Responsible Lead-acid Battery Recyclers in Low- and Middle-Income Countries

A positive listing for Nigeria

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1 Background

This document provides information on recyclers of used lead-acid batteries (ULABs) in low- and middle-income countries that have been found to be most advanced sector players with regards to emission controls, occupational health & safety and industrial hygiene in their respective country. This positive listing was motivated by substantial concerns around unsound practices in ULAB recycling, which commonly have severe and partly life-long health impacts for affected persons, most commonly the facilities' workers and communities living and working in surrounding areas. Exposure to lead is known to be a severe health risk and it is estimated that around 1/3 of all children are subject to elevated lead-in-blood levels (UNICEF & PureEarth 2020). While there are various pathways for lead exposure, lead-acid battery recycling can – in the places where such processes are conducted in an unsound way – be a very severe form of lead emissions causing short-, medium and long-term exposure. The challenge of unsound lead-acid battery recycling is most pronounced in emerging economies where economic growth, population increase and changing consumption patterns lead to rapidly growing battery volumes, while waste management and recycling systems have not yet adapted to best available practices.

The facilities listed in this document have been assessed by independent experts under the scope of the project Partnership for Responsible Battery and Metal Recycling (ProBaMet) and have been found to operate in line with the following principles:

- Meet all applicable regulations in the respective country/region;
- Operate significantly above the commonly encountered industry practices in their respective country;
- Comply with a minimum set of requirements listed in section 3;
- Being committed to continuous improvements with a view to full compliance with all established good practices as laid out in the Standard Operating Procedures within 3 years.

2 Recommended Recyclers

The following ULAB recycling facilities have been identified to operate at standards that are significantly above commonly encountered practices in their respective country and to comply with the set of minimum requirements listed in section 3. In addition, they committed to continuous improvements with a view to apply best available practices.

Company name	**Country & region**	**Facility location & contact**	**Assessment details**
Green Recycling Ltd.	Nigeria, West-Africa	Agbara, Ogun State, Nigeria 6°32'05.6"N 3°05'28.5"E https://www.greenrecycling.ng/	1st assessment: 18.04.2024 Additional visit: 10.09.2024

3 Methodology

The recommendations are based on facility assessments conducted by independent experts. The assessments use the Standard Operating Procedures for Environmentally Sound Management of Used Lead-acid Batteries as a reference document (Wilson and Manhart 2021). All assessments are documented in reports that are available for each assessed

company and the responsible environmental regulatory agency in the host country[1]. Additional information and evidence confirming the compliance with stated requirements may have been collected through further document exchange. The assessments confirm that the listed facilities comply with the requirements listed in the table below and areas for improvement highlighted in the assessment reports. In addition, the companies must be committed to continuous improvements with a view addressing any identified gaps in performance and to full compliance with all 37 Standard Operating Procedures (SOPs) within a timeframe stretching no longer than 3 years.

Facilities that have been assessed and found not to comply with the principles described above are not listed on this document.

No	Topic	Requirements
1	Location of plant	The recycling plant must be located at a site that minimises the risk of population lead exposure and/or environmental contamination (see SOP A.1.1).
2	Licences & permits	The recycling plant has all necessary business, environmental, health & safety licences / permits in accordance with the prevailing national and local laws (see SOP A.1.2).
3	Personal protective equipment (PPEs)	All operators must be provided with appropriate PPEs for their respective tasks. For factory workers, this must include protective boots, long sleeve works clothing, suitable respirators (at least FFP2 / N95) and gloves. Depending on the specific positions, this may also involve further PPEs such as googles, helmets and ear defenders (see SOPs A.2.1 and A.2.2).
4	Factory layout and floor	All ULAB recycling steps must be conducted in one or more factory halls that shelter the lead containing materials and processes from wind, rainfall and storm water. The floor of all halls and its immediate surroundings (at least 5 meters from the outer walls of each hall) must consist of a smooth impermeable cover/paving. The floor must not be broken and uneven and shall allow regular wet cleaning (e.g. with ride-on sweepers). A channel system must be in place and kept free from sludge, blockages, and interruptions. The system must capture all effluents and liquids and channel them to an appropriate treatment plant. Appropriate treatment may be an effluent treatment plant (ETP) in areas prone to acid leakages and settling ponds for rainwater to capture lead dust particulates. The factory halls and their immediate surroundings must be kept free from any unnecessary material and equipment. Necessary material and equipment must be stored in clearly assigned areas that are demarked as such.
5	Housekeeping & dust control	The factory and its immediate surroundings must be kept clean and dust free all of the time. Cleaning shall by no means use brooms or any other means that generate dust. A sound factory layout and floor cover, as well as a well organised facility (incl. immediate surroundings) are a crucial precondition for effective housekeeping (see aspects above).
6	Sourcing strategy	The sourcing strategy shall be no means encourage the delivery of dry (drained) lead-acid batteries and the factory management must be able to demonstrate that at least 50% of the received ULABs arrive complete with acid. This percentage value is considered as a low value and shall be increased stepwise by increments to >90%.

[1] Respective reports contain detailed information about recycling and business practices and are therefore sensitive in nature and not suitable for publication. In case a third party would like to get insights into these reports, they should send a request to the respective company. The requested company may grant access to the reports but is not obligated to do so.

7	Controlled battery breaking	Battery breaking must either refer to semi-automated or fully automated systems. Manual battery breaking (cutlasses, axes etc.) is unacceptable. More information can be found in SOP B.2.1. In case of semi-automated processing (battery saw), the system must be fully encapsulated and equipped with a conveyor so that operators cannot get into contact with acid and the battery blades.
8	Encapsulated and ventilated furnaces	All furnaces must be encapsulated or covered with a fume hood. The systems must be ventilated to an off-gas treatment system with a baghouse filter plant. The housing / fume hoods must be designed in a way and with sufficiently strong suction to capture all fume and dust during charging, smelting and tapping of the furnace. (see SOP B.4.1, B.4.2 and B 4.3).
9	Automated charging	Furnace charging should only be conducted by either fully automated or semi-automated methods in line with SOP B.2.5. In case semi-automated methods are used (e.g. forklift truck) the driver's cabin must be fully encapsulated and equipped with a High-Efficiency Particulate Air filter (HEPA-filter) protecting the operator from fume and dust generated during charging.
10	Complete off-gas treatment system with well controlled recycling of captured dust	Off-gas treatment systems installed at furnaces shall consist of cooling towers baghouse filter plants, a wet scrubber and a stack (see SOP B.4.1). The systems must be monitored and maintained (see SOP B.4.2). Captured filter plant dust must be protected from wind and rainfall and workers should never come into direct contact with this dust (see SOP B.4.3).
11	Casting of refined lead	Casting must refer to an automated casting machine. The casting temperature must be controlled and kept below 500°C all the time (see SOP B.2.9).
12	Storage and management of slags	Smelting/furnace slags must always be stored in fully sheltered systems (paved and impermeable floor, walls, and a roof) that shelter all slag material from wind and rainfall and effectively prevents any dissipation in the nearby surroundings. Slags must be disposed of in a well-controlled manner at a secure licensed hazardous waste disposal facility in line with national legislation. Evidence of sound slag disposal must be kept and provided upon request at inspections (see SOP B.4.4).
13	Effluent treatment	There must be an effective system to capture all liquids/effluents from the operations. Electrolyte (battery acid), process and cleaning water must be channelled to an effluent treatment plant (ETP), where it is treated with particulate and heavy metal removal and neutralisation. Rainwater from the factory roof and immediate surrounding must be channelled to a series of settling ponds allowing particles to settle. Particulate sludge from these ponds must be recycled through the furnace (see SOP B.4.5).
14	Cleaning of plastic cases	Recycling of plastic cases must involve various washing steps, including at least one using an alkaline solution to effectively remove all lead and lead-oxide before plastic is passed-on to further operators (see SOP B.3.2).

Link to SOPs: https://www.sustainable-recycling.org/wp-content/uploads/2022/04/ULAB_recycling_SOPs.pdf

4 Thematic scope

The information provided solely covers the recycling of used lead-acid batteries in the assessed facilities. It entails information about best performing recyclers for ULABs in their region, which can subsequently be recommended as preferable disposal options for ULABs that arise from domestic battery use in that geographic location. In addition, raw materials generated from the ULAB recycling activities of the listed facilities can be considered as the most responsibly generated secondary raw materials from ULABs in that specific region. However, this does not necessarily imply that a listed facility complies with all requirements and standards established in other regions.

It is noteworthy that the provided information and assessments solely cover ULAB recycling streams and are not applicable to any other waste management and recycling activities performed by the listed or any other companies and facilities.

The provided information is facility specific in a way that the evaluations are only valid for the assessed facilities. In case a listed company maintains one or more other ULAB recycling facilities, no information can be extrapolated from the assessments to these other facilities. No guarantee can be given for the completeness of the list. There may be other recycling plants in the countries mentioned which, for various reasons, have not yet been audited or are not known.

Geographic scope

To date (September 2024) assessments have been carried out in Nigeria, West-Africa.

5 Contact

The information on this document was developed and compiled under the ProBaMet project through Oeko-Institut and the Platform Lead. Inquires can be sent to probamet@oeko.de.

List of References

UNICEF & PureEarth (Ed.) (2020): The Toxic Truth: Children's Exposure to Lead Pollution Undermines a Generation of Future Potential. Available online at https://www.unicef.org/media/73246/file/The-toxic-truth-children%E2%80%99s-exposure-to-lead-pollution-2020.pdf, checked on 7/12/2024.

Wilson, B.; Manhart, A. (2021): Standard Operating Procedures for Environmentally Sound Management of Used Lead-acid Batteries. Available online at https://www.sustainable-recycling.org/wp-content/uploads/2022/04/ULAB_recycling_SOPs.pdf, checked on 7/12/2024.