Ministry of Finance and Planning

Republic of South Sudan

South Sudan Public Financial Management and Institutional Strengthening Project (P176761)

Electronic Waste (E-waste) Management Plan (EWMP)

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Table of Contents

List of Tables

Annex

1 CONSIDERATIONS ON WASTE MANAGEMENT

The Ministry of Finance and Planning commits to 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 the potential risks and impacts. The generation of waste is one of those risks that must be considered during the preplanning and implementation phases of the project. Waste management planning for the project should be conducted early as possible to identify sound management practices and procedures within legal and environmental frameworks. Possible waste streams that may be generated during project implementation may include solid wastes, hazardous wastes, and electronic wastes, etc. However, the focus of this plan is on electronic wastes or E-wastes. An E-Waste Management Plan (EWMP) is used to describe the waste management related issues within the Electrical and Electronic Equipment (EEE) industry sector and specify the best way to address these issues, giving specific actions, targets, and timeframes. This E-waste management plan should be implemented throughout the project's lifecycle to protect the environment, biodiversity, and habitats, safeguard the health of the local communities, and comply with the World Bank Environment, Safety and Health Guidelines (ESHG), Environmental and Social Standards (ESS), South Sudan legislations and regulations, and Good International Industry Practice (GIIP).

1.1 E-waste definition and general considerations

Waste electric and electronic equipment (WEEE) is referred to as e-waste or electronic waste and it is defined as any end-of-life or end-of-use piece of "equipment which is dependent on electrical currents or electromagnetic fields in order to work properly". It covers a broad range of electronic devices, ranging from large household appliances, information technology and telecommunications equipment, lighting equipment, medical devices, monitoring and control instruments, automatic dispensers, and consumer electronics, such as electrical and electronic tools, toys, leisure and sports equipment, and mobile phones to computers. Components of electric and electronic equipment (EEE), such as batteries, electric cables from end-of-life vehicles (ELVs), printed circuit boards (PCBs), plastic casings, cathode-ray tubes (CRTs), activated glass, and lead capacitors are also classified as e-waste. 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.

E-waste is one of the fastest growing waste streams worldwide, growing at a rate of 3–5% per year simply because of the market demand. The market demand for production of EEE is continuously increasing, but the life span/replacement interval of such products continues to decline in the course of technological evolution. The proper treatment of e-waste avoids negative impacts and yields many benefits. E-waste, if not properly treated, can have negative impacts, both on human health and on the environment. However, sustainable treatment of e-waste avoids these negative impacts.

1.2 Electronic products to be procured under the project

To aid implementation of the project, including the administration functions and operations, a number of electronic equipment will be procured by the Ministry of Finance and Planning. Possible electronic

products to be covered by the project may include laptops, desktop computers, projectors, printers, servers, scanners, flashy drives, etc. However, the exact quantity/number of electronic equipment to be procured by the project are not known at this time.

1.3 Toxicity and radioactive nature of E-waste to 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, bioaccumulative toxins (PBTs). They can create environmental and health risks when computers are manufactured, incinerated, landfilled, or melted during recycling. PBTs, in particular, 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 depicts a selection of the most common toxic substances in e-waste. Detailed description of the listed toxic substances is provided in Annex 1.

Table 1. Toxic Substances in E-waste

Substance	Occurrence in E-waste	Electronic Items
Halogenated compounds		
PCB (polychlorinated biphenyls)	Condensers, Transformers	Refrigerators for offices
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	Fire extinguishers, electrical cables, electrical wires
Chlorofluorocarbon (CFC)	Cooling unit, Insulation foam	
PVC (polyvinyl chloride)	Cable insulation	Electrical wires, internet and satellite dish wires
Heavy metals and other metals:		
Arsenic	Small quantities in the form of gallium arsenide within light emitting diodes	Fluorescent bulbs, bulb diodes
Barium	Getters in cathode ray tubes (CRTs)	
Beryllium	Power supply boxes which contain silicon-controlled rectifiers and x-ray lenses	Computer box, junction box, electrical equipment
Cadmium	Rechargeable computer batteries, fluorescent layer (CRT screens), printer	Computer batteries, printer inks and toners,

	inks and toners, photocopying-machines (printer drums)	photocopying machines, (printer drums)
Chromium VI	Data tapes, floppy-disks	Data taps, floppy disks
Lead	CRT screens, batteries, printed wiring boards, television sets, PC monitors, light bulbs, lamps	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	Alkaline batteries
Nickel	Rechargeable NiCd-batteries or NiMH-batteries, electron gun in CRT	Rechargeable NiCd-batteries or NiMH-batteries
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	

Other Equipment with Radioactive Substance

- **Communication equipment such as cell phones**
- **Data storage devices**
- **Air conditioners (ACs) emit electromagnetic field radiation**
- **Smoke detectors -very small amount of americium-241, a radioactive isotope.**
- **Camera Lenses**
- **Ceramics**

1.4 Benefits from Sustainable E-Waste Management Practices

Sustainable e-waste management practices which include recycling operations, considerably contribute to reducing greenhouse gas emissions. Primary production of some metals that are constituent of e-waste usually contribute largely to greenhouse gas emissions. As an example, mining, concentrating, smelting, and refining, especially of precious and special metals have a significant carbon dioxide (CO_2) impact due to the low concentration of these metals in the ores and often difficult mining conditions. But "mining" of old phones, servers, or old computers to recover the contained metals, if done in an environmentally sound or correct manner, needs only a fraction of energy compared to mining ores in nature.

In addition, recycling of e-waste equipment reduces the amount of land that would be taken away if e-waste is disposed of by encapsulation at a licensed hazardous waste disposal site. Encapsulation entails use of cement to concrete line the pit implying that once encapsulation takes place, that piece of land affected is permanently taken away by this process. If recycling, reuse, and recovery methods

are practiced, the piece of land that would otherwise be taken up for encapsulation will still be free and that would extend the life of the Hazardous Waste Disposal Site.

Recycling means that less money and energy have to be expended for the mining of the various minerals, which are consumed during the manufacturing process to produce e-waste equipment. The environmental footprint of a phone, computer, or any other electronic device can be significantly reduced if treated in an environmentally sound manner. In this context, the recycling, reuse, and recovery of e-waste will prevent hazardous emissions and ensure that a large part of the contained metal(s) is finally recovered for a new life. This E-Waste Management plan does not include or mandates for the establishment of an e-waste recycling infrastructure, but points in the direction that building a sustainable recycling infrastructure, creates jobs and contributes to capacity building. The sustainable collection, sorting, manual dismantling, and pre-processing of e-waste could create a significant number of jobs in the country that would develop this activity.

2 E-WASTE MANAGEMENT PLAN

2.1 E-Wastes management during implementation phase

This Electrical Waste Management Plan (EWMP) will be implemented throughout the project's lifecycle and will follow and comply with the ESS1 and ESS3 of the Environmental and Social Framework of the World Bank. This EWMP will be adopted and implemented for all project activities and at each project site. The plan is required to be adopted during project implementation period when project financed electrical equipment (computers, printers, servers, laptops etc.) are replaced, irreparable or at their end of life. It will also include an integrated management approach of electrical and telecommunication waste, that could occur during demolition, upgrade or renewal of installations and infrastructures. This plan must also comply with existing national legislation and 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 ensure the generated e-waste is not indiscriminately disposed to the detriment of human health and the environment.

The overall objectives of the e-waste management plan are: (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, storage, transport, treatment, and disposal measures in accordance with the current legislative requirements, WB ESHG, and GIIP; (iv) to strengthen capacity and raise awareness to communities and firms on e-waste management risks and impacts.

2.3 E-Waste management legal framework, ESS, ESHG, and GIIP

2.3.1 Laws of South Sudan

The legal framework will legally support the bases of the EWMP throughout the project lifecycle, and this will be based in the local legislature, regulations, resolutions, norms, international treaties, and other legally binding instruments that apply to the project nature.

The Transitional Constitution of the Republic of South Sudan, 2011 includes numerous provisions relating to the biophysical and social environment. Article 41 (1) provides that the people of South Sudan shall have a right to a clean and healthy environment and (2) that every person shall be obliged to protect the environment and (3) that future generations shall have the right to inherit an environment protected for the benefit of present and future generations. E-waste is one of the most indelible sources of pollution of the environment that should be mitigated.

The Wildlife Conservation and National Parks Act, at Section 5 of the Act, recognizes that wildlife constitutes an important national natural wealth and is part of the heritage of South Sudan and therefore needs to be conserved, protected, and utilized for the benefit and enjoyment of all its people. This should be protected from e-waste.

The Public Health (Water and Sanitation) Act (2008) emphasizes the prevention of pollution of air and water and also encourages improvement in sanitation. Key provisions include the protection of the sanitation of the environment and encompasses measures to address the pollution of water and air by e-waste.

Any contractor that is contracted to treat, handle, transport, store, dispose of, transit, trade in must hold a hazardous waste license/permit issued by a competent/regulatory authority. Since there is no specific landfill for e-wastes in Juba, South Sudan, project related electronic wastes will be temporarily stored by a competent contractor until licensed disposal facilities for hazardous wastes become available. Project related e-waste will be disposed of in licensed facilities for hazardous wastes or landfill sites. However, any hazardous waste disposal using this method, the landfill must be managed in accordance with Environmental Management Regulations and the guidelines prescribed by the National or Local Authorities. There will be no transboundary movement of project related hazardous waste.

The only landfill in Juba, South Sudan conforms with the IFC (2007) environmental, health, and safety guidelines on waste management facilities. The location of the landfill has taken into account potential impacts associated with releases of polluting substances including the following:

- Proximity to residential, recreation, agricultural, wildlife habitats and areas prone to scavenging wildlife, as well as other potentially incompatible land uses: residential areas about 10 km from the perimeter of the landfill cell development to minimize the potential for migration of underground gaseous emissions; and visual impacts are minimized. The main international

airport (Juba International Airport) is approximately 12 km from the landfill, hence there is no threat of scavenging birds over it.

- Proximity and use of groundwater and surface water resources: there are no private or public drinking, irrigation, or livestock water nearby; the only perennial water body is the White Nile which is located 10s of kilometres from the landfill which proved economically and environmentally feasible to protect the river from potential contamination.
- Site geology and hydrogeology;
    - The landfill located in gently slope topography, with slopes which minimize the need for earthmoving to obtain the correct leachate drainage slope of about 2%
    - Groundwater's seasonally high table level (i.e., 10 year high) are at least 1.5 meters below the proposed base of any excavation or site preparation to enable landfill cell development
    - Suitable soil cover materials are available on-site to meet the needs for intermediate (minimum of 30 cm depth) and final cover (minimum of 60 cm depth), as well as bund construction (for the cell method of landfill operation).
    - The site is not prone to potential natural hazards such as floods, landslides, and earthquakes. The landfill was sited outside of a floodplain. Besides, the area doesn't have significant seismic risk which otherwise would cause destruction of berms, drains or other civil works, or require unnecessarily costly engineering measures
    - There are no fault lines or significantly fractured geologic structure within 500 meters of the perimeter of the landfill cell development which would allow unpredictable movement of gas or leachate
    - There is no underlying limestone, carbonate, fissured or other porous rock formations which would be incompetent as barriers to leachate and gas migration, where the formations are more than 1.5 meter in thickness and present as the uppermost geologic unit above sensitive groundwater.

2.3.2 Environmental Social Standards (ESS)

The project will follow national legislation, WB 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 ESS 1 and ESS 3, and the guidelines prescribed by the national or local authorities. That is, when hazardous waste management is conducted by third parties, the project will use licensed hazardous waste contractors and all e-waste will be disposed of in hazardous waste landfill or licensed disposal facilities in accordance with the Environmental Management Regulations.

2.3.3 WBG ESHG

The WBG 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 wastes from other wastes, its appropriate storage (labelled containers) and record keeping. It allows collection, transport, and disposal in accordance with the Environmental Management Regulations. The ESHG also requires monitoring records for hazardous waste collected, stored, or shipped using the recommended procedures.

2.3.4 Good International Industry Practices (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 schemes 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.

2.4 E-Waste Mitigation Measure and Management

This E-waste management plan contains proposed mitigation measures through which all e-waste can be managed in accordance with national legislations, WB ESF, WB ESHG, and GIIP. The mitigation measures or guidelines have been designed in order 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.

2.4.1 Procurement of electronic items of 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 life cycle 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 sources of electronic items should be engaged where a repair, renewal, recycling or take back scheme option is offered. If the retailer or source does not offer some or all of 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 in licensed disposal facilities for hazardous wastes should follow the Environmental Management Regulations as prescribed by the national or local authorities.

2.4.2 Awareness and Sensitization

Awareness and sensitization of project staff who will use the electronic devices on the proper disposal once they become damaged, irreparable or at their end of life is vital. Awareness and sensitization will also be extended to contractors in the event they generate e-waste. The sensitization program will include the usefulness and significance of e-waste recycling, and the need for returning back all electronic items procured by the project to a collection centre that should be established. Also, project staff should be aware and sensitize on the fact that cell phones and computers do hold sensitive data/information, which present security risks if not properly disposed of, and this can lead to lawsuits.

2.5 E-Waste Environmental Health and Safety Guidelines

2.5.1 General E-Waste Management

The following guidance applies to the management of non-hazardous and hazardous e-waste. Additional guidance specifically applicable to hazardous e-waste is presented below. E-waste management should be addressed through an e-waste management system that addresses issues linked to e-waste, which include generation, waste management (reduction, reuse, recycling), transportation, disposal, and monitoring.

As part of the E-waste Management Plan, e-waste should be characterized according to composition, sources, types of e-waste, generation rates, and local legislation. Effective planning and implementation of e-waste management strategies should include: i) Revision of new e-waste sources during all project phases including planning, siting, and equipment upgrades, in order to identify e-waste generation, pollution prevention opportunities, and necessary treatment, storage, and disposal infrastructure; ii) Collection of data and information about the process and e-waste streams in existing facilities, including characterization of e-waste streams by type, quantity, and potential use/disposition; iii) Establishment of priorities based on a risk analysis that takes into account the potential Environmental Health and Safety (EHS) risks during the e-waste cycle and the availability of the infrastructure to manage the e-waste in an environmentally sound manner; iv) Definition of opportunities for source reduction, as well as for reuse and recycling; v) Definition of procedures and operational controls for onsite storage; and, vi) Definition of options/procedures/operational controls for treatment and final disposal.

2.5.2 E-Waste Prevention Processes

This should be designed and operated to prevent, reduce, or minimize, the quantity of e-waste generated and hazards associated with the e-waste generated in accordance with the following strategy: i) Substituting raw materials or parts with less hazardous or toxic materials, or with those where processing generates a lower e-waste volume; ii) Adopting and implementing good housekeeping and operating practices, including inventory control to reduce the amount of e-waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or are an excess to

operational needs; and iii) Reducing/minimizing hazardous e-waste generation by implementing stringent e-waste segregation to prevent the commingling of non-hazardous and hazardous e-waste.

2.5.3 Recycling and Reuse

In addition to the implementation of e-waste prevention strategies, the total amount of e-waste may be significantly reduced through the implementation of reuse and recycling plans, which should consider the following elements: i) Identification and reuse/recycling of products that can be reintroduced into the operational processes ii) Investigation of external markets for recycling by other industrial processing operations located in the neighbourhood or region of the facility (e.g., e-waste exchange); iii) Establishing reuse/recycling objectives and formal tracking of e-waste generation and recycling rates; and iv) Providing training and incentives to employees in order to meet objectives.

2.5.4 Hazardous E-Waste Management

Hazardous e-waste should always be segregated from non-hazardous e-wastes. If the generation of hazardous e-waste cannot be prevented through the implementation of the above general e-waste management practices, its management should focus on the prevention of harm to health, safety, and the environment, according to the following additional principles: i) Understanding potential risks and impacts associated with the management of any generated hazardous e-waste during its complete life cycle; ii) Ensuring that contractors handling, treating, and disposing of hazardous e-waste are reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the e-waste being handled; iii) Ensuring compliance with applicable local and international regulations, WB ESHG, and GIIP.

2.5.5 Hazardous E-Waste Storage

Hazardous e-waste should be properly stored to prevent or control accidental releases to air, soil, and water resources in areas where: i) E-waste is stored in a manner that prevents the commingling or contact between incompatible e-waste and allows for inspection between containers to monitor leaks or spills. Examples include sufficient space between incompatible or physical separation such as walls or containment curbs; ii) Store in closed containers (some could be radioactive proofed), away from direct sunlight, wind and rain; iii) Secondary containment systems should be constructed with materials appropriate for the e-waste being contained and adequate to prevent loss to the environment; iv) Provision of readily available information on compatibility to employees, including labelling each container to identify its contents; v) Limiting access to hazardous e-waste storage areas to only employees who have received proper training; vi) Clearly identifying (labelling) and demarcating the area, including documentation of its location on a facility map or site plan; and, vii) Conducting periodic inspections of e-waste storage areas and documenting the findings.

2.5.6 Transportation of E-Waste

All e-waste containers designated for off-site shipment should be secured and labelled with the contents and associated hazards. This must be properly loaded and secured into transportation vehicles before leaving the site and must be accompanied by a shipping paper (i.e., manifest, record, etc.) that describes the load and its associated hazards, and which is consistent with the Transport of Hazardous Materials good practices and guidance.

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

2.5.7 Treatment and Disposal

If e-waste materials are still generated after the implementation of feasible e-waste prevention, reduction, reuse, recovery, and recycling measures; then, e-waste materials should be treated and disposed of following all measures to avoid potential impacts to human health and the environment. Selected management approaches should be consistent with the specifications of e-waste characteristics and local regulations, and may include one or more of the following: i) On-site or off-site chemical, or physical treatment of the e-waste material to render it non-hazardous prior to final disposal; ii) Treatment or disposal at permitted facilities specially designed to receive the e-waste; iii) Permitted and operated landfills or disposal facilities designed for the respective type of e-waste or other methods known to be effective in the safe, final disposal of e-waste materials.

2.6 Monitoring Plans and Activities

2.6.1 Special considerations for Monitoring Activities

Monitoring activities associated with the management of hazardous and non-hazardous e-waste should include: i) Regular visual inspection of all e-waste storage, collection and storage areas for evidence of accidental releases and to verify that e-waste is properly labelled, and stored; ii) Inspection of loss or identification of cracks, corrosion, or damage to protective equipment, or floors; iii) Verification of locks, and other safety devices for easy operation (lubricating if required and employing the practice of keeping locks and safety equipment in standby position when the area is not occupied); iv) Checking the operability of emergency systems; v) Documenting results of testing for integrity, emissions; vi) Documenting any changes to the storage facility, and any significant changes in the quantity of materials in storage; vii) Regular audits of e-waste segregation and collection practices, viii)

Tracking of e-waste generation trends by type and amount of e-waste generated, preferably by facility departments, ix) Characterizing e-waste at the beginning of generation of a new e-waste stream, and periodically documenting the characteristics and proper management of the e-waste, especially hazardous e-wastes; x) Keeping manifests or other records that document the amount of e-waste generated and its destination; xi) Periodic auditing of third-party treatment, and disposal services including re-use and recycling facilities when significant quantities of hazardous e-wastes are managed by third parties. Whenever possible, audits should include site visits to the treatment storage and disposal location. In the event that e-waste (on-site storage and/or pre-treatment and disposal) is in direct contact with soil, additional procedures must be performed to ensure regular monitoring of soil quality.

2.7 Monitoring Roles and Responsibilities

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.

2.7.1 The Ministry of Finance and Planning

The Ministry of Finance and Planning implementing this project will be responsible for overall monitoring and evaluation of this e-waste management plan. Monitoring must be performed throughout the project life cycle. The results of the monitoring reports will be submitted to the Bank. The Ministry of Finance and Planning should also provide training and capacity building on e-waste management.

2.7.2 Project offices

The project offices that will be provided electronic items (computers, printers, servers, laptops, etc) financed by this project will be responsible for ensuring that the mitigation measures outlined in the e-waste management plans are followed and will provide quarterly reports to the project steering committee (PSC) on the status of implementation of the plans.

2.7.3 Bank's Monitoring Support

The Bank will provide a second line of monitoring compliance and commitments made in the e-waste management plan through supervision. The bank will further undertake monitoring during its scheduled project supervision missions. Specifically, for each year that the agreement is in effect, the Ministry of Finance and Planning will be required to submit all the monitoring reports to the Bank as part of its reporting and the Bank supervision missions will review these reports and provide feedback.

2.8 Public Consultation Mechanism

The information provided to the project staff and contractors (as applicable), as well as to the communities and all other relevant stakeholders, must be early and appropriate. Procedures must be established for solicitation, convening, and training to workers and affected communities. Amongst the potential topics to be covered are labor ethics, responsibilities and rights, sustainable daily issues and behavior, care for nature and biodiversity, environmental management. For information mechanisms to communities and workers the following must be considered: written information (press), radio, internet, social media, workshops, etc. The public consultation of project activities must be performed before project implementation, at the design phase. This activity is a mandate of ESS10 and demands the local stakeholder's active participation which shall be continuous throughout all the project phases. The result of the public consultations shall be included in the EWMP for all project activities.

2.9 Budget and Costs

In each phase of the project there must be a required budget with associated costs of the development and implementation of the EWMP. The budget must consider all management activities, as well as potential procurement of equipment, including personal protective equipment. The budget will also cover activities such as collection, sorting, dismantling, temporary storage, transportation, and disposal of the e-waste as well as audit and training/capacity building of project staff and contractors. The budget will also include contingency expenditures. The budget will be rationalized by the Ministry of Finance and Planning and subject to clearance by the World Bank.

2.10 E-waste Management Plan

This section describes the proposed e-waste management plan in a matrix indicating the impacts associated with handling and mishandling of e-waste against the mitigation measures, monitoring, and the relevant responsible parties in the proposed project. It can be adopted to avoid hazardous impacts associated with the dismantling and recycling of the e-waste.

Table 2. E-waste management plan matrix

Issue: Procurement and Provision of Electronic Devices (computers, printers, servers, laptops etc)			
Impact	**Mitigation**	**Monitoring**	**Responsibility**
Pollution of air, lands and water through improper disposal Which leads to release of toxic, hazardous, and carcinogenic gaseous.	Procure Electronic devices from credible manufacturers 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.	Warranty and take back schemes for Electronic Devices purchased. Credibility of manufacturers supplying the electronic devices	Ministry of Finance and Planning/ Project Implementation Unit (PIU)

Human Health Electrical and electronic equipment contain different hazardous materials, which are harmful to human health. For instance, bioaccumulative toxins (PBTs) are harmful to human health and have been associated with cancer, nerve damage and reproductive disorders. Chronic exposure to arsenic can cause lung cancer and can often be fatal. Also, exposure to barium can lead to brain swelling, muscle weakness, damage to the heart, liver, and spleen.	Reuse and recycle all e-waste where applicable and possible. Establish e-waste collection points in all project sites, 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.	Availability of e-waste receptacles in each project site. 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/disposal facilities.	Ministry of Finance and Planning/PIU

Growth of informal E-waste disposal centres. Improper and indiscriminate disposal of e-waste is likely to lead to the exponential increase of informal waste disposal centers in communities near project sites which may further exacerbate the problem of e-waste.	Procure electronic devices from credible manufacturers 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. Establish e-Waste collection centres in all project sites, including collection bins/receptacles. Use licensed hazardous waste contractors and licensed hazardous landfill sites/disposal facilities. 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.	Warranty and take back schemes for electronic devices purchased. Credibility of manufacturers supplying the electronic devices. Availability of e-waste receptacles in each project site. 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/disposal facilities.	Ministry of Finance and Planning/PIU
Lack of protective covers and insurance for electronic equipment **This may lead to abandonment of used electronic equipment and poor disposal into the environment**	Provide protective covers and insurance schemes for major electronic equipment. Where possible, suppliers of electronic equipment or licensed companies should be engaged in the repair, recycling and take-back scheme	Regular inspection of electronic equipment Renewal of insurance scheme selected for electronic equipment	Ministry of Finance and Planning/PIU
Lack of awareness and sensitization of users of electronic equipment once damaged or irreparable	Awareness of project staff, government and contractor staff on the use and safe disposal of electronic wastes that are damaged or become irreparable at their end of life. The sensitization should emphasize the importance of recycling, reusing and properly storing electronic equipment at their end of life to prevent exposure to humans and save data, hence preventing lawsuits against exposure on privacy.	Stakeholder engagement on responsible use, disposal and or storage of electronic equipment	Ministry of Finance and Planning/PIU Contractors/ Suppliers of goods

Lack of knowledge on the source of e-wastes **Some consumer goods are supplied near to their end of life period. Others were produced with heavy substances of radioactive nature**	- Review all e-waste sources during project planning, siting and equipment upgrade to prevent pollution, ensure proper storage and disposal infrastructure - Select electronic equipment with less hazardous or toxic materials, or those where processing generates a lower e-waste volume. - Adopt and implement a good housekeeping and operating practice, including inventory control to reduce the amount of e-waste resulting from materials that are out-of-date, off-specification, contaminated, damaged, or are an excess to operational needs; - Reduce/minimize hazardous e-waste generation by implementing stringent e-waste segregation to prevent the commingling of non-hazardous and hazardous e-waste.	Demand Material Safety Data Sheet (MSDS) Regular HSE Inspection for all electronic equipment,	Ministry of Finance and Planning/PIU
Some electronic equipment may be dumped at their end of life period **Electronic equipment dumped without proper disposal may pose threat to human health, water and soil ecosystem**	- Identification electronic equipment which can be reused/recycled reintroduced into the operational processes - Assess external markets which can buy and recycle e-waste either in the neighboring counties or the region. - Provide training and incentives to employees in order to manage e-waste and electronic equipment properly.	Inventory report	PIU
Transportation of e-wastes **Improper transportation of e-wastes may lead to incidents thereby littering toxic substances on land, water. This may cause bioaccumulation in the food chain and**	All e-waste containers designated for off-site shipment should be secured and labeled with the contents and associated hazards. This must be properly loaded and secured into transportation vehicles before leaving the site and must be accompanied by a shipping paper (i.e., manifest, record, etc.) that describes the load and its associated hazards, and which is consistent with the Transport of Hazardous Materials good practices and guidance.	Security and logistics report E-waste Fleet management	Ministry of Finance and Planning/PIU

affect plants, animals and humans			
E-waste may be handled improperly in the absence of certified/licensed recycler/facility	The PIU will establish a continuous liaison with the Ministry of Environment and Forestry to take action against the E-waste collectors, dismantlers and recyclers and certify them. The PIU will seek guidelines from the Ministry of Environment and Forestry on E-waste in the hazardous substances and pursue in applying Hazardous Substances Rules to all the disposal or storage facilities and issue licenses when appropriate	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/disposal facilities.	Ministry of Finance and Planning/PIU Ministry of Environment and Forestry Contractors
Accumulated e-wastes may lack proper storage facilities	Provide proper storage facilities for e-wastes until such time when a licensed disposal site is identified. All the discarded ICTs or the E-waste will be handed over to the administration department. The administration department will receive the E-waste and record it in its E-waste inventory, and place it in the specified storage bins or storage facilities based on the volume and recycling purposes of E-waste. There will be one or two storage bins allocated for the E-waste storage. The list of the items placed in the bin will be displayed at the bin so that anybody can see what type of items are placed inside the bin. The storage bins should have appropriate space for the collection of the items. The bin should be covered from all sides with one opening from the top for placing and removing the E-waste items. The bins should be placed under a covered area to protect it from sunlight and rain with proper ventilation. The bins should be placed under normal room temperature. There should be arrangements in the storage room to remove heat during hot months of December, January, February and March such as exhaust fans. The surface of the storage bins should be impermeable which should not allow it to seep in or seep out any material to/from the bin.	E-waste store inspection records, Materials Data Safety Sheet Proper labelling of e-wastes in stores	Ministry of Finance and Planning /PIU

Disposal of used electronic equipment/ E-wastes	The PIU should develop an inventory of the e-waste and update it regularly. This inventory should be reconciled with the inventory of the procured ICTs. In some cases, during the implementation of the project, the existing or new ICT equipment would become part of the E-waste, ensuring that the inventory is updated periodically for incorporating any changes with respect to allocation, movement, auction etc. This type of E-waste will also be included in the inventory with the remarks 'Obsolete ICTs' against such E-waste. This inventory will be useful in identifying the quantum of the E-waste collected.	E-Waste Inventory Report	Ministry of Finance and Planning/PIU

Annex 1. Detailed Description of Toxic Substances in E-waste

Arsenic

Arsenic is a poisonous semi-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 spark plugs, 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, low blood potassium, cardiac arrhythmias, respiratory failure, gastrointestinal dysfunction, paralysis, muscle twitching, and elevated blood pressure, liver, and spleen. Animal studies reveal increased blood pressure and changes in the heart from ingesting barium over a long period of time.

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. Beryllium can also affect organs such as the liver, kidneys, heart, nervous system, and the lymphatic system, may develop beryllium sensitization or chronic beryllium disease. 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 3 main types of BFRs used in electronic and electrical appliances are Polybrominated biphenyl (PBB), Polybrominated diphenyl ether (PBDE), and Tetrabromobisphenol - 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, 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, possibly reproductive damage, 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, human carcinogens, impacts on neonates, reproductive and endocrine functions. 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 a number of 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 it 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 causes selenosis. The major signs of selenosis are hair loss; nail brittleness, and neurological abnormalities (such as numbness and other odd sensations in the extremities).

Annex 2: Consumer products with radioactive components or emissions

- Smoke detectors: most smoke detectors available for home use contain americium-241, a radioactive element. Unless tampered with, smoke detectors pose little to no health risk; a smoke detector's ability to save lives far outweighs the health risks from the radioactive materials
- Clocks and watches: some luminous watches and clocks contain a small quantity of hydrogen-3 (tritium) or promethium-147. Older watches and clocks (made before 1970) may contain radium-226 paint on dials and numbers to make them visible in the dark. Avoid opening these items because the radium could flake off and be ingested or inhaled.
- Logitech screen monitors for e-conference/ meeting: Flat-screen monitors (e.g LCD, OLED, plasma) do not use cathode ray tubes (CRTs) and therefore do not produce ionizing radiation. Screen monitors that contain CRTs may emit x-rays. X-ray emissions from CRT monitors are not recognized as a significant health risk.
- Ceramics: ceramic materials such as tiles and pottery may contain elevated levels of naturally-occurring uranium, thorium, and/or potassium. In many cases, the activity is concentrated in the glaze. Unless there is a large quantity of the material, the amount of radioactivity in these products is unlikely to be greater than natural background levels. However, some older dishware can have radioactivity exceeding background levels; to minimize health risks, the project may not want to use these pieces for eating or drinking.
- Glass: glassware, especially antique glassware with a yellow or greenish color, can contain easily detectable quantities of uranium. Such uranium-containing glass is often referred to as canary or vaseline glass. Even ordinary glass can contain high-enough levels of potassium-40 or thorium-232 to be detectable with a survey instrument. However, the radiation received when using glassware – even canary or vaseline glass – is unlikely to exceed background radiation levels.
- EXIT signs: Some EXIT signs contain the radioactive gas called tritium, allowing them to glow in the dark without electricity or batteries. The tritium used in EXIT signs gives off low-level beta radiation, causing a light-emitting compound to glow. Tritium EXIT signs do not pose a direct health hazard, as the beta radiation can be stopped by a sheet of paper or clothing. However, tritium EXIT signs must not be disposed of in normal trash.

1. REFERENCES:

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

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

Ilankoon, I.M.S.K.; Ghorbani, Yousef; Chong, Meng Nan; Herath, Gamini; Moyo, Thandazile; Petersen, Jochen (2018). E-waste in the international context – A review of trade flows, regulations, hazards, waste management strategies and technologies for value recovery. Waste Management, 82, 258–275.

Habib Al Razi, Khandakar Md (2016). Resourceful recycling process of waste desktop computers: A review study. Resources, Conservation and Recycling, 110, 30–47.

South Sudan's Constitution (2011).
https://www.constituteproject.org/constitution/South_Sudan_2011.pdf