

Circularity Toolkit: E-Waste Blueprints

# E-waste risks

An overview of e-waste risks for OGS companies

## About the Circularity Toolkit: E-Waste Blueprints:

GOGLA, with the support of Swedfund, has developed these E-waste Blueprints as part of our Circularity Toolkit to help off-grid solar companies implement and improve e-waste management across their operations.

The Blueprints build on the knowledge and best practice identified in phase 1 of our Toolkit. Wherever possible, we have sought to ensure that the Blueprint documents are applicable to a broad cross-section of OGS companies, regardless of company stage, product type or country of operations. However, companies should adapt the Blueprints as necessary to their individual operational context.

## Acknowledgements:

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The Blueprints were developed by Sofies, in collaboration with Akinyi Chemutai (independent), Charlotte Heffer and Wilson Wambugu (d.light), and Rebecca Rhodes (GOGLA). Thank you also to those companies and members of our Circularity Working Group who were involved in the consultations that helped us to shape the Blueprint elements of our Toolkit.

**Disclaimer:** The information in this Blueprint is designed to provide guidance for use by companies. GOGLA and the authors are not responsible or liable in any manner for any damages resulting from use of information in this Blueprint.

## Assessing risks along the e-waste management chain

This document is intended to help off-grid solar companies identify and assess possible risks that they may encounter along the e-waste management chain.

[Table 1](#) defines the common risks encountered during repair, field collection, storage, and transportation.

[Table 2](#) provides an overview of risks and recommended mitigation measures for fractions typically encountered in off-grid solar products.

[Table 3](#) defines the personal protective equipment (PPE) requirements for the handling of e-waste.

For more information on risks and mitigations, see also:

- GOGLA E-Waste Toolkit, Module 1: an Introduction to E-waste ([Introduction to Recycling | GOGLA](#))
- Operational guidelines for handling used batteries in the off-grid solar sector, Sofies ([Operational guidance for battery handling | Sofies, 2021](#))

Table 1: Common risks across the e-waste management chain

Risk type	Risk level
<b>Repair Risks</b>	
Technicians are not properly trained on health and safety risks (see Table 2), and how to mitigate them.	HIGH
Technicians do not use personal protective equipment (PPE) (see Table 3).	HIGH
Technicians do not have working tools.	HIGH
Technicians do not have a designated workspace.	HIGH
There is no clear record of products being repaired, parts being removed or swapped.	MED
Technicians dismantle products onsite (this can expose them to hazardous components that need to be properly managed).	MED
Technicians dismantle battery packs.	HIGH
<b>Field Collection risks</b>	
People collecting waste from the field (such as sales agents) are not trained on how to mitigate or identify hazards in broken products and how to safely transport them.	MED
Products are not protected to avoid further breakage.	MED
<b>Storage Risks</b>	
There is no dedicated storage facility or room.	HIGH
The products are not sheltered from direct sunlight, heat and rain.	HIGH
Products are not stored in an organised manner (ie. Products and components are not segregated).	MED
Containers are not clearly labelled.	MED
There are no security systems in place such as cameras or entry log: products can be stolen.	MED-HIGH
There is no fire security plan	MED-HIGH
Lithium Batteries are not fully discharged prior to storage.	HIGH
Lithium Batteries are not stored in the appropriate containers.	HIGH
Lithium Batteries are not stored separately.	HIGH
Products are not stored in a way to avoid further breakage.	HIGH
Broken and leaking products are not stored separately.	HIGH
The floor is of a permeable material or cannot be easily cleaned.	MED
There is no record of products coming in and out of the facility.	HIGH
<b>Transportation Risks</b>	
Handlers are not trained on how to identify hazards in broken products and how to safely transport them.	HIGH
The truck does not have a permit for the transport of hazardous waste.	HIGH
The truck is not labelled with appropriate signage.	MED-HIGH
Other materials are transported at the same time as e-waste.	MED-HIGH

Products are not protected to avoid breakage.	HIGH
Lead Acid Batteries are not transported in pallets.	HIGH
Products are not packed with leakage absorbent materials (such as layers of cardboard between battery pallets).	HIGH
In the case of longer trips, such as transboundary travel, batteries have not been stored for a long time before (they should be stored long enough to help ensure they are fully discharged).	MED-HIGH
<b>For transboundary movement</b>	
Components and fractions are not segregated and stored appropriately.	HIGH
Transboundary processes and notifications documents are not complied with at all stages.	HIGH

Table 2: Typical risks for traditional solar e-waste fractions

Category	Fractions	Dangerous components	Risk Description	Example of Mitigation Measures
<i>High Risk Components</i>				
Batteries	Lithium-ion	Toxic and Flammable Substances	Lithium-ion batteries can easily <b>rupture, ignite, or explode</b> when exposed to high temperatures, or direct sunlight.	Avoid any damage to the cells.
				Do not dismantle battery packs.
				Cover the poles of the batteries with insulated tape.
				Storage area should be sheltered from heat and rain.
				Always store in a separate area of the warehouse, to mitigate the risk of fire spreading in the event of an incident.
				Discharge batteries before storing.
				Store in their original product (i.e. not removed) or in a plastic drum between layers of sand
	Lead Acid (Pb)	Lead and Battery Acid	Lead becomes dangerous if it is disturbed, such as when the case is opened (creating Lead dust) as	If undamaged, these should be transported whole to the recycler
				Keep out of direct sunlight.

			part of the dismantling process.	Wet batteries should be drained, and the acid stored in secure bins
				Sealed batteries should not be opened.
				Batteries should be kept on a permeable surface.
<b>Flat Panel Displays</b> (TVs, etc.)	LCD screen backlight tubes.	Mercury	<b>Leakage :</b> Backlight lamps are often broken due to transportation, and there is risk of mercury leakage.  <i>* Many of the TVs used with off-grid solar products, however, are a newer version that use LED backlighting which does not contain mercury.</i>	Avoid breakage.
				After the backlight tubes are removed from the TVs they must be stored in closed containers to prevent emissions.
<b>Lighting</b>	CFL	Mercury if broken	<b>Leakage</b>	Avoid breakage Store in sealed barrels
	LED	Metals	<b>Injury</b>	Store in bags or crates
<b>Medium Risk Components</b>				
<b>Cables</b>	Low Quality PCBs	Dioxins, furans	HIGH risk if burning to retrieve metals, LOW risk if appropriately handled.	Ensure it is stored and transported to a legitimate recycler.
				Personal protection equipment like goggles and gloves should be worn as splints can snap around while using a side cutter.
<b>PV Panels</b>	PV cells	Toxic substances	Leaking	Store in pallets
	Glass		Breakage and Injury	
	Aluminium frame		Injury	In non-established markets, these are often stripped and handled separately – this should generally be avoided.
<b>Low Risk Components</b>				
<b>Plastics</b>	Any with BFR	Brominated flame retardants (BFRs).	Extremely hazardous if ingested or leaked to soils and water.	Ensure it is stored and transported to a legitimate recycler.

			High environmental risk if not recycled.	
	PVC	Often heavy metals such as lead and cadmium.	Contamination and leakage.	Ensure it is stored and transported to a legitimate recycler.
<b>Printed Circuit Boards (PCB)</b>	Low quality PCBs is often used in solar products.	Toxic components: dioxins, furans	Extremely hazardous for workers and the environment if burnt or stripped with acid.	Ensure it is stored and transported to a legitimate recycler.

Table 3: Common personal protective equipment (PPE) standards for handling e-waste

- ☐ **Chemical resistant and sturdy gloves** to protect hands from cuts, harmful dusts and chemicals.
- ☐ **Safety glasses** to prevent dust and debris from entering the eyes during dismantling.
- ☐ **Coveralls** to protect against dust. These should be removed after exiting the facility to avoid transferring dust and chemicals to other areas.
- ☐ **Work boots** to protect against heavy objects falling and sharp punctures from dismantled sections.