Safety practices and awareness of Lead Acid Battery Recyclers in Addis Ababa, Ethiopia

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1. INTRODUCTION

Lead (Pb; Plumbium) is a heavy metal with a bluish-grey colour. It is ubiquitous and can be found everywhere around our work environment, the soil, the air, food, dust, water, at home, as starter for vehicles, fuels, industries, and other parts on which human being exists. It enters into the human body in different forms such as through ingestion, inhalation, or dermal contact (1,2).

Occupational safety malpractices are currently the cause of many workplace diseases and injuries throughout the world, particularly in developing countries. Unsafe work practices among high risk industries for workers exposed to heavy metals like lead, mercury and cadmium have nowadays become a global concern (3). Lead poisoning happens to the working population; hence, has an implication in the country's economy. Lead poisoning results in multi-organ and system malfunctioning including kidney, liver, central nervous system, blood circulation and others. Recent studies have revealed that lead poisoning can result in renal problems, Intelligence Quotient (IQ) reduction, hematologic effect, gastrointestinal problems, birth defects, and many others (4-6).

Possible sources and occupations for lead poisoning include: lead in paint, lead in petrol, welding, decorative paints, electricals and lead acid battery recyclers among others. The battery industry is the largest consumer of lead, using an estimated 80% of the global lead production (7). It is one of the high risk industries for lead poisoning (8).

Though studies might have been conducted on the area already, still, there are limited publications concerning lead poisoning in Ethiopia. Nationally, it needs great attention like in any other part of the developing world. Lead acid battery recycling is one of the sources of income for many households and people. The battery recycling industries need great attention especially with regards to safety.

2. STUDY OBJECTIVE

The main objective of this study was to assess the safety practices of lead acid battery recyclers, threats to human health and the environment that can be posed by the recycling industry in Ehtiopia.

The specific objectives of this study include:

- To assess the current status of lead acid battery recycling in Ethiopia;
- To see what problems the workers are facing in the recycling industry;
- To assess what safety measures were taken during lead acid battery recycling; and
- To assess the awareness level of lead acid battery recyclers.

3. METHODOLOGY

3.1. Study Area and Period

This study was conducted in Addis Ababa, the capital city of Ethiopia. It is located between 9°1′48″N 38°44′24″E coordinates (Fig.1) and lies at an altitude of about 2,300 meter above sea level. Data collection was conducted from March-May, 2015.

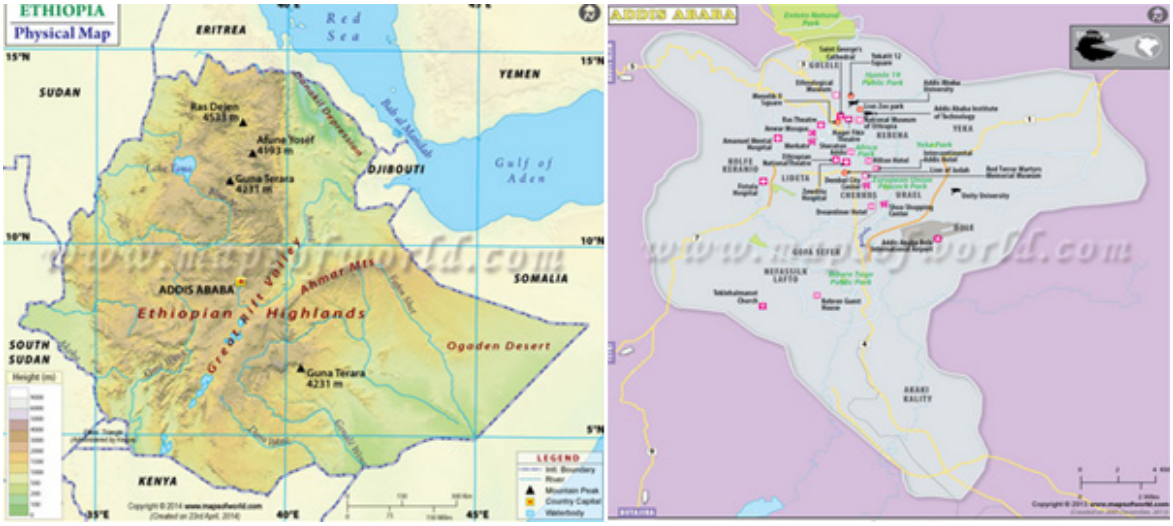

Figure -1: Map of Ethiopia (left) and Addis Ababa (right),from which the data was collected.

3.2. Data Collection Tools and Instruments

Qualitative methods were used to assess the safety practices and awareness of lead acid battery recyclers in Addis Ababa. PAN-Ethiopia collected data from seven informal Lead Acid Battery Recyclers in Addis Ababa from March-May 2015. The data collection tool used was observation supported by informal conversation based on the willingness of the owners and workers. Pictures and videos were also taken, but only at the spots where the team got permission by the owners and/ or workers of the recycling centres. A total of 14 workers and owners of these enterprises participated in this study.

4. RESULTS

4.1. Distribution of Used Lead Acid Battery (ULAB) Recyclers

Many[1] small scale lead acid battery recyclers could be identified in Addis Ababa that are mainly dependent on this work for their livelihood. Most of the recyclers were working at the backyards of their residential houses. This fact shows the possibility of increasing exposure to lead for their families. PAN-Ethiopia managed to observe seven small scale Lead Acid Battery Recycling Centres at different corners of Addis Ababa. Most of them claimed that they established the recycling centres by themselves and have been working there for many years.

4.2. Sources of ULABs

The sources of primary batteries in Ethiopia could either be production within the country or import from abroad. The sources of ULABs were from different battery brands which have been used in Addis Ababa or other towns in Ethiopia and brought for recycling. Various types of either imported or manufactured primary or repaired batteries were also available in the market. The available brands include: Awash battery, Konjo battery, 3k battery, Quantum battery, GS battery, Nextera battery, Yokohama battery, Solite battery, Long age battery and ES battery. Awash and Konjo battery brands are manufactured in Ethiopia. Most of the other battery brands mentioned were manufactured and imported from Japan. The imported primary batteries were found in adequate amounts

[1] It is difficult to estimate the number of recyclers as it is part of informal business mostly found at the backyards of residential homes.

while the locally manufactured ones were found to be few because, as per our informants, these local manufacturers were not active in the market anymore when the data collection was carried out.

There were three main sources of ULABs for small scale lead recyclers. These sources include: a) individual car owners who change their used batteries with new ones and sell their old batteries, b) informal ULAB collectors and c) ULAB traders who purchase large amount of ULAB from companies and sell it in bulks to recyclers.

4.3. **Processes in Recycling of ULABs**

The main activities in the small scale ULAB recycling centres include: smelting of lead bar[2] that leads to high lead emissions in the form of smoke (Fig. 2), joining and adjustment of positive and negative plates bare handed, fitting different components into the main battery container, preparation of electrolyte[3] which is a mixture of sulfuric acid and water and filling of this electrolyte without proper protection (Fig. 3).

Figure- 2: Smelting of lead in a small scale LAB repair shop to join the two opposite poles.

[2] A piece of bar that can be built to have a triangular shape (as held by left hand on fig.2) by liquefying the lead rod via exposing it to extreme hot temperature.

[3] The electrolyte in this case is the solution capable of conducting electric current and is made by mixing concentrated sulfuric acid with water.

Figure-3: Mixing sulfuric acid with water to transfer it to the battery in an unsafe manner- without protective gloves.

4.4. Safety Awareness and Waste Disposal System in Repair Shops

The level of awareness of owners and workers about lead poisoning was low and they were observed working in unventilated and confined area without using proper personal protective devices. In all of the seven centres, neither a proper solid and liquid waste management system nor proper washing facilities for workers were established.

During the entire process of repairing LABs, PAN-Ethiopia observed the following common problems to all repairing shops:

- lead bar smelting,
- untidy working conditions (Fig. 4);
- highly congested and confined working environment (Fig.5);
- lack of ventilation system and exhaust outlet;
- lack of occupational safety and health training and orientation;
- shortage of washing facilities;
- lack of supervision for workplace safety;
- high emission of lead dust;
- unsafe disposal of lead and acid wastes in the vicinity of workplaces;
- manual operation of sulfuric acid bare handed;
- lack of all the necessary personal protective equipment (PPE); and
- poor lighting system.

Smelting the lead bar is the most frequent activity in LAB recycling which creates smoke that contains high proportions of lead.

According to the environmentally sound management plans in the preparation of the ULABs in the context of implementing the Basel convention[4], the use of PPE is mandatory. Nevertheless, none of the repair men (except one single worker) was observed using face masks/shields, hand gloves and/or a respirator. The repair shops were also not ventilated.

Figure - 4: Lead dust thrown dumped near the gate of the compound that would possibly be taken-up by workers' shoes, hands and other body parts.

[4] it states that "…any degree of ULAB recovery operation will produce effluents, dust, discharges and residues…" and measures such as plantation of process ventilation systems; personal safety equipment ; washing and eating facilities and medical surveillance program" should be taken to minimize any potential adverse occupational and environmental impacts…..".

Figure-5: Temporary storage of lead acid batteries in small scale industries, showing scrambled working environment.

4.5. Flow of ULABs

Repair shops and ULAB collectors play a vital role in the flow of lead acid batteries. Figure-6 below shows the flow of ULAB in the market. As per the informants, large scale transport enterprises provide ULABs for auction. Mostly the participants that buy these ULAB materials come from Merkato[5] in a specific place called 'Minalesh-Tera'[6] near 'Tekle-Haimanot' church where all other second hand material could be sold and bought. Then, these auction winners will in turn give it to various individual recyclers ('customers') found in different corners of the city.

In some cases, secondary batteries are used for emergency purposes by individual car owners. Both, sellers and buyers however agree that the batteries have short life span in general.

[5] Merkato is the largest open air market in Addis Ababa.

[6] Minalesh-tera is a place in Merkato where transaction of second hand materials takes place.

Figure-6. Flow of used lead acid battery in the local market.

5. DISCUSSION

In Ethiopia, there are large numbers of small scale lead acid battery recycling industries. The result of this study showed that the recycling industries in Ethiopia are not well organized and had lots of problems including untidy and congested working environment; high emission of lead dust followed by lack of ventilation system and local exhaust outlet; unsafe waste disposal system; poor lighting systems; and unprotected manipulation of battery plates and filling of battery with sulfuric acid. However, in some African countries, these industries are found in an integrated manner (e.g. in Ghana it is carried-out with various types of furnaces) (9). According to participants of this study, there was no integrated medium level or large scale enterprise involved in such activities in Ethiopia. Furthermore, substantially increasing numbers of small scale enterprises were believed to exist at every corner of Addis Ababa.

The level of awareness of the workers and owners in these small scale LAB recycling industries about lead poisoning was so low that they didn't take any protective measure to avoid exposure.

There are various health hazards associated to battery work. These include: electrical hazards, fire and explosion hazards, chemical hazards systemic ailments (10). Workers and managers should be trained and should have enough information about lead poisoning. Besides, employers are responsible to provide the necessary Personal Protective Equipment (PPEs), undertake proper supervision in workplaces and provide proper washing facilities (11). Furthermore, installation of ventilation systems and housekeeping should be in place to minimize workers' exposure to lead. The government is authorized to ensure the implementation of provisions under national legislations related to safety and health at work (11). However, this is highly limited in practice.

In the developed world, an environmentally sound management of lead and sulfuric acid is practiced as per the requirement of international standards. These battery recycling enterprises have either their own way of neutralizing sulfuric acid in the field in an environmentally sound manner or transfer it to waste management companies (12). However, in Ethiopia, these wastes form used lead acid batteries are carried out in an environmentally unsound manner. As to the knowledge of PAN-Ethiopia, there is no study conducted in the area on safety awareness pertaining to lead poisoning. Therefore, much is expected to be explored in the area.

6. CONCLUSIONS

Generally, lead smelting and battery recycling is conducted in small scale informal sector in Ethiopia. The following conclusions were drawn from the findings of the study:

- There is highly limited awareness about lead poisoning;
- There is poor occupational safety and health practice;
- Enforcement of regulations by the government on informal work place safety issues is still weak;
- Workers do not use PPEs while performing their activities;
- No provision of hygienic facilities;
- The working sections were unventilated, confined rooms with difficulty to see materials, and messy work environment that puts workers under many electrical, chemical, fire and explosion hazards;
- There is no defined and well known established downstream market for lead wastes; and
- There is no treatment and discarding system of wastes containing lead and sulfuric acid.

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