Zambia - Southern African Development Community (SADC) Regional Statistics Project P175731

Electronic Waste Management Plan

March 2023

Electronic Waste (E-waste) Management Plan

1. Considerations on Waste Management

The ZAMSTATS will manage environmental and social risks and impacts of the project throughout the project life cycle in a systematic manner, proportionate to the nature and scale of the project and to the potential risks and impacts. The generation of all forms of waste is one of those risks that must be considered during preplanning, construction, operations, and the decommissioning phases of the project. Waste management planning for the project should be conducted early as possible to identify sound management practices and procedures all within the country's legal and environmental frameworks. Wastes include hazardous, solid, demolition or construction, clinical and electronic waste. The focus of this plan is on electronic waste or E-waste. This E-waste management plan should be implemented throughout the project's lifecycle to protect the environment, safeguard the health of the local communities, and comply with The World Bank Environment, Safety and Health Guidelines (ESHG) and Good International Industry Practice (GIIP).

1.1. E-waste definition and general considerations

Electronic waste (E-waste) is a term used to cover items of all types of electrical and electronic equipment (EEE) and its parts that have been discarded, irreparable or at the end of life. Although E-waste is a general term, it is considered to cover laptops, desktops, tablets, TV's, mobile phones, and household appliances. E-waste contains materials that, if mishandled, can be hazardous to human health and the environment, but, most importantly, also materials that are valuable and scarce.

1.2 Toxicity and radioactive nature of E-waste to the human, water, soil, and animals

Electrical and electronic equipment contain different hazardous materials, which are harmful to human health and the environment if not disposed of carefully. While some naturally occurring substances are harmless in nature, their use in the manufacture of electronic equipment often results in compounds, which are hazardous (e.g., chromium becomes chromium VI). Lead, mercury, cadmium, and polybrominated flame retardants are found in electronic equipment and are all persistent, bio-accumulative toxins (PBTs). They can create environmental and health risks when computers are manufactured, incinerated, landfilled, or melted during recycling. PBTs, are a dangerous class of chemicals that have longevity in the environment and bioaccumulate in living tissues. PBTs are harmful to human health and the environment and have been associated with cancer, nerve damage and reproductive disorders. Table 1 is a selection of the mostly found toxic substances in E-waste.

Table 1. 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
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 CRT
Beryllium	Power supply boxes which contain silicon-controlled rectifiers and x-ray lenses
Cadmium	Rechargeable NiCd-batteries, fluorescent layer (CRT screens), printer inks and toners, photocopying-machines (printer drums)
Chromium VI	Data tapes, floppy-disks
Lead	CRT screens, batteries, printed wiring boards
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
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

Arsenic

Arsenic is a poisonous metallic element, which is present in dust and soluble substances. Chronic exposure to arsenic can lead to various diseases of the skin and decrease nerve conduction velocity. Chronic exposure to arsenic can also cause lung cancer and can often be fatal.

Barium

Barium is a metallic element that is used in sparkplugs, fluorescent lamps, and "getters" in vacuum tubes. Being highly unstable in the pure form, it forms poisonous oxides when in contact with air. Short-term exposure to barium could lead to brain swelling, muscle weakness, damage to the heart, liver, and spleen. Animal studies reveal increased blood pressure and changes in the heart from ingesting barium over a long period of time. The long-term effects of chronic barium exposure to human beings are still not known due to lack of data on the effects.

Beryllium

Beryllium has recently been classified as a human carcinogen because exposure to it can cause lung cancer. The primary health concern is inhalation of beryllium dust, fume, or mist. Workers who are constantly exposed to beryllium, even in small amounts, and who become sensitized to it can develop what is known as Chronic Beryllium Disease (beryllicosis), a disease that primarily affects the lungs. Exposure to beryllium also causes a form of skin disease that is characterized by poor wound healing and wart-like bumps. Studies have shown that people can still develop beryllium diseases even many years following the last exposure.

Brominated flame retardants (BFRs)

The three (03) main types of BFRS used in electronic and electrical appliances are Polybrominated

biphenyl (PBB), Polybrominated diphenyl ether (PBDE) and Tetrabromo-bisphenol - A (TBBPA). Flame-retardants make materials, especially plastics and textiles, more flame resistant. They have been found in 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. Major electronics manufacturers have begun to phase out brominated flame-retardants because of their toxicity.

Cadmium

Cadmium components may have serious impacts on the kidneys. Cadmium is adsorbed through respiration but is also taken up with food. Due to the long half-life in the body, cadmium can easily be accumulated in amounts that cause symptoms of poisoning. Cadmium shows a danger of cumulative effects in the environment due to its acute and chronic toxicity. Acute exposure to cadmium fumes causes flu-like symptoms of weakness, fever, headache, chills, and sweating and muscular pain. The primary health risks of long-term exposure are lung cancer and kidney damage. Cadmium also is believed to cause pulmonary emphysema and bone disease (osteomalacia and osteoporosis).

CFCs (Chlorofluorocarbons)

Chlorofluorocarbons are compounds composed of carbon, fluorine, chlorine, and sometimes hydrogen. Used mainly in cooling units and insulation foam, they have been phased out because when released into the atmosphere, they accumulate in the stratosphere and have a deleterious effect on the ozone layer. This results in increased incidence of skin cancer in humans and in genetic damage in many organisms.

Chromium

Chromium and its oxides are widely used because of their high conductivity and anti-corrosive properties. While some forms of chromium are nontoxic, Chromium (VI) is easily absorbed in the human body and can produce various toxic effects within cells. Most chromium (VI) compounds are irritating to eyes, skin, and mucous membranes. Chronic exposure to chromium (VI) compounds can cause permanent eye injury, unless properly treated. Chromium VI may also cause DNA damage.

Dioxins

Dioxins and furans are a family of chemicals comprising 75 different types of dioxin compounds and 135 related compounds known as furans. Dioxins is taken to mean the family of compounds comprising polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Dioxins have never been intentionally manufactured but form as unwanted by-products in the manufacture of substances like some pesticides as well as during combustion. Dioxins are known to be highly toxic to animals and humans because they bio-accumulate in the body and can lead to malformations of the foetus, decreased reproduction and growth rates and cause impairment of the immune system among other things. The best-known and most toxic dioxin is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

Lead

Lead is the fifth most widely used metal after iron, aluminium, copper, and zinc. It is commonly used in the electrical and electronics industry in solder, lead-acid batteries, electronic components, cable sheathing, in the glass of CRTs, etc. Short-term exposure to high levels of lead can cause vomiting, diarrhoea, convulsions, coma or even death. Other symptoms are appetite loss, abdominal pain,

constipation, fatigue, sleeplessness, irritability, and headache. Continued excessive exposure, as in an industrial setting, can affect the kidneys. It is particularly dangerous for young children because it can damage nervous connections and cause blood and brain disorders.

Mercury

Mercury is one of the most toxic yet widely used metals in the production of electrical and electronic applications. It is a toxic heavy metal that bio-accumulates causing brain and liver damage if ingested or inhaled. In electronics and electrical appliances, mercury is highly concentrated in batteries, some switches and thermostats, and fluorescent lamps.

Polychlorinated biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are a class of organic compounds use in a variety of applications, including dielectric fluids for capacitors and transformers, heat transfer fluids and as additives in adhesives and plastics. PCBs have been shown to cause cancer in animals. PCBs have also been shown to cause several serious non-cancer health effects in animals, including effects on the immune system, reproductive system, nervous system, endocrine system, and other health effects. PCBs are persistent contaminants in the environment. Due to the high lipid solubility and slow metabolism rate of these chemicals, PCBs accumulate in the fat-rich tissues of almost all organisms (bioaccumulation).

Polyvinyl chloride (PVC)

Polyvinyl chloride (PVC) is the most widely used plastic, used in everyday electronics and appliances, household items, pipes, upholstery, etc., PVC is hazardous because contains up to 56 percent chlorine which when burned produces large quantities of hydrogen chloride gas, which combines with water to form hydrochloric acid and is dangerous because when inhaled, leads to respiratory problems.

Selenium

Exposure to high concentrations of selenium compounds cause selenosis. The major signs of selenosis are hair loss; nail brittleness, and neurological abnormalities (such as numbness and other odd sensations in the extremities).

2. E-Waste Management Plan (EWMP)

2.1 E- Wastes management during the project

This Electrical Waste Management Plan (E-Waste MP) will be implemented throughout the project's lifecycle and is not limited to the use of electronic devices used for the project. The plan is required to be adopted during project implementation period when the project finances electrical/electronic equipment (computers, tablets, mobile phones, laptops, etc.) are replaced, irreparable or at their end of life. This plan must comply with the existing Zambian legislation and regulations, WB ESHG and Good International Industrial Practice (GIIP).

2.2 Aims and objectives of the EWMP

The aim is to achieve and maintain an integrated E-Waste management plan, that is effective and efficient to serve the projects within Zambia.

The overall objectives of the waste management assessment are summarised below: (i) to assess the activities involved for the proposed project and determine the type, nature, and estimated volumes of waste to be generated; (ii) to identify any potential environmental impacts from the generation of waste at the project sites; (iii) to recommend appropriate waste handling and disposal measures in accordance with the current legislative requirements, WB ESHG and GIIP.

2.3 E-Waste management legal framework, ESHG and GIIP

2.3.1 Zambian law

The Environmental Management (Licensing) Regulations (SI. No 112 of 2013) implements the Environmental Management Act 2011 and concerns a wide variety of matters regarding environmental protection including air quality control, waste management, hazardous waste, and other substances harmful to the environment such as pesticides and ozone-depleting substances. E-Waste belongs to the fifth schedule, regulation 18 (1), list of hazardous wastes, 'Waste electronic or electronic assemblies….' Any contractor that is contracted to treat, handle, transport, store, dispose of, transit, trade in shall hold a ZEMA hazardous waste licence. Project related E-waste could end up in a landfill site. However, any hazardous waste disposal using this method, the landfill must be managed in accordance with the guidelines prescribed in the regulation's ninth schedule and in accordance with section 24. (2) the requirements of an operator at a hazardous waste disposal site. There will be no transboundary movement of project related hazardous waste.

2.3.2 Environmental Social Standards (ESS)

The project will follow national legislation, ESHG and GIIP for the management of E-waste. The project will avoid the disposal of E-waste by reuse, recycle and recover. Where E-waste cannot be reused, recycled, or recovered then the project will treat, destroy or dispose of E-waste in accordance with The Environmental Management (Licensing) Regulations (SI. No 112 of 2013). That is, when hazardous waste management is conducted by third parties, the project will use ZEMA license hazardous waste contractors and all E-waste will be disposed of in hazardous waste landfill in accordance with the Environmental Management (Licensing) Regulations (SI. No 112 of 2013).

2.3.3 WB ESHG

The WB ESHG promotes waste prevention, reuse, and recycling, good housekeeping, inventory control, avoidance of damage and instituting procurement measures that allow the return of reusable material. It requires the segregation of hazardous type wastes from other waste, its appropriate storage (labelled containers) and record keeping. It allows collection, transport, and disposal in accordance with the Environmental Management (Licensing) Regulations (SI. No 112 of 2013). The ESHG also requires monitoring records for hazardous waste collected, stored, or shipped using the recommended procedures (see below).

2.3.4 GIIP

GIIP promotes the use of an obligation on distributors to offer to consumers a take-back system where E-waste items can be disposed of free of charge. There are two types of take-back systems, and distributors of EEE items must offer one of these schemes to their customers. Examples include free in-store take-back scheme where distributors accept E-waste items from customers purchasing equivalent new items. Distributors take-back scheme where consumers can dispose of WEEE items free of charge at designated collection facilities. E-waste generators should manage and dispose of E-waste responsibly in ways already mentioned in the preceding paragraphs. In addition, when purchasing a new electrical item arrange with the retailer to collect the old one. Businesses and other users (i.e., schools, hospitals, and government agencies) of electrical and electronic goods (EEE) must ensure that all separately collected E-waste is treated and recycled.

2.7 E-Waste Mitigation Measure and Management/Disposal Plan

This E-waste management plan contains proposed mitigation measures through which all E-waste can be managed in accordance with Zambian law, WB ESF, WB ESHG, and GIIP. The mitigation measures or guidelines have been designed to avoid, minimize, and reduce negative environmental and social impacts at the project level. The mitigation measures are presented in table 2 in a descriptive format.

2.7.1 Procurement of electronic items of a high quality and from reputable retailers/sources

The first mitigation measure is to ensure that all electronic devices are procured from retailers and sources that are credible, that all devices will have a clear date of manufacture and warranty and the item is of a high quality. This will avoid procurement of poor quality, refurbished, or used second hand electronic devices with a shorter lifecycle that leads to a rapid generation of E-waste. All items should be purchased where applicable, with protective covers and insurance. If possible, retailers or source of electronic items should be engaged where a repair, renewal, recycling or take back scheme option is offered. If the retailer of source does not offer some or all these options, then the project is to locate legally licensed facilities that do repair or recycle electronic items. If such options do not exist, then disposal should follow the Environmental Management (Licensing) Regulations (SI. No 112 of 2013) as detailed in the preceding paragraphs.

2.7.2 Awareness and Sensitization

Awareness and sensitization of teachers who will use the electronic devices on the proper disposal of once they become damaged, irreparable or at their end of life. The schools should include in the sensitization the usefulness and significance of E-waste recycling, and the need for returning all electronic items procured by the project to a collection centre that should be established at each hub and satellite centre.

2.7.3 Disposal

The last option in the management of E-waste is disposal. All E-waste should be segregated from other waste, collected at a designated point at each hub and satellite site, inventories, stored in a labelled container. When preparing for shipment the following should be implemented:

- Name and identification number of the material(s) composing the E-waste
- Physical state (i.e., solid, liquid, gaseous or a combination of one, or more, of these)
- Quantity (e.g., kilograms or liters, number of containers)

- Waste shipment tracking documentation to include, quantity and type, date dispatched, date transported, and date received, record of the originator, the receiver, and the transporter
- Method and date of storing, repacking, treating, or disposing at the facility, cross-referenced to specific manifest document numbers applicable to the E-waste
- Location of each E-waste within the facility, and the quantity at each location

Any contractor that is contracted to treat, handle, transport, store, dispose of, transit, trade in shall hold a ZEMA hazardous waste licence. Project related E-waste could end up in a landfill site. However, any hazardous waste disposal using this method, then the landfill must be managed in accordance with the guidelines prescribed in the regulation's ninth schedule and in accordance with section 24. (2), the requirements of an operator at a hazardous waste disposal site. There will be no transboundary movement of project related hazardous waste.

2.8 Monitoring Plans and Indicators

2.8.1 Monitoring of Environmental and Social Indicators

The goal of monitoring is to measure the success rate of the project, determine whether interventions have resulted in dealing with negative impacts, whether further interventions are needed, or monitoring is to be extended in some areas. Monitoring indicators will be very much dependent on specific project contexts.

2.8.2 Monitoring

The Ministry of Education implementing this project will be responsible for overall monitoring and evaluation of this E-waste management plan. The results of the monitoring reports will be submitted to the Bank. In appreciation of the fact that it would be impossible to visit or monitor all project investments to be financed under the project, "spot checks" may be undertaken by external consultants but no investment will be ignored in this high-level monitoring.

2.8.3 Bank's Monitoring Support

The Bank will provide second line of monitoring compliance and commitments made in the E-Waste Management Plans through supervision. The Bank will further undertake monitoring during its scheduled project supervision missions.

Specifically, for each year that the agreement is in effect, MoH will be required to submit all the monitoring reports to the Bank as part of its reporting and the Bank support and supervision missions will review these reports and provide feedback.

2.9 Monitoring Roles and Responsibilities

2.9.1 Zambia Statistics Agency (ZamStats)

The Zambia Statistics Agency (ZamStats) will provide overall responsibility for the Government of the Republic of Zambia (GoZ)cooperation on this program and remain the World Bank's principal client for the delivery of the program.

2.9.2 ZamStats

ZamStats will be provided electronic items financed by this project will be responsible for ensuring that the mitigation measures outlined in E-waste management plans are followed and will provide quarterly reports through the E&S focal points on the status of implementation of the plans.

Table 2. E-Waste Management/Disposal Plan

Issue: Procurement and provision of Electronic Devices (laptops, smartphones and tablets etc)				
Impact	**Mitigation**	**Monitoring**	**Responsibility**	**Budget (USD)**
Air Pollution through improper disposal which leads to release of toxic, hazardous, and carcinogenic gaseous **Human Health** Impacts due to poor disposal. **Pollution of water bodies** Electrical and electronic equipment contain different hazardous materials, which are harmful to human health and the environment if not disposed of carefully.	Procure Electronic devices from credible manufactures to avoid purchasing second hand, refurbished or obsolete devices with a short shelf life or already categorized as E-Waste. If possible, select sources offering repair and take back schemes. Ensure insurance coverage and electronic physical protective devices are fitted. Reuse and recycle all E-waste where applicable and possible. Establish E-Waste collection points at ZamStats; including collection bins/receptacles. Conduct awareness and sensitization targeting the users of the electronic devices to ensure that they engage in best practice for E-waste management.	Warranty and take back schemes for Electronic Devices purchased Credibility of manufacturers supplying the electronic devices Availability of E-waste receptacles at ZamStats Offices Number of awareness and trainings conducted for users of electronic devices on E-waste E-waste certificates of disposal using licensed hazardous waste contractors and licensed hazardous waste landfills.	ZAMSTATS	XXXX USD for
Pollution of land resources including landfills Electrical and electronic equipment contain different hazardous materials, which are harmful to human health and the	Procure Electronic devices from credible manufactures to avoid purchasing second hand, refurbished or obsolete devices with a short shelf life or already categorized as E-Waste. If possible, select sources offering	Warranty and take back schemes for Electronic Devices purchased Credibility of manufacturers supplying the electronic devices	ZAMSTATS	XXX USD

environment if not disposed of carefully.	repair and take back schemes. Ensure insurance coverage and electronic physical protective devices are fitted. Reuse or recycle all E-waste; Establish E-Waste Collection Centers at all ZamStats offices; including collection bins/receptacles; Use licensed hazwaste contractors and licensed hazwaste landfill sites. Create and maintain records of all E-waste items for disposal, securely store and prepare for shipment correctly. Conduct awareness and sensitization targeting the users of the electronic devices to ensure that they engage in best practice for E-waste management.	Availability of E-waste receptacles at all ZamStats offices Number of awareness and training conducted for users of electronic devices on E-waste E-waste certificates of disposal using licensed hazardous waste contractors and licensed hazardous waste landfills.		
Growth of informal E-waste disposal centers. Improper and indiscriminate disposal of E-waste is likely to lead to the exponential increase of informal waste disposal centers in communities near at all ZamStats offices which further exacerbates the problem of E-waste	Procure Electronic devices from credible manufactures to avoid purchasing second hand, refurbished or obsolete devices with a short shelf life or already categorized as E-Waste. If possible, select sources offering repair and take back schemes. Ensure insurance coverage and electronic physical protective devices are fitted. Reuse or recycle all E-waste;	Warranty and take back schemes for Electronic Devices purchased Credibility of manufacturers supplying the electronic devices Availability of E-waste receptacles at all ZamStats offices Number of awareness and training conducted for users of electronic devices on E-waste	ZAMSTATS	XXX USD

	Establish E-Waste Collection Centers at all ZamStats offices; including collection bins/receptacles; Use licensed hazwaste contractors and licensed hazwaste landfill sites. Create and maintain records of all E-waste items for disposal, securely store and prepare for shipment correctly. Conduct awareness and sensitization targeting the users of the electronic devices to ensure that they engage in best practice for E-waste management.	E-waste certificates of disposal using licensed hazardous waste contractors and licensed hazardous waste landfills.		

References:

a. Environmental Waste Management, Environmental, Health, and Safety (EHS) Guidelines General EHS Guidelines. International Finance Corporation, World Bank Group (IFC-WBG), 2007

b. The (Zambian) Environmental Management (Licensing) Regulations (SI. No 112 of 2013).

c. Environmental Social Standards 1 and 3. The World Bank Environmental and Social Framework 2017.

d. The European Union Waste Electrical and Electronic Equipment (WEEE) Regulations 2013.