e-waste, return them to the store, sell unused products, find more about the recycling possibilities in your region, Consider the future, lifespan of product, awareness program about e-waste.

C. Waste segregation at source

Sorting out e-waste at the source, just like any other waste, has a massive advantage. The time required for post-processing is reduced. It allows for better planning of treatment of e-waste, reduces transportation expenses, and alleviates the overall workload of the chain. Separating waste allows us to recycle more items, preventing their disposal in landfills. By reducing landfill disposal, we reduce our environmental impact.

D. Waste collection and storage

The collection and transport of separately collected e-waste shall be carried out in a way, which optimizes reuse and recycling of those components or whole. Collecting electronic items via recycling bins, take-back programs, collection locations, or on-demand collection services is the first step in the e-waste recycling process. After that, the mixed e-waste is sent to specialized electronics recyclers.

E. Waste transportation

the reliability of e-waste transportation across borders is one of the key challenges faced by transporters and recycling companies who are authorized. So, it will be better to send them to material recovery facilities (MRF).

F. Waste treatment and disposal

There is no formal recycling plant or scientific recycling process in Nepal. At present the common disposal of e-waste is found to be selling to the unorganized sector (Scrap Collector). Large quantities of e-waste are stored in the storerooms of offices and households due to lack of proper disposal system. The HEIs should look at providing incentives to encourage infrastructure development for environmentally sound recycling. There should be separation of source for the waste management. E-waste is different than general municipal solid waste because of its toxic nature. E-waste should be isolated from other general municipal solid waste in a proper way. It should be made compulsory to dispose of E-waste only to formal recyclers. There is an urgent need for enabling regulation to manage E-waste. A comprehensive legislation based on the basic principles of the environmental justice- **'precautionary principle' and 'polluters pay'** should be developed. Because of the complex composition of valuable and hazardous substances, specialized, often "high-tech" methods are required to process e-waste in ways that maximize resource recovery and minimize potential harm to humans or the environment.

Common e-waste disposal methods are landfilling, acid bath. incineration, recycling, reuse.

G. Monitoring and evaluation

Monitoring the quantities and flows of e-waste is essential for evaluating developments over time, and to set and assess targets towards a sustainable.

Annex-II: E-waste Separation

Sorting out E-waste at the source, just like any other waste, has a massive advantage. The time required for post-processing is reduced. It allows for better planning of treatment of E-waste, reduces transportation expenses, and alleviates the overall workload of the chain. Separating waste allows us to recycle more items, preventing their disposal in landfills. By reducing landfill disposal, we reduce our environmental impact.

Some general guidelines for E-waste segregation are to be done based on the types as

1. Home Appliances
   a. Microwaves
   b. Home Entertainment Devices
   c. Electric cookers
   d. Heaters
   e. Fans
   f. Fridges, freezers and other cooling equipment

2. Communications and Information Technology Devices
   a. Cell phones
   b. Smartphones
   c. Desktop Computers
   d. Computer Monitors
   e. Laptops
   f. Circuit boards
   g. Hard Drives
   h. Batteries

3. Home Entertainment Devices
   a. DVDs
   b. Blu Ray Players
   c. Stereos
   d. Televisions
   e. Video Game Systems
   f. Fax machines
   g. Copiers
   h. Printers

4. Electronic Utilities
   a. Massage Chairs
   b. Heating Pads
   c. Remote Controls
   d. Television Remotes
   e. Electrical Cords
   f. Lamps / LED bulbs
   g. Smart Lights
   h. Night Lights
   i. Treadmills

j. Fit Bits
k. Smart Watches
l. Heart Monitors
m. Diabetic Testing Equipment
n. Vending machines
o. solar panels

5. Office and Medical Equipment
   a. Copiers/Printers
   b. IT Server Racks
   c. IT Servers
   d. Cords and Cables
   e. Wi-Fi Dongles
   f. Dialysis Machines
   g. Imaging Equipment
   h. Phone & PBX systems
   i. Audio & Video Equipment
   j. Network Hardware (i.e. servers, switches, hubs, etc.)
   k. Power Strips & Power Supplies
   l. Uninterrupted Power Supplies (UPS Systems)
   m. Power Distribution Systems (PDU's)
   n. Autoclave
   o. Defibrillator
   p. Cathode ray tubes
   q. Leaded plasma display glass

Annex-III: Toxic Substances in E-waste

Substance	Occurrence in E-waste
Halogenated compounds	
PCB (polychlorinated biphenyls)	Condensers, Transformers
TBBA (tetrabromo-bisphenol-A) PBB (polybrominated biphenyls) PBDE (polybrominated diphenyl ethers)	Fire retardants for plastics (thermoplastic components, cable insulation) TBBA is presently the most widely used flame retardant in printed circuit boards
Chlorofluorocarbon (CFC)	Cooling unit, Insulation foam
PVC (polyvinyl chloride)	Cable insulation
Heavy metals and other metals:	
Arsenic	Small quantities in the form of gallium arsenide within light emitting diodes
Barium	Getters in cathode ray tubes (CRTs)
Beryllium	Power supply boxes which contain silicon-controlled rectifiers and x-ray lenses
Brominated Flame Retardants (BFRs) Polybrominated biphenyl (PBB), Polybrominated diphenyl ether (PBDE), and Tetrabromo-bisphenol-A (TBBA). Polychlorinated dibenzo-p-dioxins and furans (PCDD/Fs).	Flame-retardants make materials, especially plastics and textiles, more flame resistant. Indoor dust and air through migration and evaporation from plastics. Combustion of halogenated case material and printed wiring boards at lower temperatures releases toxic emissions, including dioxins, which can lead to severe hormonal disorders.
Cadmium	Rechargeable computer batteries, fluorescent layer (CRT screens), printer inks and toners, photocopying-machines (printer drums)
Chromium VI	Data tapes, floppy-disks
CFCs (Chlorofluorocarbons)	Used mainly in cooling units and insulation foam
Copper	mobile phones, laptops and printers as well as cables and wiring
Dioxins	unwanted by-products in the manufacture of substances like some pesticides as well as during combustion
Iron (ferrous)	Most of all electrical and electronic goods- ground water pollution
Lead	CRT screens, batteries, printed wiring boards, television sets, PC monitors, light bulbs, lamps
Lithium	Li-batteries
Mercury	Fluorescent lamps that provide backlighting in LCDs, in some alkaline batteries and mercury wetted switches
Nickel	Rechargeable NiCd-batteries or NiMH-batteries, electron gun in CRT

Polychlorinated Biphenyls (PCBs)	various applications, including dielectric fluids for capacitors and transformers, heat transfer fluids and additives in adhesives and plastics.
Polyvinyl Chloride (PVC) and phthalates	electronics and appliances, household items, pipes, upholstery. When burned, it produces large quantities of hydrogen chloride gas,
Rare Earth elements (Yttrium, Europium)	Fluorescent layer (CRT-screen)
Selenium	Older photocopying-machines (photo drums)
Zinc sulphide	Interior of CRT screens, mixed with rare earth metals
cadmium, chromium, beryllium, lead, lithium, nickel, mercury, selenium, zinc, yttrium, brominated flame retardants, halogenated flame retardants, tin, polyvinyl chloride (PVC) and phthalates, etc.	laptops, printers, photocopy machines and other electronic accessories

Note; list is not a complete list of incompatibles; this has to be used only as a guide.

Different types of scrap metal are extracted from waste computers, such as copper, aluminum, nickel, mercury, lead, magnesium, zinc, etc. Since the market value of these scrap metals is different, they should be separated at the time of the dismantling process. The scrap metals mined from waste computers can be separated into two categories by magnet test: ferrous and non-ferrous metals. Non-ferrous metals are typically more valuable than ferrous metals. Once the magnet test is finished, additional scratch tests could be executed to distinguish the non-ferrous metal (i.e., aluminum, copper, stainless steel, etc.). Those things can be disposed in MRF.

Annex-IV: Safety Considerations

1. General Emergency

It is the responsibility of E-waste management team tom ensure that the storage area must be covered place. Depending on the type of the emergency, there are specific guidelines to follow; however, there are a few general principles to follow for any type of emergency:

a) adequate firefighting arrangement and emergency escape route
b) Keep yourself safe first and remain calm.
c) Inform people nearby of what happened.

2. Fire or Explosion

i. Fire or explosion may occur from overheating, burning electrical and electronic goods, or gases exposed to excessive heat, an open flame, or electric sparks in the institutions. Be careful when working with flammable or explosive electrical and electronic goods and avoid heat or electric sparks nearby. Safely operate electric equipment and any source of heat to prevent fire or explosion.
ii. In case of a fire involving an individual's clothing, do not run since it might accelerate the fire. Stop, drop onto the ground with hands covering the face, and roll to extinguish the fire. If possible, use the safety shower to extinguish the fire.
iii. In case of a lab fire or explosion, ensure your safety first and call emergency responders immediately for help.
iv. Evacuate the building safely and pull fire alarms or notify nearby people, if possible.
v. Don't use elevators. Use stairs and locate the nearest exit.
vi. If possible, shut down the electric power before evacuating.
vii. Use a wet towel to cover the mouth and nose, if there is heavy smoke.
viii. In case of a small fire, use a proper fire extinguisher and make sure an easy exit is available if you fail in extinguishing the fire. Here we listed the types of extinguisher and discussed the circumstances in which each extinguisher type should be use

2.1 Types of fire.

Class A: Ordinary combustible solids such as paper, wood, clothes.

Class B: Flammable liquids such as gasoline, petroleum oil and paint and flammable gases such propane, methane and butane.

Class C: Electrical equipment such as appliances, motors.

Class D: Combustible metals such as sodium, aluminum and potassium.

Class K: Cooling oil and greases such as animal or vegetable fats.

2.2 Types of extinguisher.

i. Water and Foam: for Class A fires only. Not suitable for class B or C fires. Water and foam extinguish fire by reducing the heat and the foam helps to separate oxygen from the objects.

ii. Carbon Dioxide: for Class B and C fires. Not effective for Class A fire. Carbon dioxide extinguishes fire by separating oxygen from the object and removing heat.

iii. Dry Chemical/dry sand: multipurpose dry chemical works for Class A, B and C and ordinary dry chemicals works for Class B and C only. Dry chemical extinguishes fire by interrupting the chemical reaction.

iv. Wet Chemical: for Class K fire only. Wet chemical extinguishes fire by removing heat and separates oxygen from fuel elements.

v. Clean agent: for Class B and C. Clean extinguishers used halon or halocarbon agents to interrupt the chemical reactions.

vi. Dry Powder: for Class D only. Dry powder takes away heat and separates oxygen to extinguish fire.

3. Personnel Injuries

Besides chemical spills, fire, or explosion, there are many other accidents that might happen in the lab, such as electric shock, heat burn, bleeding, or poisoning. Here are some general principles to follow for personnel injuries.

i. Assess the situation before taking any actions.

ii. Ask the person what happened to them first, if they are conscious. Look for possible signs of injury if the person is unconscious and/or unresponsive.

iii. Call local emergency responders immediately if the person is in danger.

iv. Don't move the injured personnel unless imminent danger is present.

v. If an individual has received an electrical shock, shut down the power first, if possible. Do not touch the person with bare hands. Use non-conductive material such as wood, glass, or rubber to pull the person away from the electric contact.

vi. If bleeding from minor cuts, flush with water to avoid contamination and treat with first aid supplies. If cuts are more serious, call for medical assistance.

vii. Initiate first aid to help, if possible.

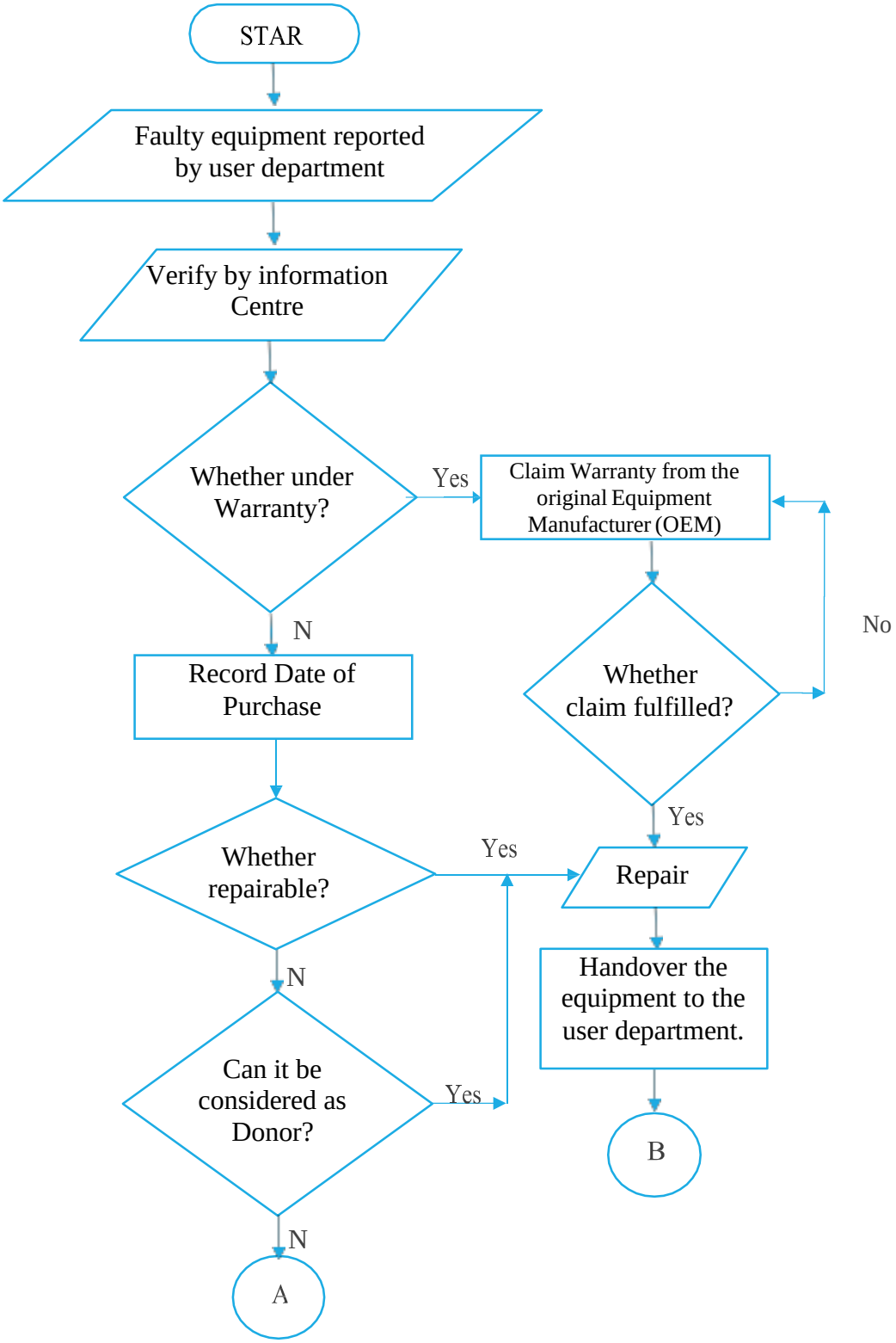
4. Occupational Health Safety (OHS)

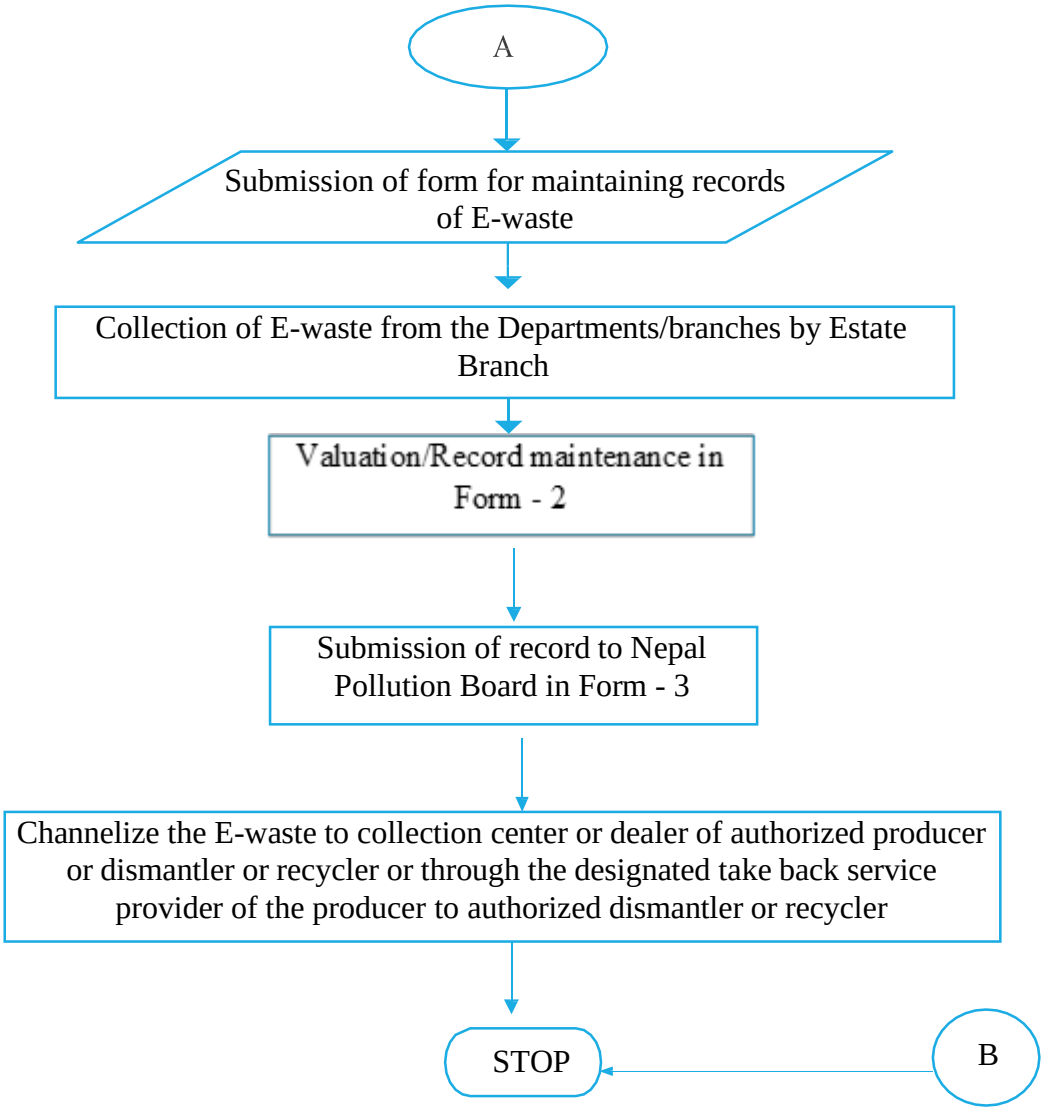
The attention of e-waster components in OHS have to be undertaken in steps like;

i. Collection
ii. Transporting
iii. Storage
iv. Refurbishing
v. Recycling
vi. Dismantling and extraction.

Annex-V: Process Flow Chart

The process of E-waste management system is designed based on the process flow as illustrated in the following flow chart.




A
Submission of form for maintaining records of E-waste
Collection of E-waste from the Departments/branches by Estate Branch
Valuation/Record maintenance in Form - 2
Submission of record to Nepal Pollution Board in Form - 3
Channelize the E-waste to collection center or dealer of authorized producer or dismantler or recycler or through the designated take back service provider of the producer to authorized dismantler or recycler
STOP
B

Annex-VI: Safety Labelling

Physical Hazards

SN	Hazards	Pictogram
1	**Explosive:** • Chemical that can detonate • Self-reactive • Organic Peroxide	
2	**Flammable:** • Chemical that can be ignite easily (catch fire) • Self-reactive • Organic Peroxide • Emits Flammable gas • Pyrophoric self-heating	
3	**Oxidizing:** • Chemical that can support and intensify combustion causing rapid fire on contact • Oxidizer	
4	**Compressed Gas:** • Chemical that can escape at a velocity of a missile, becoming uncontrolled rockets or pinwheels, causing explosion, harming health • Self-reactive • Organic Peroxide • Emits Flammable gas • Pyrophoric self-heating	
5	**Corrosive:** • Damage metals and living tissue on contact • Skin corrosion • serious damage to eyes • corrosive to metals	

Health Hazards

SN	Hazards	Pictogram
1	**Acute Toxicity:** • Chemical that can fatal or toxic	
2	**Harmful/Irritant:** • Chemical that are harmful on exposure, harmful if sawallowed, inheled, cause skin irritation, eye irritation, allergic skin reaction, drowsiness, dizziness. • Irritant Skin sensitizer • respiratory track irritant • Hazardious to ozone layer	
3	**Resperatory Hazard:** • Chemical that cause allergy, asthma symptom, breathing difficulties • Respiratory sensitizer • Aspiration Toxocity	
4	**Carcinogenic Hazard:** • Chemical that might cause cancer Most common are formaldehyde, Benzene, Methylene Bromide	

Environmental Hazards

SN	Hazards	Pictogram
1	**Hazard to Aquatic Environment:** • Include properties of chemicals that pose long term damaging effect to the aquatic life and environment	

General Safety Sign

SN	Hazards	Pictogram
1	**Radioactive:** • Ionizing radiation hazard. Common Sources are X-ray, medical beam cannons, particle accelerator	
2	**Fire:** • Should be used in those places where possibilities of fire are likely.	
3	**Heat Sources:** • Burn hazard come from oven, autoclave, stem pipes, hot plate etc. • Use heat resistant gloves	
4	**Electrical Hazard:** • Can cause mild tingling to death. • Device in question should be disconnected immediately • Turn off and unplug the equipment when not being used	
5	**Low Temperature:** • Crygenic hazard found in cold storage of laboratory such as liquid nitrogen, dry ice. • Wear correct PPE.	
6	**Biohazard:** • Used for laboratory equipment such as fridge or freezers that contain biohazards material such as blood samples.	
7	**Eye Wash Station:** • Indicate the location of eye wash	
8	**Safety Shower:** • Indicate the location of shower in case of splashes or spill.	

9	**HandWash Zone:** • Make the place for hand washing	
10	**First Aid Station:** • Indicates the availability of first aid kit. • Should be inspected periodically to ensure that no items are missing	
11	**Food and drink Prohibited:** • Inside the laboratory eating and drinking is not permitted. • Should not be used refrigerator and drying rack for food	
12	**Emergency Meeting Point:** • Make safe place either inside or outside the building where laboratory employee meet in actual emergency.	
13	**Safety Goggles:** • Use the safety goggles for the protection of eyes.	
14	**No open flame:** • Indicate the risk and prohibition of open flame device such as Bunsen burner, lighter, matches and any other flame producing devices.	
15	**Fire Blanket:** • Indicate the location where fire blanket is stored.	
16	**Fire Extinguisher:** • Indicate the location where Fire Extinguisher.	

17	**Laser Beam Hazard:** • Hazard from the laser beam. • Eye Protection and non-flammable clothing should always be worn in these areas.	
18	**UV Light Hazard:** • This symbol appear near UV light area.	

Annex-VII: Forms for Maintaining Records of E-waste

The design of this form is to collect all the relevant details with regards to E-waste items generated by individual branch/department of HEIs and institutes:

Form-1

Form for Maintaining Records of E-waste

Branch/Department name:-

S. No.	Description of E-waste	Quantity (nos.)	Status		If not working, since when?	Date of purchase	Date of receive/in-stallation	Additional data, if any
			Working	Not working				

Date:
Signature:
Name:
Designation:

Form 2:
Format for maintaining the record of E-waste generated by university:

FORM FOR MAINTAINING RECORDS OF E-WASTE HANDLED OR GENERATED

Generated Quantity in Metric Tonnes (MT) per year

1.	Name & Address: Producer or Manufacturer or Refurbisher or Dismantler or Recycler or Bulk Consumer*		
2.	Date of Issue of Extended Producer Responsibility Authorisation*/ Authorisation*		
3.	Validity of Extended Producer Responsibility Authorisation*/ Authorisation*		
4.	Types & Quantity of e-waste handled or generated**	Category Item Description	Quantity
5.	Types & Quantity of e-waste stored	Category Item Description	Quantity
6.	Types & Quantity of e-waste sent to collection centre authorised by producer/ dismantler/recycler / refurbisher or authorised dismantler/recycler or refurbisher**	Category Item Description	Quantity
7.	Types & Quantity of e-waste transported*	Category Quantity	Quantity
	Name, address and contact details of the destination		
8.	Types & Quantity of e-waste refurbished*	Category Item Description	Quantity
	Name, address and contact details of the destination of refurbished materials		
9.	Types & Quantity of e-waste dismantled*	Category Item Description	Quantity
	Name, address and contact details of the destination		

Form 3:

Format for filing the annual returns to State Pollution Control Board (SPCB) of E-waste generated by university:

Quantity in Metric Tonnes (MT) and numbers

1	Name and address of the producer or manufacturer or refurbisher or dismantler or recycler			
2	Name of the authorised person and complete address with telephone and fax numbers and e-mail address			
3	Total quantity of e-waste collected or channelised to recyclers or dismantlers for processing during the year for each category of electrical and electronic equipment listed in the Schedule I (Attach list) by PRODUCERS			
	Details of the above	TYPE	QUANTITY	No.
3(A)*	BULK CONSUMERS: Quantity of e-waste			
3(B)*	REFURBISHERS: Quantity of e-waste:			
3(C)*	DISMANTLERS: i Quantity of e-waste processed (Code wise); ii. Details of materials or components recovered and sold; iii. Quantity of e-waste sent to recycler; iv. Residual quantity of e-waste sent to Treatment, Storage and Disposal Facility.			
3(D)*	RECYCLERS: i. Quantity of e-waste processed (Code wise); ii. Details of materials recovered and sold in the market; iii. Details of residue sent to Treatment, Storage and Disposal Facility.			
4	Name and full address of the destination with respect to 3(A)-3(D) above			
5	Type and quantity of materials segregated or recovered from e-waste of different codes as applicable to 3(A)-3(D)	Type	Quantity	

✔ Enclose the list of recyclers to whom e-waste have been sent for recycling.

Place_____

Annex-VIII: Safety Measures

Safety Equipment:

1. First aid kit
2. Fire blanket
3. Fire extinguisher
4. Fume hood
5. Safety shower
6. Safety Cabinet
7. Smoke Detector
8. Gas cylinder Trolley/cabinets
9. Water hose

Personal Protective Equipment

1. Gloves
2. Lab coat
3. Respirator
4. Safety glasses
5. Face shield
6. Splash goggle
7. Ear Plug
8. Shoes
9. Gas Mask
10. Helmet

Security Equipment

1. Lock
2. CC camera
3. Metal detector
4. Assess control door

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