National Strategy for Used Lead Acid Battery (ULAB) Recycling in Bangladesh

A Sustainable Strategy for ULAB Waste Management

Report By

Environment and Social Development Organization – ESDO

In Association with

United Nations Environment Programme - UNEP

NATIONAL STRATEGY FOR USED LEAD ACID BATTERY (ULAB) RECYCLING IN BANGLADESH

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Environment and Social Development Organization-ESDO

House# 8/1, Level# 5, Block# C, Lalmatia, Dhaka-1207, Bangladesh

Phone: 880-2-912-2729 Fax: 880-2-913-0017, E-mail: info@esdo.org

URL: www.esdo.org, www.facebook.com/esdobd

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Table of Contents

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Acronyms

ADB	Asian Development Board
BUET	Bangladesh University of Engineering and Technology
DoE	Department of Environment
DGHS	Directorate General of Health Services
ESDO	Environment and Social Development Organization
ESM	Environmental Sound Management
GDP	Gross Domestic Product
HSE	Health, Safety and Environment
Icddr,b	International Centre for Diarrhoeal Disease Research, Bangladesh
ILA	International Lead Association
IPS	Integrated Power System
LAB	Lead-Acid Battery
MoEFCC	Ministry of Environment, Forest and Climate Change
NBR	National Board of Revenue
Pb	Lead
SLI	Starting, Lighting and Ignition
SRO	Statutory Regulatory Order
ULAB	Used Lead-Acid Battery
UNEP	United Nations Environment Programme
UPS	Uninterruptible Power Supply
WLAB	Waste Lead-Acid Battery

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Executive Summary

Among many issues related to the burning concern of environmental pollution, toxic chemical impacts are gradually drawing attention to global and national policies. One such rising concern is the ramifications of the impacts of recycling lead and used lead acid batteries (ULAB)[1]. This category of batteries has long been used because of its efficiency for storing energy over long periods. Since the ULABs are recycled and reused in several sectors in Bangladesh due to the high demand, there is also an association with a great deal of lead pollution in soil and water that ultimately causes harm to human health and the environment. The lead pollution is attributed to unsafe, informal, illegal, and unregulated ULAB recycling facilities that have been established all over the country.

Target audience

This report is designed for policymakers considering the introduction of measures to reduce consumption by making goods last longer and to improve the management of ULAB in Bangladesh.

Structure

The assessment starts with an overview of the global and regional trends of lead-acid battery production, consumption and end-of-life management. The assessment continues by examining the environmental, social and economic impacts of the mismanagement of battery waste, generated from the formal and informal sectors of used lead-acid battery recycling.

The study then presents the recent conditions in terms of waste management and public awareness, followed by a strategy for policymakers looking to reduce lead pollution from the lead-acid battery in the concluding chapter.

Why we need to change

The Ministry of Environment, Forest and Climate Change of the Government of Bangladesh published a gazette to implement "Used Lead-acid Battery (ULAB) handling and management rules" in 2006; where the prior environmental certification is required before recycling any ULAB. However, a study by icddr,b (2021) reveals that almost half of the industry's lead supply is sourced from ULABs that are recycled by informal small enterprises. Though the 2006 rules on ULAB cover most aspects of ULAB management, there exist some gaps that needed to be addressed. Hence, the Department of Environment (DoE) drafted an amendment to the rules in 2018 which is now under review.

After careful consideration of the 2018 draft and comparing the relevant laws, regulations, and guidelines from other countries with similar cultural, economic, social, and demographic conditions to Bangladesh, there are still some gaps in the draft rules, summarized below.

Key gaps in the existing SRO:

(a) **The Mismanagement of Recycling:** There is no proper management of and implementation of the Rules relating to LAB and ULAB in Bangladesh.

[1] Used lead-acid batteries (ULAB) and waste lead-acid batteries (WLAB) are defining the same type of hazardous waste, focusing on the waste part of the life cycle of batteries. They are often used interchangeably.

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(b) **Safe Handling of Toxic Components:** ULAB contains certain toxic components such as lead and dilute sulfuric acid, which are required to be handled safely but which is not properly addressed in Bangladesh.
(c) **Prohibiting Child Involvement:** There is no current age limit for labors. There needs to be an age limit for working in ULAB processing units.
(d) **Public Health and Environmental Exposure:** No mention of public health and environmental exposure measuring procedure or safety related clause.

As a result, there is now a need for appropriate legislation for battery handling, transporting, and end life management systems in Bangladesh. For this purpose, the government needs a strategic plan to follow and establish an environmentally sound management system throughout the country.

Key findings and recommendations

Bangladesh is believed to have more than 1,100 informal and illegal ULAB recycling operations across the country. To date, 270 of these locations have been identified and assessed by environmental health professionals from Pure Earth and the Department of Geology of the University of Dhaka. These assessments reveal high concentrations of lead surrounding, informal ULAB recycling operations and severe public health risks to nearby residents. The environmental and demographic data captured through these assessments is publicly available in an online database at www.contaminatedsites.org. Based on these findings, informal and unsound ULAB recycling is believed to be a significant contributor to population lead exposure across the country and the primary contributor to lead pollution hotspots.

The average concentration of lead in children's blood in Bangladesh is estimated to be among the highest in the world at approximately 8 micrograms per deciliter (µg/dL). This concentration is significantly above the "reference level" of 5 µg/dL that triggers government intervention and case management for a child in the United States. A recent meta-analysis suggests that nearly 28.5 million children in Bangladesh have blood lead levels (BLL) above 5 µg/dL, and that more than 21 million have BLLs above 10 µg/dL (Ericson, 2020). At these levels, it would be reasonable to expect significant IQ reductions among the tens of millions of chronically exposed children. It has estimated that 35.5 million children in Bangladesh are affected with blood lead levels above 5 µg/dL[2], making the country the fourth most-seriously hit in the world[3].

A study of the economic impacts from lead exposure estimates that each year Bangladesh loses US $15.9 billion dollars in GDP from reduced lifetime earning potential among the exposed population[4]. This figure includes only the lost earning potential due to IQ decrements, and does not include healthcare costs, lost earnings from premature death, or lost taxes from illegal ULAB recycling operations. Based on the extraordinary public health and economic toll, investments in lead exposure reduction programs in Bangladesh would likely yield significant returns on investment, resulting in a more productive, healthier and resilient population.

[2] The toxic truth-Children's exposure to lead pollution undermines a generation of future potential, UNICEF and Pure Earth, 2020. https://www.unicef.org/reports/toxic-truth-childrens-exposure-to-lead-pollution-2020#:~:text=Around%201%20in%203%20children,requires%20global%20and%20regional%20interventions
[3] https://www.thedailystar.net/country/news/lead-exposure-bangladesh-4th-worst-hit-terms-affected-children-1938673
[4] https://www.dhakatribune.com/bangladesh/2016/06/01/lead-exposure-costs-bangladesh-15-9-bn-year

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Given the broad range of possible actions to curb the mismanagement of used lead-acid batteries and to foster its of environmentally sound management lead-acid in Bangladesh, a 9-step national strategy has been proposed to the government that are looking to adopt similar measures or improve on current ones. The steps are given below:

1. **Target the most problematic areas**

Problematic areas need to be addressed and identified where used lead-acid batteries are recycled illegally by conducting a baseline assessment to identify the locations, as well as the current causes, extent and impacts of their mismanagement.

2. **Evaluate the appropriateness of possible actions**

Consider the best actions to tackle the problem (e.g., through regulatory, economic, awareness, voluntary actions, management procedure), given the country's socio-economic standing and considering their appropriateness addressing the specific problems identified.

3. **Assess sustainable development impacts of preferred options**

Assessment of the potential social, economic and environmental impacts (positive and negative) of the preferred short-listed instruments/actions. How will the poorest be affected? What impact will the preferred course of action have on different sectors and industries?

4. **Development and implementation of a stakeholder engagement strategy**

Identify and engage key stakeholder groups – retailers, consumers, battery manufacturers, industry representatives, local government, manufacturers, civil society, environmental groups and academia – to ensure a broad buy-in. Evidence-based studies are also necessary to counter any opposition from the battery industry.

5. **Raise public awareness**

Public awareness should be raised about the harm caused by toxic waste from a used lead-acid battery. Clearly explain the decision and any punitive measures that will follow.

6. **Capacity building for ESM of ULAB**

Trainings for government officials and other relevant actors (NGO, academics, etc.) need to be included for better understanding and to address the technical aspects required for the sustainable, safe and environmentally sound recycling of ULAB in a manner that minimizes occupational and population lead exposure. The training must include guidance on how to assess the environmental performance of recycling sites and evaluate associated public and occupational health risks. In this regard, training workshops can be arranged and formal guidelines can be issued specifying the responsibilities of all the key stakeholders.

7. **Financial incentives**

Provide support and incentives to industry by introducing tax rebates or other conditions to support its transition. Government will face resistance from the battery industry, including importers and distributors of LAB. Giving them time to adapt will help in this issue. Use revenues collected from

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taxes or levies on battery recycling to maximize the public good. Support environmental projects or boost local recycling facilities with the funds. Create jobs in the battery recycling sector with seed funding.

8. **Policy implementation plan and enforcement of regulations**

The regulation must be enforced at all levels. For such initiatives to be pragmatically successful, it is imperative to monitor the progress and effectiveness of the law and adjust or update the directives accordingly. It is important for governments to keep the public updated on the progress and benefits achieved, to continue building consensus and demonstrate accountability. It is advisable to review the policy instruments on a regular basis. In the case of law enforcement, these are critical to ensure that the prohibited recycling is not illegally carried out in remote areas.

9. **Carry out monitoring**

To adjust the chosen measures if necessary and update the public on progress monitoring processed should be introduced. For monitoring and supervision of the ESM of ULAB recycling, it is important to clearly define roles and responsibilities between local, national and sub-national authorities and organizations beforehand. To gather data on effectiveness, governments may consider including in the legislation a reporting obligation. Progress can be assessed in several ways, including Health, Safety and Environmental (HSE) audits, surveys, impact assessments and focus-group discussions.

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1. Lead and Used Lead-acid Battery Context

The lead-acid batteries were invented in 1859 by French physicist Gaston Planté and is the oldest type of rechargeable battery. One of the first applications of Plante's lead-acid battery was to power the lights in train carriages when it stopped in a station. Despite many potential alternatives that have been created since then, the traditional lead-acid battery remains today the most widely used source of grid electrical power, both for a range of electric powered vehicles and power backup systems. Rahimafrooz Limited introduced the first lead-acid battery into Bangladesh in 1954 and they are the pioneers of producing and selling batteries. The first LAB in Bangladesh was introduced for automobiles. After the revolutionary introduction of a LAB, it is now being used in many sectors.

In Bangladesh, at present, grid electricity is insufficient to meet the electricity demands of the country. The Government of Bangladesh declares in its vision to bring the whole country under adequate electricity access by 2021. At present, it is mainly rural people that are deprived of electricity. However, the Government of Bangladesh have initiated one of the world's most ambitious domestic solar energy programmes. The fact is that the energy storage media of choice is the Lead-acid Battery. Another major sector, which is using used Lead-acid Batteries, is the telecommunication sectors. A recent study spotted 59 lead-contaminated locations out of 147 battery recycling zones in six divisions of the country—Dhaka, Rajshahi, Khulna, Chittagong, Rangpur and Mymensingh[5] from telecommunication batteries. Lead-acid industrial batteries are very good storage media for large and medium industry power and energy usage. However, their use can directly affect the environment and health (see section 2) and there are potentially hazardous issues as well. So sustainable battery manufacturing is a necessity.

The Bangladesh Lead-acid Battery Buyers Directory provides list of Bangladesh Lead-acid Battery importers, buyers and purchasers who import lead-acid batteries in Bangladesh. Almost 377 Lead-acid Battery Buyers & Importers are now importing and 44 Lead-acid Battery Suppliers & Exporters are supplying lead-acid batteries in Bangladesh[6].

1.1 Definition

A standard lead-acid battery for starting, lighting and ignition (SLI) of vehicles has an average gross weight of about 14 kg, which consists of different components. An analysis of the different components (percentage by weight) in a used lead-acid battery was conducted at the laboratory of Chemical Engineering Department of Bangladesh University of Engineering and Technology (BUET) and the analysis of the result is shown below:

- Lead metal and metal oxides: 65%
- Cell separators, made of Polyester. Polypropylene or a fibrous glass mat: 7%
- Electrolyte (dilute sulfuric acid): 16%
- Plastic casting (or hard rubber casing for truck or large industrial batteries): 12%

[5] http://www.newagebd.net/article/32824/lead-acid-battery-recycling-poses-health-hazard
[6] https://bangladesh.tradeford.com/buyers/lead-acid-battery

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1.2 Life Span of ULAB

The useful battery life is defined as the period of time in which a battery is capable of being recharged and retains the charge. Once the battery is no longer capable of being recharged or cannot retain its charge properly, its lifetime reaches its end and it becomes a "used battery" for the application it was designed for. The main cause of this "death", as one might think is due to the irreversibility of the whole process, the battery's useful life is limited by the sulfation process of the paste. This begins when lead sulfate ($PbSO_4$) precipitates over the battery plates eventually reaching a point where the ions can no longer migrate from or to the plates in the electrolyte due to lead sulfate coating, and the reversible reactions, which produce the electric energy cease.

Under ideal conditions, an automobile battery can last up to six years or more, but several factors contribute to decrease this optimal lifetime:

(a) incomplete charging process;

(b) battery remains too long without use or stands a long time between two charges;

(c) hot weather: it increases the sulfatation process rate;

(d) deep discharging process, the deeper the discharge the less lifetime the battery will have;

(e) low electrolyte level: air exposed plates become sulfated immediately.

When all these factors are considered together, the battery life span ranges from 6 to 48 months, yet only 30% of all batteries actually reach the 48-month mark. However, some procedures may be adopted in order to extend the battery life:

(a) battery labeling should explain the correct procedures to prolong battery life, such as just adding distilled water or usage tips, thus providing information for consumers in order to avoid the above-mentioned problems;

(b) addition of additives in order to reduce the buildup of sulfates on the active surface of the plates, despite the fact that the use of additives may pose problems to the sulfuric acid recycling;

(c) adoption of new and improved recharging processes that may increase the battery lifetime.

1.3 Consumption

In Dhaka City, the most prominent battery recycling, and reusing areas like; Dholaikhal, Doyagonj, Sadarghat, Kakrail, and Mirpur were selected for a study to assess the current situation of the existing recycling procedure (Chakraborty and Moniruzzaman, 2017). As well as a survey involving approximately 106 battery recycling shops were identified, and 55 shops were surveyed in the five specified locations of Dhaka city in the same study. The outcome of this study showed that; i) two recycling processes were found which are named Direct, and Indirect recycling process in this study; ii) batteries used in ships, vehicles, generators, IPS, UPS, solar panels are recycled; iii) reconditioned batteries cost 30-35% of new battery iv) direct recycling process is not performed in a sustainable way v). Both shopkeepers and customers are mostly unaware of their contribution to environmental deterioration through this process, and Vi) determining the monthly collection, and selling a number of lead-acid batteries in each shop. In Dhaka city battery waste reusing, and recycling is mostly dealt with by the informal sector with suboptimal procedures resulting in lower recovery rates, and dangerous exposure to the environment, and adverse health risks.

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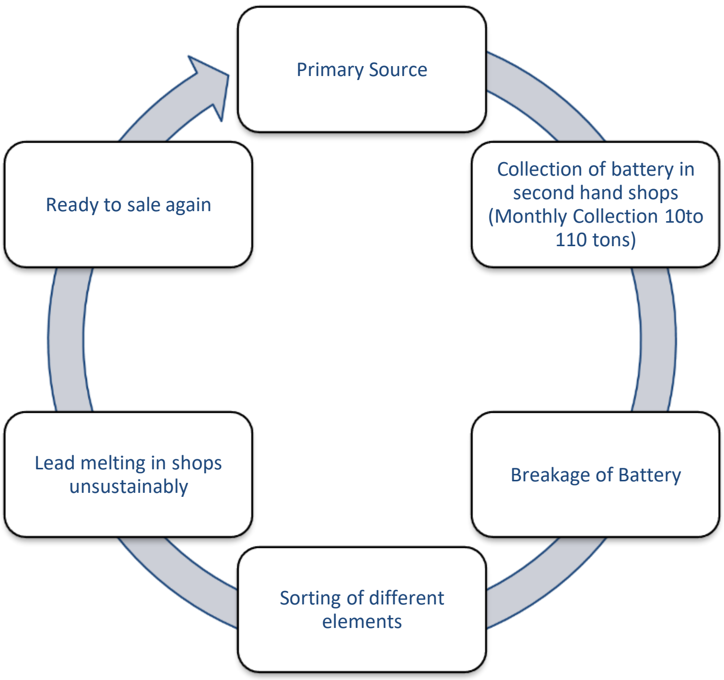
<u>According to ILA trade analysis report (ILA, 2020)</u>, The total amount of ULAB generated annually in Bangladesh is estimated to be in the region of 118,000 mt, and the various life cycles for each category of LAB and their respective applications. In addition to the domestic LAB replacement market of about 118,000 mt, the LAB industry sector also exports nearly 11,500 mt of automotive and industrial LAB indicating that the LAB manufacturing output from Bangladesh is in the order of 130,000 mt of LAB. The refined lead required to produce 130,000 mt of LAB is in the region of 78,000 mt. The ULAB generated annually will yield just over 70,500 mt of lead, leaving a shortfall of approximately 7,500 mt. However, in 2018 just over 19,400 mt of refined Lead was imported together with over 1,700 mt of lead scrap (normally lead scrap has a high lead content approaching 99%), a total of approximately 21,150 mt.

Without knowing exactly the tonnage of ULAB recycled in the formal sector, it is difficult to confirm the amount of ULAB recycled informally, but in the absence of any official lead production data or records of the capacities of LAB manufacturers licensed to recycle ULAB, the default position is that the informal sector may well be the major source of lead for the LAB manufacturing sector.

1.4 End of Life

From different studies, two recycling processes, which are namely Direct and Indirect recycling process, are found in Bangladesh. The direct recycling process mainly involve direct collection and smelting of waste batteries from different households and commercial areas by uncertified collectors (feri-wala). Whereas, the indirect process involves collection by the specified battery manufacturers and transport these waste batteries in their recycling facilities. Both direct and indirect processes have two similar steps : collection and breakage of battery. The direct process (informal recycling) is done in non-sustainable manner produces lead oxides and dioxide and some other harmful gases has bad impact on environment and human health. A general flow diagram of direct reusing and recycling process is shown below:

<u>Direct recycling process (informal recycling)</u>



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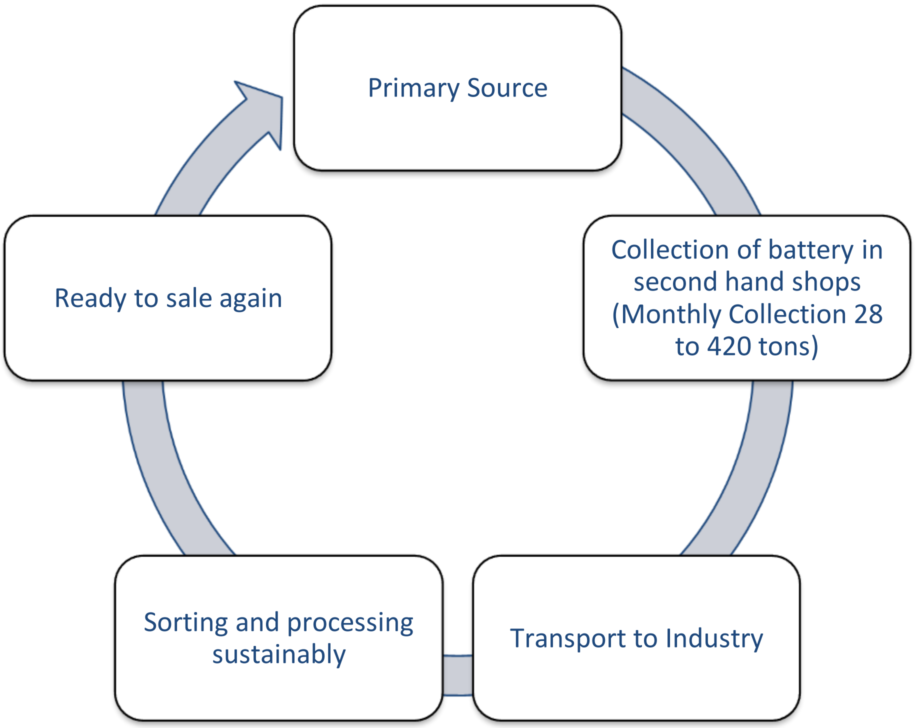
In case of indirect process (formal recycling), collected old lead acid battery and its parts are transported to industry for recycling according to the dealings between industry and second-hand old battery shop owners. The profit is bigger in the indirect process compare to the direct process because of big amount of sale in indirect recycling process. A qualitative flow diagram of indirect reusing and recycling process is shown below:

Indirect recycling process (formal recycling)



In Bangladesh, 19 companies that either manufacture LAB, recycle ULAB, or are integrated and perform both operations are registered with the Government. In this list of companies, Rahimafrooz Batteries Ltd is the largest lead-acid battery manufacturer in Bangladesh and the main exporter to overseas markets. The company has the largest recycling plant in Bangladesh. On the other hand, Panna Group and Hamko Group are also major recyclers of ULAB in Bangladesh.

2. Informal ULAB Recycling in Bangladesh

The informal economy represents a substantial portion of Bangladesh's workforce and productivity. Small-scale picking, sorting, cleaning, trading and processing of inorganic recyclables is traditionally tolerated in Bangladesh without official authorization. Authorities are tolerant as the informal recycling sector helps reduce the volume of waste disposed of in landfills. Informal recycling is also acknowledged in the national *Reduce, Reuse and Recycle* strategy as an important source of income for the urban poor. The decentralized nature of the informal economy poses regulatory challenges which have implications for environmental quality and health. Because unlicensed ULAB recycling is illegal, it is conducted in secret, outside of the view of law enforcement, and thus regulators cannot enforce other standards related to pollution control and worker safety.

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Why Informal ULAB Recycling Exists:

Informal ULAB recycling is predominately found in developing countries or nations in economic transition[7]. The following points are key contributor to this situation:

1. Lack of official inspection and enforcement
2. Inadequate licensing procedures
3. Licensed smelters are too far away or abroad
4. ULAB can be reconditioned/recycled easily
5. Licensed smelters do not pay a fair price for ULAB
6. Formal recyclers have to pay VAT/GST for ULAB, informal recyclers do not need to do so, which is more profitable for them

According **International Labor Organization (ILO)** report on Bangladesh, 87 per cent of the labour force is employed in the informal economy. Those working in the informal economy include wage labourers, self-employed persons, unpaid family labour, piece-rate workers, and other hired labour. The huge scale of vulnerable employment presents a challenge to stable and sustainable development as the workforce in this sector usually engages in activities which are unregulated, unrecognized and "low productive" in nature. This indicates the reason of existence of informal recycling sectors in Bangladesh. In addition, a high incidence of poverty and severe decent work deficits increases the tendency for informal or illegal working options (Bangladesh Economic Review, 2019).

Approximately one quarter of thes sites (more than 250 individual recycling sites) have been identified and assessed through the Toxic Sites Identification Program (TSIP). Most of the informal ULAB recycling activities are often carried out in or near residential communities where lead dust can accumulate in high-risk areas such as paths, roads, sports fields, playgrounds, schools, homes, and other areas where dust is likely to be agitated and then ingested or inhaled. The breaking of lead-acid batteries and the disposal of associated wastes can release lead into water, although contamination of groundwater with lead does not appear to be a common issue due to non-solubility of the lead released during the recycling process.

The plots of land used for smelting are typically leased from local owners and are not valuable for agricultural production. Recyclers tend to offer relatively high rates for the land and do not always disclose their intended use. News reports suggest that such smelting operations also take place in homestead forests away from dwellings (Rahman, 2018), residential areas within small towns (Alam, 2015), abandoned poultry farms (BDnews24, 2019), flour mills and filling stations (Prothom Alo, 2016). During the day, operators break and sort battery parts, while smelting is conducted secretly at night. A mid-sized informal smelter typically employs 8-10 people (Hossain, 2019), and child labor is prevalent in the breaking, sorting and furnace preparing activities (Ahmed & Hasan, 2020). In terms of wages, the smelting expert is paid the highest wage, at 600-1300 taka per night. Other workers can earn 400-500 taka per day (Prothom Alo, 2019), but the earnings can vary by tasks. For example, unloading of batteries from trucks/boats can pay 1.5 tk./kg while loading of lead ingots pays 9 tk./kg.

[7] Personal communication, Brian Wilson, ILA.

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Children involved in breaking batteries can earn 4.5 tk. per kg of recovered lead, and typically extracts 30-40 kg daily (Ahmed & Hasan, 2020).

While locals are often aware and tolerant of the ULAB piles stocked for breakage/separation, they often object to the night-time smelting activities due to smoke and acidic smells. The most visible impact triggering local protest against smelters is the death of domestic cows and goats living near the site. Lead ash contaminated grass and other feed can be fatal for these animals and has resulted in large numbers of deaths within a short period (Farazi, 2019; Prothom Alo, 2016; and Rahman, 2018). Protests and complaints to local authorities at times result in dismantling furnaces either officially (Uddin, 2019) or through mobs (Rahman, 2018b). Arbitration is sometimes arranged by local leaders or police to compensate the aggrieved parties (Ashraf, 2018; Kaler Kontho, 2019). If the operators cannot resume their practice, they often move to another site, creating a second contaminated area.

In Bangladesh, it was observed that in most cases lack of official inspection and enforcement is the biggest reason behind informal ULAB recycling sectors existance. There could be many reasons why government regulators and inspectors do not conduct on site health, safety and environmental inspections, but essential there are only six main reasons.

Reasons for a Lack of Inspection & Enforcement:

1. No appreciation or understanding of the adverse health impacts of occupational or population lead exposure
2. No understanding of the HSE issues associated with the ULAB recycling process by the regulators
3. Lack of training from government officials to undertake an HSE inspection of a ULAB recycling plant
4. Do not know the locations of the informal recyclers
5. Licensed inspection not required under the law

Though informal economic operations offer useful resources for low-income and vulnerable communities, ULAB recycling is actually too risky to operate outside a permitted, controlled and environmentally friendly facility. Equipment, sanitary procedures, uniform protocols and inspection required to avoid industrial and public exposure to lead are not available in informal operations, which are usually plain, covert operations that use primitive processes and lack basic safety measures.

3. Problems Associated with ULAB

Lead poisoning is considered the most serious health hazard for children and it is one of the most significant contributors to occupational disease. Lead causes symptoms ranging from loss of neurological functions to death depending upon the extent of exposure. Likewise, ESDO in association with Pure Earth has conducted a study (2020) to assess the country situation for the informal ULAB sector in Bangladesh. The study shows that informal recycling in both rural and urban areas is potentially a high health risk due to the extreme exposure to direct lead and acid due to unsafe operation of the recycling processes.

3.1 Environmental impacts

Lead is a well-documented ecotoxicant, posing threats to both aquatic and terrestrial ecosystems (UNEP, 2010). A study has shown that forests serve as reservoirs of particulate matter in the

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atmosphere. Atmospheric lead is accumulated in leaves in rainwater or as leaf litterfall and transferred to the surface. There are also especially high levels of lead in species in the forest ecosystems (Zhou *et al.*, 2019). Lead pollution also impacts many bird species and poses a biodiversity threat. It was also shown that marine organisms, including aquatic plants, invertebrates, and fish take lead while found in polluted water. In fish, for example, lead can have hematological and neurotoxic effects and can disrupt enzyme function, thereby decreasing long-term survival and reproductive success (WHO, 2020).

Based on field observations and discussions with the 'actors' (i.e., people who are primarily exposed to the hazards) experts and environmental impacts associated with different aspects of recycling activities were documented, summarized in Table 1.

Table 1: Environment Impact by Type of Recycling Activities.

Actors	Aspects	Impact
Small Buyer/Broker	Acid disposed of near drains, water sources, and adjacent areas	Soil and water pollution
Separator	Acid disposed near drains and adjacent areas	Soil and water pollution
	Plastic cover	Soil Pollution
	Polyester separator	Soil Pollution
Backyard smelter (Lead recovered without purification)	Lead fume and dust	Air Pollution
	Fuel smoke due to coal burning	Air Pollution
	Burnt coal with lead sludge (slag) which is disposed on adjacent lowland	Soil and water pollution
Large smelter (lead recovery and purification)	Acid disposed near drains and adjacent areas	Soil and water pollution
	Fuel smoke due to coal burning/furnace oil	Air Pollution
	Burnt coal with lead sludge (slag) which is disposed on adjacent lowland	Soil and water pollution
	Lead Smoke	Air Pollution
	Lead Dust	Air Pollution

According to desk assessment report of Pure Earth, ESDO and ILA (2020)[8], the unsound ULAB recycling is believed to be a noteworthy contributor to elevated blood lead levels in Bangladesh, but the exact relative contribution of this activity versus other sources of exposure is not known. It is likely that unsound ULAB recycling is a major driver of exposures in communities near ULAB production, repair, and recycling sites, and minor contributor in areas where no formal or informal battery-related industries are present. A recent study suggest that spices adulterated with lead additives (lead chromate, lead carbonate, and lead sulfate) may be the primary contributor to elevated blood lead levels among rural Bangladeshis (Forsyth, 2019). However, it is possible that the lead used in these

[8] Assessment of Informal Used Lead Acid Battery Recycling and Associated Impacts in Bangladesh. 2020. Pure Earth, Environment and Social Development Organization, International Lead Association and United Nations Environment Programme.

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additives is illegally sourced from informal ULAB recyclers, thus implicating both two industries in the spice-related exposures.

3.2 Health and Social impacts

The World Health Organization (WHO) estimates that 120 million people are overexposed to lead with 99 percent of the severely affected people are living in developing countries. In children, lead exposure is responsible for a significant decrease in school performance, and lowering of IQ scores. Both children and adults can suffer from a range of illnesses, including adverse effects on the central nervous system, kidneys, gastrointestinal tract, and red blood cell formation. Lead-acid batteries contain components and chemicals that are toxic and may damage the environment and are detrimental to human. The two main substances of concern are:

- **Lead**

Acute health effects: Lead dust or fumes can irritate eyes on contact. Inhalation of lead dust can irritate the nose and throat. Exposure can cause poor appetite, weight loss, indigestion, nausea, and muscle cramps. Lead fume, if inhaled s readily absorbed into the blood.

Chronic health effects: May damage kidney, brain and blood cells leading to anemia. Probable teratogen, which will damage a developing fetus. May decrease fertility in males and females. Repeated exposure causes tiredness, trouble sleeping, stomach problems, constipation, headaches, and moodiness. Higher levels may cause trouble concentrating and remembering things, aching and weakness in arms and legs. Exposure increases the danger of high vital signs. Accumulates within the bones with repeated exposure.

- **Sulfuric Acid**

Acute health effects: Extremely corrosive; can severely irritate and burn skin and eyes. Inhalation can irritate lungs, causing coughing and/or shortness of breath; higher-level exposures can cause a build-up of fluid within the lungs. If disposed of into a municipal sanitation system with concrete drains, will, in time, dissolve the concrete.

Chronic health effects:

Limited evidence shows that sulfuric acid can cause carcinoma in refinery workers. Repeated exposure can cause bronchitis, with cough, phlegm, and shortness of breath or emphysema. It can cause a chronic runny nose, tearing of the eyes, nosebleeds, and indigestion.

Occupational Health Hazards:

The most common human exposure pathways to lead at ULAB recycling sites are ingestion and inhalation of lead dust. While lead can migrate through water, the lead waste generated from ULAB recycling generally has low water solubility, and thus does not pose a great risk to drinking water supplies. Exposure to lead through dermal contact is a much lower-risk exposure pathway than ingestion and inhalation.

In addition to public exposure to outdoor contamination, lead from ULAB recycling can also pose risks through take-home exposure. Lead-containing dust lands on workers' clothing and hair and is brought into the home. Once in the home, lead dust can contaminate food and is often ingested by children playing at ground level through to hand-to-mouth activity (World Health Organization, 2017).

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Most of the lead-acid battery industries are cottage industries and situated in the thickly populated residential areas. These industries have small premises; many of the operations are carried out in the open air and the melting operation to recover lead from scrap is usually carried out in small rooms having almost no exhaust fan ventilation or a chimney. The worker's working room is usually too hot and has poor ventilation and lighting. The respondents in the recent study were mostly (60%) young (≤30 years of age). About 19% of the workers were illiterate and another 28% had undergone only five years of schooling[9]. Considering the present age of the workers and their years on the job, most of the workers were exposed to lead from a young age and continued to be exposed for long time. It is well reported that the children are most vulnerable to lead as they absorb more lead than adults and they are more susceptible to develop lead toxicity, particularly neurological toxicity even at low-level exposure[10].

Higher blood lead level is generally found among the workers who are working in dismantling and breaking of old lead batteries, melting recovered lead, casting and molding lead plates, trimming plates, applying lead oxide paste to the plates, and forming, acidification, and assembling of new batteries. The workers from these sectors are at high risk of lead exposure because of the possibility of coming into direct contact with lead during the handling of the recovered lead, making and trimming new lead plates, pasting lead oxides, and finishing of a new lead battery. Inhalation of lead might also occur by air borne lead particulate matter and by fumes during melting to recover lead[11]. This chronic exposure to lead may cause symptoms which affects gastrointestinal, hematopoietic, nervous, renal, and reproductive systems and may cause an occurrence of various diseases.

4. Actions to Minimize lead contamination from ULABs

The main pathways of exposure to lead from recycling used lead acid batteries arise from environmental emissions, which occur at various stages in the improper recycling process. In Bangladesh, ULAB recycling and smelting operations are conducted in the open air, in densely populated urban areas, and often with few pollution controls. Informal recycling operations release considerable amounts of lead particles and fumes emitted into the air, deposited onto soil, water bodies and other surfaces, with both environment and human health negative impacts.

According to the Basel Secretariat to minimize lead contamination from ULAB environmentally sound management(ESM) is the most suitable action. According to Basel Secretariate, ESM means taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes[12]. An ESM offers a mechanism for managing lead wastes from batteries and contaminants and minimizing the risk of toxic contamination to communities. Unfortunately, no such safeguards exist in the informal sector and if a disused site is left to the elements, the lead waste will possibly disperse into the atmosphere and contaminate the surrounding area with lead-bearing dust and acidic residues.

[9] Ahmad, S., Khan, M. H., Khandker, S., Sarwar, A. F. M., Yasmin, N., Faruquee, M. H., & Yasmin, R. (2014). Blood lead levels and health problems of lead-acid battery workers in Bangladesh. The Scientific World Journal, 2014.
[10] WHO, Childhood Lead Poisoning, World Health Organization, Geneva, Switzerland, 2010.
[11] B. Ravichandran, K. Ravibabu, S. Raghavan, V. Krishnamurthy, B. K. Rajan, and H. R. Rajmohan, "Environmental and biological monitoring in a lead-acid battery manufacturing unit in India," Journal of Occupational Health, vol. 47, no. 4, pp. 350–353, 2005.
[12] http://www.basel.int/Implementation/CountryLedInitiative/EnvironmentallySoundManagement/ESMFramework/tabid/3616/Default.aspx

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These circumstances pose a possible environmental risk and a financial burden on local authorities and ultimately on the state, because, in the absence of a legal owner, the government is likely to bear the costs of remediating such sites and addressing the neighboring population lead exposure.

However, actions exist to minimize the lead contamination from ULAB and to promote an environmentally sound management of the lead-acid batteries at the end of their life.

4.1 Social awareness and public pressure

Social awareness and education are essential to shape and encourage changes in consumer behavior, but a gradual transformational process is necessary. A longstanding change in cultural attitudes towards environmental matters is often not attainable through brief or stand-alone awareness campaigns. It is instead best achieved through embedding messaging in regular didactic practices and school curriculums from a very young age. Public awareness strategies can include a wide range of activities designed to persuade and educate. These strategies may focus not only on the reuse and recycling of resources, but also on encouraging responsible use and minimization of waste generation from recycling of lead acid batteries. Public pressure can act as a trigger for policy decision-making. Public pressure is also widely recognized as precipitating private sector choices, given that demand drives supply.

For the awareness raising, the following activities in close cooperation with the focal person (Director General-DG, DoE under MoEFCC) will be undertaken:

1. Screen existing information, most importantly from the national lead (Pb) profile and the legal, policy and institutional review.
2. Identify target audiences for an awareness raising programme which includes children and other vulnerable groups, retailers selling lead-added products, government officials and representatives of the battery manufacturing industry including the informal sector.
3. Draft key messages targeted and adapted to identify audiences.
4. Prepare materials and identify the means of communication, for example:
    - Conferences, workshops, and training arranged by Government
    - Brochures distributed in hospitals about lead poisoning
    - Roundtable meetings with industry representatives, talk shows on TV and radio
    - Articles in newspapers, press release in print media, short clips in TV, video clips, advertisements on the radio etc.
    - Electronic documentaries
    - Participation in fairs and exhibitions, e.g., via a booth with banners
    - Power point/video presentations and posters at an inter-ministerial meeting
    - Awareness campaigns on social media (Facebook, Twitter, Instagram, LinkedIn, etc.)

Additional information on how to organize an awareness-raising campaign can be found in the WHO Guidance on organizing an advocacy or awareness-raising campaign on lead paint (WHO and UNEP, 2020), and tailored it to the ULAB issues.

4.2 Promotion of alternatives

Lead-acid batteries are the most widely used rechargeable batteries and principally serve two sectors: automotive and industrial. Designing a green and sustainable battery system is essential, so criteria

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such as life cycle, abundance of raw materials and electrolyte recycling are becoming crucial. LABs are traditionally used for most automotive applications as they are cheaper and have low-technology requirements compared to lithium-ion batteries. However, lithium-ion batteries are becoming more popular due to them being lighter, more efficient, having a longer battery life, safer, and more eco-friendly than lead acid batteries[13].

At the moment, there are 5 different market segments of automotive batteries categorized by chemical composition; lithium-ion (Li-ion), nickel-metal hydride (Ni-MH), nickel-cadmium (Ni-Cd), gasoline, and lead-acid. The energy density in Wh/kg is greatest in gasoline batteries, Li-ion, then Ni-MH, and least in lead-acid. As there is a rising demand for hybrid cars and fully electric vehicles which are more efficient and environmentally friendly, E-vehicles will take time to become popular in Bangladesh and drive demand for Li-ion batteries.

The main competitors to lead-acid batteries are nickel-cadmium and lithium-ion batteries. Nickel-cadmium has an established niche position and lithium-ion batteries are being promoted in the industrial market. Lithium-ion batteries will remain more expensive than lead-acid which will restrict their uptake, plus the fact that at present, Li-ion batteries cannot be recycled profitably. Unfortunately, lithium-ion batteries are more expensive than LAB this might not be suitable alternatives for Bangladesh, especially when the largest users of LAB come from e-rickshaws, motorcycle and solar system whereas Nickel-cadmium batteries are also more expensive than LAB, restricted to certain application and not environmentally friendly.

Nickel-Metal Hydride Batteries:

Nickel-metal hydride (Ni-MH) batteries are constructed in a similar way to sintered Ni-Cd cells but instead of a Cd electrode they have a metal hydride. The cost is high because of the use of Ni and rare earth metals in the hydride store. They are widely used for consumer applications because they are not restricted in the same way as Ni-Cd cells. They are being used in large quantities for hybrid electric vehicles but they have very limited application as industrial batteries. They are not and will not become a threat to lead-acid batteries because of cost and also because Li-ion batteries have greater energy storage potential.

Nickel-Zinc Batteries:

Nickel-zinc (Ni-Zn) batteries have a lower cost compared to Ni-MH. There have been many attempts to develop Ni-Zn batteries but were not successful because of the behavior of the Zn electrode which restricts cycle life. There are a small number of companies developing Ni-Zn batteries who claim to have solutions to these problems including EnerSys. If these programmes are successful, Ni-Zn may take market share from Ni-MH for consumer applications and Ni-Cd for industrial applications but it will remain more expensive than lead-acid and will not be a threat.

Sodium-Nickel Chloride Batteries:

Energy density is high but lower than Na-S batteries and a long cycle life is achieved. The targeted markets are utility energy storage, telecommunications, electric vehicles and hybrid railway locomotives. There are demonstrator batteries installed for utility energy storage and limited

[13] https://databd.co/stories/battery-industry-moving-to-greener-alternatives-1704

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deployment in other applications. This chemistry is not a mainstream competitor for lead-acid industrial batteries.

Flow Batteries:

For utility energy storage flow batteries have some potential. There are various chemistries but they all have energy producing cells with remote storage of active materials and so batteries with very large capacities are possible. In practice, the batteries are complex and the materials are expensive but the claimed life is very long. To date only a small number of demonstrator systems have been installed and vanadium redox batteries (VRB) batteries are only suitable for utility energy storage because of the size of battery envisaged. Zinc-bromine ($ZnBr_2$) batteries are another type of flow battery.

4.3 Policy instruments

Public policy literature generally suggests three alternative approaches to environmental management. These are:

1. The so-called "do-nothing" approach;
2. Strict regulatory approach; and
3. An adaptive approach.

The 'do-nothing approach' is based on the view that any policy intervention will rather distort the spontaneous market/incentive-based activities of numerous labors and enterprises involved in collection, selling, buying and recycling of used LABs. Nevertheless, this view is not convincing enough since uncontrolled, inefficient and environmentally unacceptable methods of secondary lead recovery is very real in the absence of any effective regulation. On the other hand, this approach can be adapted to evaluate the gaps by monitoring the implementation of the existing SRO. In addition, government can take to assess the situation of informal recycling of ULAB in remote places.

At the other extreme of the policy option spectrum is to adopt a 'strict regulatory approach' prohibiting unauthorized collection, reconditioning and smelting of used LABs altogether. The outcome of such an approach may be persuasive from the environmental viewpoint but it will be socially unacceptable (because many poor and low-income labour groups will lose their income-earning opportunities) and may also be economically inefficient because such strict regulation may create a monopoly or monopolistic market condition for the recovery of lead from ULABs.

In the case of Bangladesh, the desirable option is to search for an 'adaptive approach' in which the basic principle should be to make the smaller battery recyclers and reconditioners in the informal sector as part of an effective and efficient collection infrastructure that will support environmentally sound lead recycling. Necessary regulatory measures and incentive provisions ought to be a part of adaptive approach.

Based on the ground realities as documented in this study, operationalization of the above principle generates three options:

Option 1. Combination of economic incentives with regulatory support;

Option 2. Reliance on regulatory measures with economic incentives for battery collection

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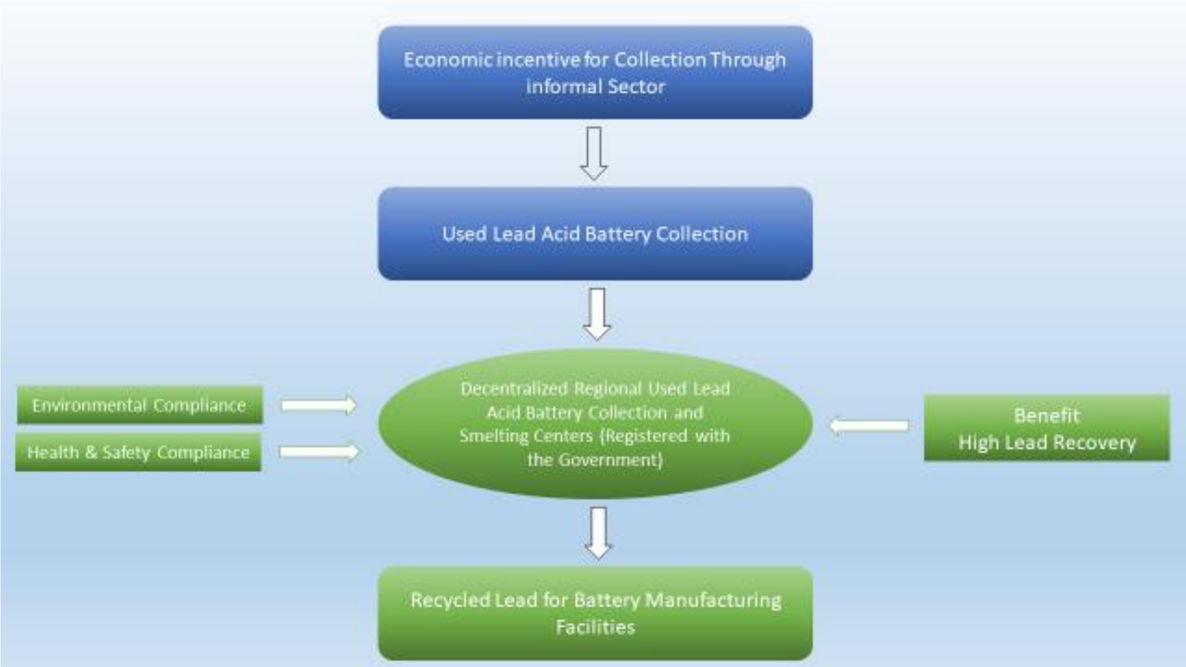
Option 3. Reliance on regulatory measures with economic incentives for battery collection and government infrastructure

4.3.1 Option 1- Combination of economic incentives with regulatory support



This option envisages the following:

a) ULABs to be collected by the existing informal sector by providing economic incentives; and
b) Regulatory control over the decentralized ULAB recycling centers where used ULABs are dismantled and lead is recovered.

This option intends not to disturb the existing collection system run by the informal sector, rather making it more efficient by providing them a better price for the used batteries, that is, the market rate, by the registered decentralized used lead-acid battery dealers. For the safety of battery collectors, protective units can be provided and regular based health checkup can be assigned within the zone. By providing the informal sector collectors with a better price and health safety insurance than the unregistered used battery recyclers and smelters would lead to more used batteries recycled by the registered recyclers / smelters and in return will stop or reduce the number of batteries produced without any brand as well as ensuring the availability of good quality batteries for the consumers. Moreover, there are other environmental and economic benefits associated with this option, which are as follows:

- Since the regulated recyclers/ smelters have to obtain a license from the government they have to comply with the Government of Bangladesh's environmental rules/ regulations as well as health and safety measures which will eventually make the ULAB recycling/smelting process environmentally sound.
- By regulating recyclers / smelters it would also lead to higher efficiency in the lead recovery system which would have an impact on the imports of refined lead from international markets,

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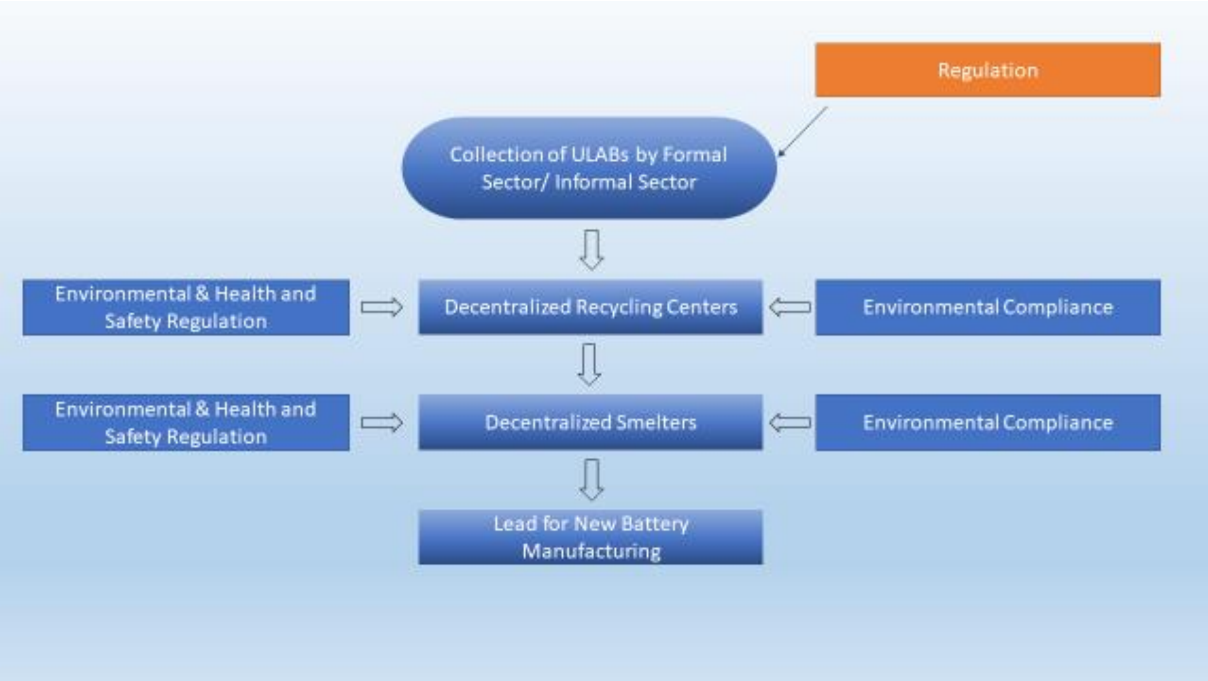
because less lead would need to be imported. This will favorably affect the country's balance of payments.

4.3.2 Option 2- Reliance on Regulatory Measures with Economic Incentives for Battery Collection



In this option, both the ULAB collectors (formal and informal) as well as the recyclers and smelters have to get a license for their operations and to comply with the government's environmental and health regulations. The environmental and economic benefits are similar to option-1. However, the major difference in option-2 is the inclusion of a formal sector in the waste collection process i.e., new battery manufacturers can have their own collection system.

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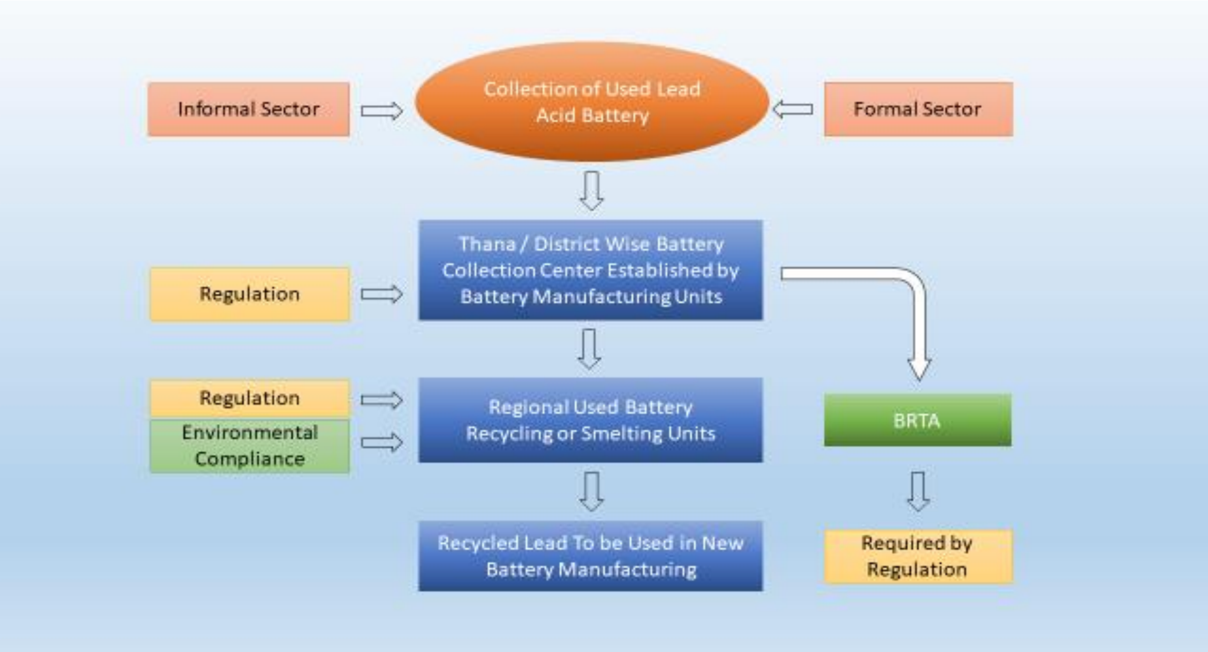
4.3.3 Option 3- Reliance on Regulatory Measures with Economic Incentives for Battery Collection and Government Infrastructure



This option considers the following:

a) Providing cash incentives for used lead-acid battery (ULABs) collected in both formal and informal sectors, under a regulation. For this, the formal sector battery manufactures need to establish used battery collection centers at the Thana/district level which may also be the sales shop for new or replacement batteries.

When a person is buying a new battery of any type, they should have to deposit the old battery at the time of buying a replacement, for which the battery seller shall reduce the battery price (the price reduction should be based on the type of the battery). Moreover, the battery seller should also provide a certificate to the purchaser of the battery clearly stating that the buyer has deposited their old battery for safe disposal against a reduced price for a replacement. Furthermore, the seller shall also state on the certificate the number of vehicles with date of replacement of the used lead-acid battery, which the owner of the vehicle has to deposit during the annual renewal of vehicle papers at the Bangladesh Road Transport Authority (BRTA) offices. In this regard, the Ministry of Environment, Forest and Climate Change (MoEFCC) has to formulate a new regulation.

b) After collecting the ULABs, the seller of a new battery has to take it to the authorized recycling center/ smelters, where the ULABs shall be dismantled and the lead content recovered. The environmental health and economic benefits associated with this option is similar to option 1.

These three options bear the hallmark of an 'adaptive approach' in the sense that each seek to recognize and preserve the vital role of the informal sector in the collection process. Each also seeks to introduce some measures of regulation with a varied dose of incentive provisions in order to promote an environmentally sound recycling process. They vary basically in terms of the degree of regulation but in no option is regulation alone adequate for arriving at an economically viable, socially desirable and environmentally sound management of lead-acid batteries in Bangladesh.

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An overall policy package also ought to include-

(a) An awareness campaign, particularly to make all involved workers and parties aware of the health hazards and the adverse environmental impacts associated with lead recycling;

(b) Promoting longer life of a lead-acid battery.

(c) Requiring to use environmentally sound smelting technologies in the smelters; and

(d) Facilitating licensed smelters to adopt environmentally sound technologies that give high lead recovery rates. This could be achieved by asking/requesting the formal/informal collectors to bring the ULABs to such smelters.

4.4 Site remediation

Unlike organic compounds that can be transformed, heavy metals, such as lead, can only be covered, buried, removed recycled and moved to a safer location, or transformed into a less toxic or inert form. One of the most common remedies used worldwide for lead-contaminated soils, for example, mixing the soils with chemical binders such as Portland cement and transferring the contaminated waste to a secure landfill site. <u>However, landfill strategies are becoming increasingly unacceptable solutions as it is an expensive option where it is permitted and it is necessary to put it as the last option for solution or management.</u>

One important factor when deciding the correct approach is the chemical source of lead pollution in soils and waste residues. Many synthetic lead compounds are toxic, whereas other naturally occurring forms have a lower toxicity due to the poor bioavailability of certain natural mineral sources of lead. This poor bioavailability means that the naturally occurring forms of lead will migrate virtually unabsorbed through the human digestive system.

It follows therefore that if toxic lead compounds are often converted to inert and bio-unavailable forms then a contaminated site might be rendered safe, even for human habitation and possible agriculture, although crop selection is going to be limited to those plants with low lead uptake.

Soil and residue characterization is going to be a key element when determining the acceptable remediation strategy. It must take into consideration the mineral form, particle size, toxicity, and encapsulation of the lead contaminant, because these features will have an immediate impact on solubility and bioavailability. As these characteristics are site-specific, it is vital to organize remediation strategies and models on real field sampling, monitoring, and accumulated exposure data. There are four main remediation strategies to consider and selection should be based on the most appropriate or a combination of two or more of the four:

1) Removal and replacement of contaminated soils by either:

- Removal and treatment to decontaminate the soils to safe lead levels and then return the treated soils to the original site
- Removal of contaminated soil and replacement with uncontaminated soil.

2) Treatments involving the transformation of contaminants.

- Thermal, biological, and chemical treatment methods that can be applied on or offsite.

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3) Immobilization of contaminants including capping of landfill residues, chemicals[14] and "*in-situ"* stabilization[15], solidification, and containment technologies.

4) Extraction, separation and recovery of contaminants

- Including soil treatment by, soil washing[16], thermal extraction[17], and phytoremediation[18] extraction using "*in-situ*" phytoextraction using specially selected plants to "pull" the lead out of the soil. Where appropriate ground water treatment using gravimetric separation, ion exchange, and bio-chemical or phytoremediation[19] extraction.

Anticipate that a single technique or approach can not sufficiently remediate an entire site and be prepared to consider several different treatment methods that can be combined to minimize the risk of lead pollution from all sources of contamination, if not remove them. In these cases, resources need to be used efficiently and any remediation strategy should have a mechanism for locating, reviewing, and remediating abandoned recycling sites and lead smelters from the informal sector to reduce the impact of legacy activities.

5. Procedure for Formulating a Lead Risk Reduction Strategy

Formulating a lead risk reduction strategy for ESM of LAB and ULAB, is one of prime work needs to be done before national strategy can be implemented.There are essentially four ways to manage the lead exposure and pollution risks i.e., accept the risk, avoid the risk, transfer the risk or mitigate the risk. [20] First option is not suitable as this option works only when it possesses minor risk which is not possible in terms of ULAB management. The second option is also not possible to adopt as LAB sales can not be stopped. The third option is applicable if the ULAB can be exported safely to another country with an ESM hub. Final option is limiting lead exposure and pollution pathways using a comprehensive and effective risk reduction strategy that has a legal framework and support services.

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[14]Investigations in Military Range Sustainability, G L Fabian, Military Environmental Technology Demonstration Center, U.S. Army Aberdeen Test Center, "Lead Immobilization Using Phosphate Based Binders", February 2001, (http://www.che.msstate.edu/misstap/bios%20and%20abstracts/fabian.pdf).

[15] Interstate Technology and Regulatory Cooperation (http://www.itrcweb.org/), Work Group, Metals in Soils Work Team, Inactivation Project, "Emerging Technologies for the Remediation of Metals in Soils - Insitu Stabilization / Inplace Inactivation", December 1997, (http://www.itrcweb.org/mis-3.pdf).

[16] Interstate Technology and Regulatory Cooperation (http://www.itrcweb.org/), Work Group, Metals in Soils Work Team, Regulatory Guidance Project, "1998 Technology Status Report", December 1998, (http://www.itrcweb.org/mis-6.pdf) and Metals in Soils Work Team Soil Washing Project, "Technical and Regulatory Guidelines for Soil Washing", December 1997, (http://www.itrcweb.org/MIS-1.pdf).

[17] Emerging Technology Report: Reclamation of Lead from Superfund Waste Material Using Secondary Lead Smelters, EPA 540-R-95-504: NTIS: PB95-199022 (Project Summary: EPA 540-SR-95-504), (http://www.clu-in.org/products/site/complete/chmrsmlt.htm).

[18] US Army Environmental Center, Pollution Prevention and Environmental Technology Division, "Innovative Technology Demonstration, Innovation and Transfer Activities", February 1993, (http://aec.army.mil/prod/files/p2etd-fy00.pdf).

[19] Interstate Technology and Regulatory Cooperation (http://www.itrcweb.org/), Work Group, Metals in Soils Work Team, Inactivation Project, "Emerging Technologies for The Remediation Of Metals In Soils In-situ Stabilization / In-place Inactivation", December 1997 (http://www.itrcweb.org/mis-5.pdf.

[20] Personal communication, Brian Wilson, ILA.

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Now, there are five key steps towards formulating a risk reduction strategy that will manage the lead exposure and pollution risks.

1. Identifying the risks posed by LAB and ULAB

To understand the potential risks which cannot be mitigated, it is prior necessary to identify the risks posed by LAB and ULAB. For the LAB, there is metallic lead, lead alloys, lead oxides, lead sulfate and dilute sulfuric acid, which counts as potential risky elements individually. Potential risks associated with ULAB recycling are lead dust and fume, furnace slag or residues, refining drosses, and plant effluent. There are also occupational and population exposure risk as well as the threat of environmental pollution, are associated in the process.

2. Analyzing the extent of risk

It is utterly important to prepare LAB and ULAB inventory and trade analysis by government authorities. For the inventory, it is important to find out the information regarding the use of LABs and how many ULAB are generated annually, as well as:

- Domestic LAB sales
- Domestic LAB exports
- LAB & Pb Imports
- LAB Applications
- Tonnage in Use
- Useful Life of LAB
- Trading value USD$

It is also necessary to ascertain how many ULAB are recycled- Domestic ULAB Exports, Formal, Informal, ULAB Tonnage etc. This inventory and trade analysis report produced by the ILA will help the government to formulate the regulatory steps in future.

3. Prioritizing and Assigning the risks

It is necessary to ensure that the appropriate stakeholders rank the risks as high and know their responsibility as well as to define the roles and responsibilities of all the stakeholders especially:

- Domestic and overseas LAB manufacturers
- LAB importers and retailers
- End users

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- ULAB collectors, transporters and recyclers
- Civil society, NGOs and Academia
- Government Agencies:
    - Health – Safety - Environment
    - Business/Finance.

4. Responding to the risks

After collecting all the information required and informed the stakeholders of their roles and responsibilities, a comprehensive lead risk reduction strategy can be formulated. It is essential that such a strategy include a legislative framework for:

- ✓ Hazardous Waste Management
- ✓ Emissions to atmosphere
- ✓ Effluent discharges
- ✓ Occupational health and safety
- ✓ Incentives to promote the ESM of ULAB
- ✓ Measures to eliminate informal recycling
- ✓ Provisions for licensing and monitoring
- ✓ Public awareness and education
- ✓ Corporate Social Responsibility
- ✓ Promoting circular economy

5. Monitoring the Risks

Having formulated and implemented a lead risk reduction strategy, it is vital that health, safety, and environmental performances are monitored to ensure compliance with the strategy and the legal instruments. So, in accordance with the Basel Convention Training Manual for the preparation of National Plans for the ESM of ULAB, the monitoring should include the followings:

- ▶ Appropriate licensing process for the LAB and ULAB sectors with HSE site assessments should be implemented in all the recycling plants;
- ▶ Assessment of the HSE site should be based on a site visit and inspection to confirm compliance with the specified standards;
- ▶ Compatibility of HSE compliance Audit for plant emissions and discharges should be assessed bi-annually in full scale;

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- Medical surveillance (examining physician) for Occupational Lead in Blood should be setup;
- Twice a year perimeter sampling for Lead in Air should be examined and monitored (comparison with previous data);
- HSE site assessment for ULAB collectors should be monitored in quarterly basis;
- Licensing for ULAB transporters should be renewed in bi-annual basis.

6. Strategy Plan for policymakers

This section presents a **10-step strategy** to guide government agencies to help decide for the appropriate policy approach (the introduction of a sound management system). To prepare a coherent national strategy and action plan for the ESM of ULAB in Bangladesh, all the available information from ILA, Pure Earth, UNEP, the Basel Convention and ESDO will need to be collated. Data from other relevant stakeholders and government authorities (DoE) are also necessary to identify the goals. The clear objective of this strategic plan will be to lay out a clear set of goals and agreed strategies that government and industry as well as civil society organizations can follow to build a sustainable structured system for their future programs. Distinct steps are discussed in the following sections:

1. **<u>Situation Assessment: National Inventory of informal recycling</u>**

This inventory procedure needs to be designed as a nationally applicable way, consistent method of identifying all the possible sources of illegal usage and finding essential gaps in the existing legislation and its implementation (addressed in ESDO and UNEP report, 2020)[21]. The following sections can be followed to assess the existing situation and gaps:

a. Conducting field survey which will lead but not limited to: -

Identify the sources of lead (Pb) emissions from the recycling of used lead-acid batteries in the country, the Department of Environment (DoE) under the Ministry of Environment, Forest and Climate Change (MoEFCC) need to conduct a survey and prepare an inventory. Mentioning the exposure levels and adverse health impacts in the situation assessment will add value to the study and assist with the development of a proper ULAB management system.

b. Conducting inventories of added value lead product manufacture and trade, or otherwise obtain available data on manufacturing and trade, as required (addressed in Inventory of Lead Acid Batteries and Used Lead Acid Batteries in Bangladesh by ILA and UNEP)**;**

[21] Comparative Regulatory Review: Assessment of Regulations of ULAB in Bangladesh and Recommendations for Legislation. 2020. Environment and Social Development organization-ESDO and United Nations Environment Programme-UNEP.

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c. **Identifying the sources of the informal industry's work and its impacts on people and the economy;**
d. **Preparing a report and distributing it to key stakeholders;**
e. **Developing a national strategy for phasing out lead-added value products.**

Key objectives will be to-

- Find the gaps in existing policies, legislation and regulation relevant to lead-added value products;
- Develop an inventories of lead-added value product manufacture and trade;
- Assess institutional capacity to support added-value leaded product phase-out activities.

DoE, as the environmental regulatory agency in Bangladesh, has a mandate to protect the environment from the adverse effects of hazardous substances, and to safeguard the health and well-being of the people. This report will contain the baseline account of lead use in society as well as a roadmap on mitigation, reduction or elimination of lead use in the informal sector. All this information can feed into the national planning process and help the country formulate strategies for definitive action.

2. **Evaluate the Appropriateness of Possible Actions**

Based on the findings of the baseline study, it will be important to evaluate what are the most appropriate instruments that will be beneficial when addressing the specific problems or needs that have been identified. Among the elements to be analyzed, and of upmost importance, are the institutional capacity and the existing economic conditions to ensure that the instrument(s) being considered are realistic and have high probability of being successfully implemented.

At this stage, the government has the opportunity to assess the best process to follow for the introduction of the preferred instrument(s), and estimate the time and resources needed. For instance, if one of the instruments considered is regulatory, perhaps the inclusion of provisions in an existing law or act might be sufficient and more time and resource efficient than opting for the enactment of a new law.

Regulatory Framework:

Referring to the relevant laws, regulations, and guidelines of the other countries, it is necessary to impose proper legislation for ULAB battery handling, transporting, and end-life management systems in Bangladesh.

Bangladesh has Constitutional mandate as well as legal obligation to protect 'right to life' and 'right to the safe environment'. It is impossible to expect a healthy life if lead poisoning from informal ULAB

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recycling continues the way it is happening currently and it is putting human and animal life in major threat. Therefore, Bangladesh government should include ESM in its national regulations and legislations for regulating unauthorized ULAB recycling. Bangladesh government may have to follow the UNEP Technical Guideline and Basel Convention Regulations during formulating the final draft of the amended version of SRO on ULAB management in Bangladesh.

Economic Capacity:

Instruments such as tolls require the existence of effective legal and fiscal systems (Issues like controlling environmental pollution and maintaining ecological balance have been given due attention in the Finance Act 2019. As such, companies in the RMG sector having green building certification will enjoy a reduced tax rate of 10 percent on its income[22]). If for instance these are not in place, governments may wish to consider other types of action (e.g. Equity and Fairness: Surcharge, Increasing tax compliance and combating tax evasion, Adopting international best practices, and Simplification of tax system and increasing the effective use of tax laws), rather than the introduction of such charges.

EPR Scheme:

Stakeholders for the extended producer responsibility (EPR) scheme consist of battery manufacturers and the manufacturers of products using batteries as well as retailers (shops cooperating for recycling), municipalities, household generators (general consumers), commercial generators (businesses cooperating for recycling) and the national government. Accordingly, these stakeholder's have a role in ensuring the environmentally sound management (ESM) of used lead-acid batteries (ULAB) and should be included in the EPR scheme to collect and recycle waste and specific obligations to follow the rules.

Recommendation:

- Collection processes should be based on 'One Stop Service' where they can store the batteries in a specific area. As ULAB contain hazardous components, its processing should be done in a specific area free from the local populations. In addition, there is a need for limited processing units where ULAB will be collected.

3. Assess sustainable development impacts of preferred options

Once the relevance of all possible actions has been assessed, governments may be left with a shortlist of possible and suitable instruments. Before selecting the most appropriate option or mix of options

[22] https://mof.portal.gov.bd/sites/default/files/files/mof.portal.gov.bd/page/f2d8fabb_29c1_423a_9d37_cdb500260002/Chapter-04%20%28English-2020%29.pdf

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that would address the issues and needs identified in the baseline assessment, a key step is to study the sustainable development impacts of the short-listed choices, taking into consideration all the sectors (including food, clothing, etc.) and all segments of the population. For instance, it might be the case that in a certain country, although the foreseen environmental benefits of introducing a sound management system might be highly positive, the social impacts on a large part of the population might be unsustainable, making management options not the most desirable option. Assessing the social, economic and environmental impacts of a policy will also help to identify its boundaries and scope.

Table 2. Example of instruments to minimize the lead-acid battery waste.

<table>
<tr><th colspan="2">Type of instruments</th><th>Overview of Method</th><th>Example of applications</th><th>Positive impacts</th><th>Negative impacts</th></tr>
<tr><td rowspan="3">Voluntary Reduction Strategies</td><td>Voluntary approach</td><td>It builds on the understanding that for change to be long-lasting, it needs to be voluntary and based on choice.</td><td>Promotion of formal recycling options and advantages by Battery Recyclers</td><td>Allows time for population to change consumption patterns, which can trigger changes among manufacturers and informal recyclers</td><td rowspan="3">Illegal business of lead scrap and other materials can increase in between local recyclers.</td></tr>
<tr><td rowspan="2">Public-Private Partnerships</td><td rowspan="2">The agreement sets the overarching goal, but leaves the choice to the private sector on how to achieve the results</td><td>Voluntary agreements between government and retailers</td><td rowspan="2">Achieves reductions in illegal battery recycling or Stimulated used lead businesses</td></tr>
<tr><td>Agreements with producers (e.g., to voluntarily establish Extended Producer Responsibility, including deposit return schemes)</td></tr>
<tr><td>Public Educations</td><td></td><td>It requires a gradual and transformational process, key to change informal recyclers and</td><td>Introduction of environmental conservation principles in school curriculums</td><td>Common denominator for the success of any initiative</td><td></td></tr>
</table>

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		consumers' behavior	Social campaigns		
Policy Instruments	Regulatory	Laws and acts mandating that informal recycling of LAB, and bear some responsibility in recovering material wastes	Ban on Informal Recycling Process and Extended Producer Responsibility (EPR)	Relatively simple to introduce Can reduce amount of informal recycling both in rural and urban areas Can be a step towards more comprehensive policies	Unmonitored areas will increase with illegal business of lead scraps and informal recycling, leading to increased lead pollution
	Economic	Levies or taxes on certain items	Levy on suppliers Levy on retailers Levy on consumers	Dissuasive effect, Leading to behavioral change, Generated (short-term) income	
	Combination of regulatory and economic		Regulation and levy Extended Producer Responsibility	A combination of the above	

Recommendation:

While assessing the preferred option, the present and future roles of the informal sector should be kept in mind. The preferred option would act as a positive driver on the informal recycler and would strive to formalize them to avoid negative socio-economic consequences on a vulnerable fringe of the population.

4. Development and implementation of a stakeholder engagement strategy

Stakeholder engagement is only one piece of a larger communication plan, which our government will need to create. Here the government has a key role to play to facilitate the development of effective strategies and implementing them.

Government's Role
• Identify the relevant ministries and stakeholders and form a structure to facilitate project input and coordination, such as a Battery Products Advisory Committee (BPAC) or ULAB Recycling and Lead Phase-out Coordination Committee

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• Determine the roles, responsibilities, timeline etc. for moving forward between the ministries with jurisdiction over the relevant Article 4 obligations (i.e., Ministries of Environment, Health, Trade, etc.)
• Hold inception meeting, identify significant implementation issues and data needs, set project goals, specify the sequence and timing of project milestones, and establish mechanisms for conducting outreach and obtaining input as the project progresses
• Secure financial, technical and informational cooperation as needed from relevant agencies/organizations and stakeholders
• Facilitate stakeholder reviews and input on significant project work products

STEPS TO ENGAGE STAKEHOLDERS IN BANGLADESH

- ✓ Identifying relevant ministries and stakeholders
- ✓ Form a structure to facilitate project input and coordination;
- ✓ The ULAB Recycling and Lead Phase-out Coordination Committee will be headed by the Director General of the Department of Environment (DoE) which will be formed to oversee the development of the ULAB project.
- ✓ The committee includes members from governmental and non-governmental entities such as the Ministry of Health, Ministry of Industry, Ministry of Commerce, Accumulator Battery Manufacturers & Exporters Association of Bangladesh (ABMEAB), Bangladesh Standard & Testing Institute (BSTI), customs authority, private sector, academia and other relevant NGOs.
- ✓ Establish a Battery Product Advisory Committee/ ULAB Recycling and Lead Phase-out Coordination Committee involving relevant technical personnel. The objective would be that this is institutionalized and starts meeting regularly.

Determine roles, responsibilities, timeline, etc. for moving forward between the ministries with jurisdiction of the ministries and departments:

- ▶ The primary purpose of the committee is to oversee the preparation of the activities under lead phase-out and the ULAB recycling project and to coordinate progress on the project activities.
- ▶ When the initial assessments and inventories are completed, the Ministry of Environment, Forest and Climate Change will set up a lead phase-out co-ordination Cell (LPCC) at DoE. The LPCC will be headed by a Director of DoE who will also serve as the national focal point for the committee. The LPCC will be staffed by relevant DoE officials and/or consultants to support the implementation of lead phase-out and the ULAB recycling project.

The activities and responsibilities of the committee focal point will be the following:

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- To ensure that the obligations of the LPCC are taken seriously at senior government levels in the concerned ministries
- Foster inter-ministerial collaboration and formulate joint strategies with other sectors involved in the action plan
- Propose and undertake programmes associated with the activities under the Lead Action Plan, monitor and track the progress of the programmes that are being implemented
- Set out a Political Framework designed to support the ESM of ULAB.
- Improve the financial viability of the formal sector

5. **Raise awareness**

Evidence shows that resistance is likely to decrease if consumers are aware of the social, environmental and economic impacts of mismanaged used lead-acid batteries. These can be communicated through a variety of methods, ranging from:

- Conferences, workshops, and training arranged by Government
- Brochures distributed in hospitals, schools, community centers that explain the dangers of lead poisoning
- Roundtable meetings with industry representatives, talk shows on TV and radio
- Articles in newspapers, press release in print media, short clips in TV, video clips, advertisement on the radio etc.
- Electronic documentaries
- Participation in fairs and exhibitions, e.g., via a booth with banners
- Power point and video presentations and posters at an inter-ministerial meeting
- Awareness campaigns on social media (Facebook, Twitter, Instagram, LinkedIn, etc.)

Each campaign should have a clear and simple message, that can be relevant to a wide range of stakeholders, but occasionally targeting a specific constituency. The message should clarify why a certain instrument has been chosen and what will be the benefits for the population. For instance, if a levy is to be introduced, it would be important for the public to fully understand the link between the fee that will have to be paid and the environmental benefits that will derive. The public should also be made aware of any eventual punitive measures included in the law.

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Recommendations:

- The DoE have to educate people about the ULAB recycling process. This process can be done in various ways like; advertisements in social media, creating infographics, banners, posters etc. Seminars and workshops can be arranged with local people especially uneducated people who have no knowledge about it.
- The hazardous effects of ULAB can be mentioned in children's textbooks so that they can learn about lead poisoning and its impact on human health from their early ages.

6. Capacity building for environmentally sound management (ESM) of ULAB

To ensure good governance, enforcement and monitoring and supervision of the ESM of ULAB recycling, it is important to clearly define roles and responsibilities between local, national and sub-national authorities and organizations beforehand. It is advisable to consider measures and budgets are in place that ensure the necessary skills and human resources are in place before the policy enforcement phase. In this regard, training workshops can be arranged and formal guidelines can be issued specifying the responsibilities of all the key stakeholders.

Specific and targeted capacity-building initiatives need to be undertaken by government and relevant stakeholders at each single level. Potential capacity building initiatives for each cluster are:

- INDIVIDUAL: training programmes, business development activities, workshops for in-depth discussion of specific topics; conferences;
- INSTITUTIONAL: development of internal policies, organizational and procedural restructuring; and
- SYSTEMIC: advocacy initiatives, consultations, open dialogue, reforms.

To do these single level capacities building the government has to adjust the following requirement accordingly:

- Identify target populations for strategy implementation, improve hazard and risk communication initiatives;
- Improve occupational health and safety standards and practices for handling lead in recycling facilities;
- Establish methods for determining lead levels in products, calibration, validation, etc.
- Promote a reduction in the illegal transboundary trade in lead-added value products;
- Use of child labour is prohibited in every phase of the LAB life cycle

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Steps to Address Capacity Building in Bangladesh:

- Assess institutional capacity to support lead-added value product phase-out activities and the environmentally sound management of ULAB
- Enhance or establish information reporting and data platforms
- Establish methods and identify a laboratory for product testing
- Create a mechanism (for example- Benchmarking Assessment Tool (BAT) for compliance evaluation
- Enhance trade monitoring and compliance with the Basel Convention PIC procedure for Waste Lead Acid Batteries transboundary movements
- Provide training of relevant officials and enforcement regulators
- Ensure occupational health and safety standards and best practices for handling lead and lead waste are adopted and in operation at the recycling facilities.

Recommendation:

- ▶ The Government, in association with relevant stakeholders should take steps to set up a more effective program regarding ULAB management. They can arrange a workshop, seminar, mobile campaigns for industry and mass population education and awareness. Moreover, they can use social media and print media or both for awareness.

7. Financial incentives

When wanting to regulate the informal battery recycling, governments are likely to face resistance from the local industry as well as from illegal importers and distributors. To limit resistance and gain as much support as possible, governments may wish to consider providing incentives to industry. It may be beneficial to introduce the incentives long before the new legislation is put into effect in order to guarantee enough time for battery manufactures, distributors and retailers to adapt to the new stipulations. Such measures might include:

- ❑ Provisions to allow time to adapt to the transition;
- ❑ Tax rebates and financial incentives to stimulate production of cost-effective batteries through environmentally sound managed system.

When introducing an internal revenue service on used lead-acid batteries, consideration should be given to how revenues from that economic instrument will be used. To maximize public benefits, the revenues from the tax could be ringfenced and reinvested to:

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- Support specific environmental projects involving ecotoxicological studies
- Support the provision of measure to formalize the informal ULAB recycling sector
- Boost the local recycling industry (end-use markets)
- Create job opportunities in the private battery recycling industries (through seed funding)
- Finance awareness initiatives which promote for instance battery waste minimization

Given that the main objective of the levy system is to be dissuasive, it is important that the levy's revenues are ringfenced for activities that are time-bound. For instance, if the levy is successful, people will be dissuaded from continuing to buy lead-based batteries, and revenues should be expected to gradually decrease and eventually stop. To ensure a transparent process and maximize public support, it is important to widely communicate the chosen purpose for which the revenues will be utilized (PwC, 2020).

Recommendation:

- There is a need to focus on an incentive scheme for ULAB processes to promote the ESM of used lead-acid battery management in Bangladesh. For instance, these incentives could be used for appropriate setup of environmentally sound technologies and procedures at every facility.

8. Policy implementation plan and enforcement of regulations

When considering what strategic options will facilitate an improvement in the environmental performance of the informal sector, it should be borne in mind that legislation is not the sole solution to problems identified in the assessments. Whilst there might not be specific legislation in place in some areas that set standards for lead exposure and leaded waste disposal, there is always legislation that can be found that the informal sector will fail to meet. Indeed, owners of informal operations are well aware that their activities are illegal, albeit they might not know exactly what laws they are breaking.

For that purpose, the regulation must be enforced at all levels. It is important for governments to keep the public updated on the progress and benefits achieved, to continue building consensus and demonstrate accountability. Progress can be assessed in several ways, including Health, Safety and Environmental (HSE) audits, surveys, impact assessments and focus-group discussions. It is advisable to review the policy instruments on a regular basis. In the case of law enforcement and monitoring of compliance, these are critical to ensure that the prohibited recycling is not illegally carried out in remote areas. To gather data on effectiveness, governments may consider including in the legislation

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a reporting obligation. The points presented below need to be established to do proper implementation of the regulations:

Used Lead-acid Battery (ULAB) handling and management rules (2006)**:**

The Ministry of Environment, Forest and Climate Change of the Government of Bangladesh published a gazette to implement "Used Lead-acid Battery (ULAB) handling and management rules" in 2006; where the prior environmental certification is required before recycling any ULAB. Though the 2006 rules on ULAB cover most aspects of ULAB management, there exist some gaps that needed to be addressed. In 2018, another amendment to this SRO was proposed and stakeholder meetings were organized jointly by the DoE and Accumulator Battery Manufacturers & Exporters Association of Bangladesh (ABMEAB).

The amendment included the mandatory safety precautions of the recyclers of the lead acid battery. The compilation and fixation of the deceased lead acid battery is a prerequisite now. It is also mentioned that in case of importing the battery from abroad and for beginning the recycling process with expired battery, permission from the Ministry of Environment, Forest and Climate Change is mandatory. Without the ministry's approval, import and recycling of the batteries cannot be executed. Country Code Number, Serial Number, Company Code, Digital and Bar Code Numbers need to be written in the battery's body in both the imported and Bangladeshi lead acid batteries. Even Before taking the 'No Objection Letter' from the ministry for starting recycling of Lead Acid Battery, the manufacturing company needs to receive prior membership enrollment with the Accumulator of Battery Manufacture and Exporters Association (BMB). The license holding local/national companies should inform the authority that how much lead they would use, and the ones that are expired shouldn't be dumped in open spaces like soil and water. Local battery manufacturing companies can collect/buy lead from license holding battery recycling companies. Awareness among public has also been focused in the new draft where the role of print and electronic media has been mentioned in creating awareness about the harmful impacts of lead acid battery recycling.

After careful consideration of the 2018 draft and comparing the relevant laws, regulations, and guidelines from other countries with similar cultural, economic, social, and demographic conditions to Bangladesh, there are still some gaps in the draft rules, summarized below. These gaps should be addressed in the revised amendment to support a comprehensive and efficient implementation of the regulation.

Key gaps in the existing SRO:

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(a) **The Mismanagement of Recycling:** There is no proper management of and implementation of the Rules relating to LAB and ULAB in Bangladesh.

(b) **Safe Handling of Toxic Components:** ULAB contains certain toxic components such as lead and dilute sulfuric acid, which are required to be handled safely but which is not properly addressed in Bangladesh.

(c) **Prohibiting Child Involvement:** There is no current age limit for labors. There needs to be an age limit for working in ULAB processing units.

(d) **Public Health and Environmental Exposure:** No mention of public health and environmental exposure measuring procedure or safety related clause.

Bangladesh Environmental Conservation Act, 1995 (Amendment, 2010): Incorporates the obligations of the Bangladesh Environmental Conservation Act, 1995 (Amendment, 2010) and protection of public health from hazardous materials into existing national legislation through amendments of the new regulation on ULAB recycle and lead phase-out as follows:

a. Incorporation of the provision for keeping records of current stocks of lead in industries in the Hazardous Waste and Ship-breaking Waste Management Rules, 2011

b. Include the products listed in national inventory on lead containing products.

Environmental Conservation Rules, 1997:

In the Environmental Clearance Application process as per ECR 1997, ensures that processes listed in the Industrial Categories under the Environmental Conservation Rules, 1997 (ANNEX-I) should be included, and if that is not possible to incorporate new rules or procedure in the ECR, 1997. For clarification ANNEX-1 should be included the listed processes.

Amend ECR 1997:

Amend ECR 1997 to set industry-specific gaseous emission standards for lead including standards for Exhaust of automobiles, Ship Breaking sectors, Turmeric containing lead from soil, Lead containing product burning, Additives as pigments in Industrial Paints, Fertilizer, Pesticides and Biocides, Metal plating, finishing operations, Leaching from ULAB and Battery manufacturing, Lead/ULAB contaminated sites, waste from small and medium manufacturing facilities should be listed in SCHEDULE – 1, 10, 11 and 12.[23]

Institutional Responsibility:

[23] http://www.basel.int/Countries/NationalLegislation/tabid/1420/Default.aspx

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Ministry of Industry-MoI (for the import policy order and export policy), MoEFCC (Basel Competent Authority and the enforcement authority), DGHS are the responsible institutions here.

A. Develop a portal for inter-agency database sharing regarding import and export of lead, lead-acid battery and leaded compounds

- ❖ DoE, MoI, National Board of Revenue (NBR), Bangladesh Bank are responsible in this regard

B. Formulate mechanisms for the implementation of existing guidelines for environmentally sound management (ESM) of lead and used lead-acid battery recycling in different sectors, amend or modify existing standards if any.

DoE (under MoEFCC) will be responsible for the above and ESDO, ILA, Pure Earth will be available to assist the government for ESM guideline .International organizations such as UNEP or other donors may be approached with request for technical assistance or funding.

Recommendations:

Bangladesh is a signatory of both the Basel and Rotterdam Convention. The Basel Convention as well as Ban Amendment and Rotterdam Convention should be taken into consideration while making new Rules. As a signatory state, it is the prime responsibility of Bangladesh to implement the relevant articles into its legislation.

Strategy for the ESM of ULAB Recycling in Bangladesh in compliance with the Basel Convention

- ▶ Technical Aspects & Environmental/Health Management
  - ✓ Estimate the size and nature of the lab market
  - ✓ Calculate the Amount of ULAB Generated
  - ✓ Determine Capacity/Viability of Available Formal Recycling Plants
  - ✓ Undertake an ESM Assessment of Recycling Performance
  - ✓ Set out Technical and Policy Road Maps
  - ✓ Recommend either Domestic or Regional Recycling with Stakeholders
  - ✓ Set out the best options to Implement the Agreed National/Regional Strategy
- ▶ Considering ‘Polluters Pay Principle’, there are no proper and specific penal provisions in the existing SRO and that deficiency/ gaps needs to be addressed accordingly.

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- Child involvement in ULAB should be abolished. There needs to be an age limit for working in ULAB processing units (at least 18 years as a minimum). As Bangladesh has age limitations for various working sectors like; the garment sector or other industrial sectors, ULAB processing sectors should be identified like this.
- The SRO should be published in both Bangla and English for the battery importer. There is a good scope for importing ULAB in the foreign market. As English is a widely spoken language, regulations need to be published in English.

9. <u>Carry out monitoring</u>

For such initiatives to be pragmatically successful, it is imperative to monitor the progress and effectiveness of the law and adjust or update the directives accordingly. To ensure enforcement and monitoring of the policy, it is important to clearly distribute and define roles and responsibilities between local, national and sub-national authorities and organizations. It is key to ensure that the process of enforcement is made clear to the users who will be impacted by the policy. For instance, in the case of a levy on retailers, it should be made clear to the retailers how and when the levy should be collected or deposited. In the case of a levy on consumers, the public should be made aware of the amount they are expected to pay and why the levy is necessary.

When the law includes punitive measures, the prosecution of offenders will help ensure compliance to the policy. As conditions change over time, it is important to monitor the progress and effectiveness of the policy introduced and adjust the policy accordingly. It is important for governments to keep the public updated on the progress and benefits achieved, to continue building consensus and demonstrate accountability. Progress could be monitored in several ways, including HSE audits, surveys, impact assessments and focus-group interviews. It would be advisable to review the policy instruments on a regular basis (for instance with a yearly frequency for the first three to five years, and afterwards every five years or as deemed necessary). In the case of total bans on informal recycling, law enforcement and monitoring of compliance are critical to ensure that the prohibited recycling is not illegally happening.

To gather data on effectiveness, governments may consider including in the legislation a reporting obligation (providing a standard template to allow for comparability across years) to estimate the reduction in consumption. Once progress and effectiveness have been estimated, these would inform and form part of the new baseline scenario. The steps presented in the road map for policymakers could then be reviewed and refreshed to ensure that the measures in place continue to be the most effective and appropriate for the country or local context.

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Recommendations:

As part of the policy development, it would be advisable to consider measures that ensure the necessary skills and human resources (and therefore budget) will be in place before the policy enters into force.

Strategy for policymakers: 9 steps to consider when introducing environmental sound management (ESM) for Used Lead-acid Battery (ULAB) Recycling

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7. Conclusion

Large amounts of used lead-acid batteries are improperly finding their way into residential areas where informal recycling occurs, especially in rural areas with inadequate waste management systems and limited public awareness. Only a small percentage are recycled in formal way. From the initial desk assessment studies, it is evident that the presence and impacts of mismanaged lead-acid batteries are not solely characteristic of developing countries. Therefore, proper assessments or inventories and location identification of hotspots and implementation of regulation are required to stop informal recycling practices and impose standard management processes.

The following responsibilities of relevant ministries in the implementation of plans should be maintained while developing and ESM of ULAB in Bangladesh:

I. ULAB Recycling and Lead Phase-out Coordination Committee identification and assigned their roles and responsibility regarding implementation of the strategy;

II. Publish Initial Assessment and Inventory Report:

- Lead Inventory and Identification of Emissions and Effluent Discharges in Bangladesh
- Assessment and Findings of the Policy, Regulatory and Institutional Framework
- Communication Strategy

III. Assessment of country situation in the informal sector:

- Showcase of informal recycling of used lead-acid batteries
- Legal instruments for managing and regulating hazardous lead chemicals
- Non-regulatory mechanisms for managing lead

IV. Improvements of occupational health and safety standards and best practices for handling lead and ULAB;

V. Systematic arrangement of implementation of the responsibilities for each relevant ministry, departments;

VI. Development of a National implementation strategy to phase out of lead-added value products;

VII. Modification of Existing Laws, SRO and orders through Gap Analysis, Inputs and Clause identification;

VIII. National Guidelines for the Environmentally Sound Management (ESM) of Used lead-acid batteries;

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IX. National Policy Guidelines for ULAB Management;
X. Adapted bill/regulation on lead and ULAB.

Bangladesh has Constitutional mandate as well as a legal obligation to protect the 'right to life' and a 'right to the safe environment' beyond which no one can expect a healthy life and lead poisoning from informal ULAB recycling is putting human and animal life at major risk. The Department of Environment (DoE) should include environmentally sound management (ESM) and regulate unauthorized ULAB recycling through their updated SRO. The DoE may have to follow the Basel Technical Guideline[24] and Basel Convention training manual[25] during formulating the final draft of the amended version of SRO on ULAB management in Bangladesh.

[24] https://digitallibrary.un.org/record/699690?ln=en - Technical Guidelines for the Environmentally Sound Management of Waste Lead-Acid Batteries- Basel Convention technical guidelines- UNEP
[25] http://archive.basel.int/meetings/sbc/workdoc/tm-ulab/tm_ulab.pdf - BASEL CONVENTION TRAINING MANUAL- National Management Plans for Used Lead-acid Batteries.

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"Lead is a potent neurotoxin, affecting the way our kids learn and behave. There is no safe level of lead for children."

— Dr. Sean Palfrey, Medical Director, Boston Lead Poisoning Prevention Clinic

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