

Lead Battery Manufacturing Certification in the Developing World: Applying BEST Standards in India and Vietnam

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Abstract

The lead battery industry in developing countries is growing rapidly as a result of motorization, increases in off-grid power technologies, and requirements for backup power supplies. Unfortunately, sustainable collection policies and recycling practices have not been adopted by most nations. As a result of the lack of formal recycling infrastructure and relatively high values of lead, lead batteries are often recycled in informal backyard smelters, creating high levels of environmental and occupational pollution. This paper discusses the Better Environmental Sustainability Targets (BEST) certification for battery production. BEST is a voluntary certification that battery manufacturers can choose, ensuring that they meet minimum requirements for occupational safety and used battery recovery. This paper discusses the potential of BEST certification to reduce lead exposures in the developing world.

Introduction

Lead poisoning is one of the most serious environmental health threats to children and is a significant contributor to occupational disease. The World Health Organization (WHO) estimates that 120 million people are over-exposed to lead (approximately three times the number infected by HIV/AIDS) and 99% of the most severely affected are in the developing world. Over 75% of all lead production goes into batteries.¹

The alarming number of children and adults impacted by lead poisoning and the disparity in average blood lead levels between the US and developing nations underlines the need to address this problem. Given the much higher emissions reported around lead smelters and battery manufacturing facilities in developing countries, we know that improvements are not only possible, but necessary. Reducing lead poisoning is central to the future health and development of many countries.

Occupational Knowledge International, in cooperation with the University of Tennessee, has been working to build capacity to improve the environmental performance of this industry in India and Vietnam. The Better Environmental Sustainability Targets (BEST) certification was introduced in 2008 to provide an incentive to lead battery companies in rapidly industrializing countries to meet minimum standards for emissions and product stewardship.

1 Personal correspondence from Paul Marsh, Lead Development Association International.

Impacts of Lead Poisoning

Overwhelming evidence suggests that lead poisoning adversely affects nearly every system in the body and even modest exposures reduce the learning capacity of children and compromise their future potential to contribute to society (Bellinger et al. 2005). While severe lead poisoning can cause coma or death, most overexposed individuals have no obvious symptoms. Millions of children with moderate environmental lead exposures from contaminated air, soil, water, and dust experience reductions on school performance indicators. Lead poisoning is also linked with hyperactive and violent behaviour in children (US Department of Health and Human Services 2007).

Adult lead poisoning, usually from occupational exposures, also weighs heavily on society. Lead affects the brain, kidneys, blood, and the reproductive system in both men and women. At relatively low levels, lead is known to contribute to high blood pressure (Cheng et al. 2001). The potential costs of lead poisoning to society are great, which is why most countries have taken steps, including removing lead from gasoline, to address the problem.

Hazards of Lead Battery Manufacturing and Recycling

Lead-acid batteries for automobiles, trucks, industrial equipment, photovoltaic solar systems, and backup power supplies are the largest use of lead worldwide. The worldwide market for lead automotive batteries is estimated as \$14.6 billion annually, and batteries for other back-up power supplies represent an additional \$2.85 billion (Frost and Sullivan 2004). It is estimated that between 60,000 and 70,000 people are employed in lead battery manufacturing, with similar numbers of people working in mining, primary smelting, refining, and recycling (IC Consultants Ltd 2001).

The demand for lead batteries is predicted to increase for all uses, especially in industrializing countries, where they are often used for backup power in areas with intermittent electricity (IC Consultants Ltd 2001). New car designs, hybrid cars, and electric vehicles, many of which rely on battery systems that are significantly larger than standard 12-volt batteries, are further contributing to rising demand (CHR Metals 2008). The expected rise in automobile and computer sales throughout the developing world will fuel future growth in the production and eventual recycling of lead batteries.

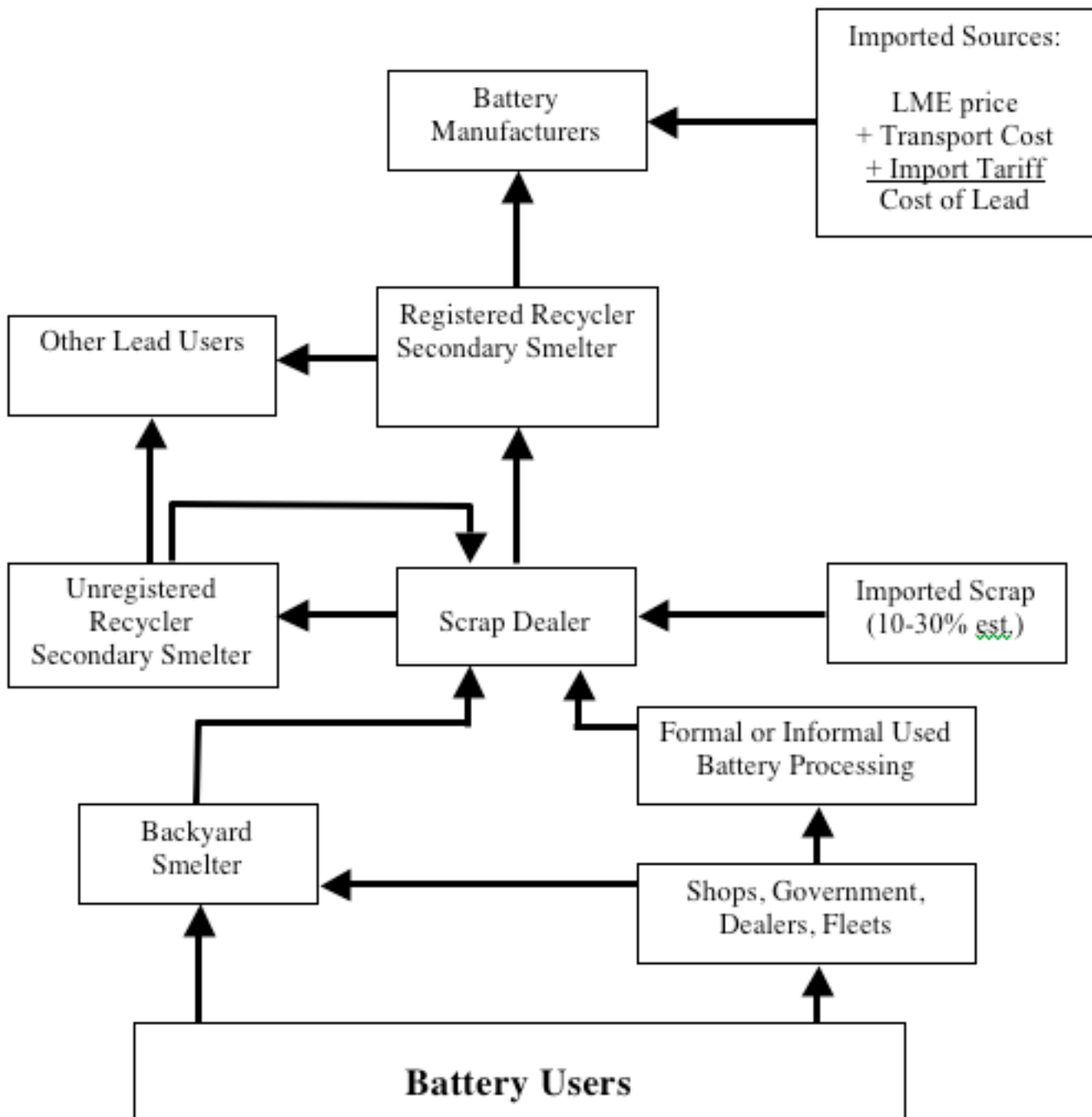
Recycling lead (also known as secondary smelting) by melting down used batteries is a common, informal sector business throughout the developing world. Unfortunately, recycling lead from used batteries cannot be done safely by micro and small enterprises operating without adequate capital equipment and procedures to minimize emissions. In India, for example, most recycling operations are carried out in the informal economy by small facilities known as backyard smelters. Because of the primitive nature of these operations and their enormous number, estimated to be in the tens of thousands, lead poisoning and lead spreading to workers' homes and the environment is a major challenge. Unfortunately, the full extent of this problem is undocumented and it is difficult. Evidence in the Philippines suggests that about 45% of lead scrap is processed by the informal sector, losing up to 50% of the lead content of the battery to the environment (Hoffmann and Wilson 2000). India's case is likely comparable.

Battery manufacturing is also associated with significant environmental lead emissions. Average exposure levels among children residing near battery plants in developing countries are four times the WHO acceptable level and workers in these plants have approximately twice the recommended exposure (OK International 2003). There are dozens of examples of polluted lead battery manufacturing sites from around

the world that have been the source of lead poisoning to those residing nearby.

Blood lead surveys in several areas of India following the removal of lead in gasoline have found high percentages of children with elevated blood lead levels (53% of children under twelve years of age) (Clark et al. 2005). A number of these surveys focused on populations near informal lead-acid battery recyclers. These types of facilities have long been recognized as significant sources of lead contamination in the environment and major health hazards to workers and people living nearby.

To trace public health impacts, it is important to understand material flows and the various actors involved in lead battery production. The existing general flow of lead for raw material to battery manufacturers and recyclers is depicted in Figure 1. The figure shows that the current lack of domestic supply is costing manufacturers more for raw materials. As lead is traded on the London Metal Exchange, pricing is set uniformly around the globe. However, transportation and import duties can make imported lead more expensive than if sourced locally. A similar cost structure is in place in many countries without sufficient domestic supply. In this way the development of large-scale efficient recycling is a goal shared by



manufacturers in most developing countries, but the common hurdle is developing a battery collection system that can support the necessary investment.

Extended Producer Responsibility

In the context of distributed environmental impacts, producer responsibility models have countered some of the challenges with difficult-to-enforce industries. Extended producer responsibility models impose the burden of end-of-life waste management on the producer of the product with varying levels of success in industries that include household batteries, computers, and other consumer waste. These programs can be voluntary or mandatory. Some of the most significant challenges related to producer responsibility programs are the collection of waste materials from consumers. Several collection systems have emerged. A specialized collector system requires retailers to take back waste products and return them to collection points or specialized collectors, who then return the waste to the producer for appropriate disposal or recycling. Specialized collectors can work for any company and allow retailers to mutually benefit from economies of scale. Manufacturer-supported reverse distribution systems place the burden of collecting waste on retailers, and individual producers are required to collect the batteries from retailers. This system allows delivery vehicles to exchange new products with waste products for return to the producer.

The BEST Program

International and Indian NGOs, government agencies, and industry have formed a partnership to respond to the lead poisoning epidemic. These parties have come together with a common goal of improving the health and educational opportunities of millions of children around the globe. The partnership is developing an environmental certification program for lead battery manufacturers that meets minimum emission standards and agrees to take back used batteries for environmentally sound recycling. The objective is to reduce emissions from lead battery plants and discourage backyard recycling, and thereby prevent lead poisoning. The participation of leading battery companies will be encouraged with a program to recognize companies that meet minimum standards.

The Better Environmental Sustainability Targets (BEST) program is designed to restructure the incentives that drive industry behavior. Environmental standards for the lead battery industry are being developed in partnership with the battery industry, major battery purchasers, NGOs, government, and other experts. The goal is to encourage companies to adopt improved pollution control measures by offering an eco-labeling program as an incentive. Participating companies will agree to meet minimum emission standards and to take back batteries for proper recycling. An accredited local auditor will conduct an annual assessment to verify compliance with minimum performance standards. Companies that meet these standards are eligible to place eco-labels on their batteries. The program is economically sustained by generating revenues from licensing fees for displaying the certification label based on production volume.

The BEST lead battery standard is being implemented first in India, but because the industry is fairly uniform with similar inputs and outputs throughout the world, the standard is intended to be internationally applied. We have also initiated outreach programs in Vietnam, as we believe that there will be significant potential for wider adoption of the standard, as the government is developing lead battery take-back regulations.

BEST Objectives

In response to the lead poisoning epidemic and the inability of existing regulatory structures to correct deficiencies in the market, a multi-stakeholder group developed the BEST Standard 1001 to be used to conduct environmental audits of lead battery manufacturing facilities under a third party verification system. The objectives of this environmental standard for lead battery manufacturing plants are:

Objective 1: Reduce lead exposures in communities where lead batteries are manufactured.

Objective 2: Reduce lead exposures and improve the health status of employees of lead battery manufacturing facilities that are exposed to lead and other hazardous materials.

Objective 3: Increase the adoption of sustainable practices in order to reduce the environmental impact of lead battery manufacturing by encouraging efforts to minimize waste, lower emissions, reduce energy and water consumption, and encourage environmentally sound recycling.

The BEST Standard 1001 provides the criteria to evaluate the environmental performance of lead battery manufacturing facilities against these objectives. However, the standard does not address other parts of the lead supply chain including recycling, transport, mining, primary smelting, or mineral processing. The standard also does not address wages, working conditions, or other social criteria not directly related to occupational health.

India's Lead Battery Management Situation

India offers a clear example of the limitations of regulatory efforts to correct economic disincentives to environmentally sound lead battery recycling in the developing world. In response to concerns about lead poisoning, the Central Government of India, Ministry of Environment and Forests, promulgated "The Batteries (Management and Handling) Rules, 2001" to stem the flow of used lead batteries into the informal economy for recycling. The rules specify how manufacturers, importers, re-conditioners, assemblers, dealers, recyclers, auctioneers, and bulk consumers must ensure that used batteries are disposed of in accordance with these requirements and file regular reports to the government.

Under this regulation, manufacturers, assemblers and re-conditioners are required to ensure that:

- at least 90% of used batteries are collected back against new batteries sold;
- collection centers are set up for collection of used batteries from consumers or dealers;
- reports of sale and buyback volumes are filed with state pollution control boards;
- used batteries that are collected are sold only to formal sector recyclers registered by the state pollution control boards; and
- recycled lead may only be purchased from registered recyclers.

Despite these regulatory efforts, the mandatory reporting by battery manufacturers to the government under this law demonstrates that the vast majority of used lead batteries are not collected and directed to registered recyclers in India. Several elements work against the effective implementation of this law, including:

- a tax structure that favors undeclared transactions in the informal sector,
- a lack of enforcement power by government regulators,
- a lack of consumer awareness,
- the large number of backyard smelters, and
- the competitive nature of battery manufacturing, which discourages companies from providing incentives to buy back used batteries without the participation of their competitors.

Because of these structural impediments, lack of resources for enforcement, lack of meaningful penalties, and the enormous number of transactions that occur at the consumer-dealer level, it is unrealistic to expect that existing laws can operate effectively without additional incentives to battery manufacturers and their

retail dealers. As a result, and because of the favourable economics involved, backyard smelters continue to thrive in India, with the costs ultimately shifted to society. BEST offers compliance through third party verification audits and is therefore an improved mechanism to ensure compliance, particularly under threat of losing their certification and thus market share of BEST battery purchasers.

This situation adversely affects the supply of lead needed for battery manufacturing in the country. Although India has some domestic mining and primary smelting capacity, it is a net importer of lead, as is necessary to feed a rapidly growing battery industry. Much of the lead processed by backyard smelters is low in purity and therefore cannot be used for manufacturing high quality battery plates. Because of inefficient recycling, much of the lead is lost to the environment, impacting resource utilization. Competition with the informal sector creates unfavorable incentives to invest in large scale recycling facilities, as they require more advanced environmental controls and increased transportation and logistics costs. Though some of these costs can be recovered in higher efficiencies, omitting environmental and public health externality costs from the informal sector leaves larger plants at a disadvantage. Moreover, investments in large-scale modern battery recycling plants have not been made in India as they cannot be assured of a sufficient supply of used lead batteries due to the widely distributed informal sector. If BEST is adopted, the informal sector could transfer toward battery collection activities, maintaining their opportunity in the battery recycling sector but reducing the environmental and public health impacts of their activities.

The lack of a battery collection system and tax structures favoring the unorganized sector are impediments to the development of environmentally sound recycling plants. The importation of used lead batteries is also not permitted due to the Basel Convention restriction on the transboundary shipments of used lead batteries (UNEP 1994). Instead, India is importing more ore to feed primary lead smelters.

OK International has been working cooperatively with one of India's largest lead battery companies for several years. The company allowed OK International to conduct a pilot study at their facility, which became the construct for the BEST program. Since that time, they have continued to consult with OK International and our partners at the National Referral Centre for Lead Poisoning in India (NRCLPI) on the best means to improve their environmental practices in anticipation of becoming BEST certified.

Their efforts to improve the facility infrastructure and programs have been quite admirable. For example, they have hired a medical officer to oversee adoption of the BEST Standard as well to oversee the general health and safety of the workforce. The company has also formed a "Lead Team" charged with overseeing the BEST certification process and creating new health and safety programs designed to comply with these requirements. The company has consulted with OK International on the design of a large shower facility to improve hygiene practices and avoid take home exposures. Other improvements are ongoing.

Vietnam Lead Battery Management Situation

A similar growth pattern to that observed in India is evident in Vietnam, where the number of registered vehicles increased by 33% between 2003 and 2006. Meanwhile, Vietnam's battery market reached a substantial estimated domestic size of \$65.3 million in 2006, and plans were established to supplement the country's heavy lead importation by expanding lead mining capacity by 5,000 tons per year in the northern provinces of Bac Can and Tuyen Quang.

As growth in the automobile industry continues, increased production of lead

batteries will lead to more lead recovery through battery recycling, and potentially to more lead poisoning. The recycling of lead batteries in the developing world is dominated by informal secondary smelters,

as is the case in Vietnam. Unfortunately, the recycling of lead batteries in the informal sector is an unsophisticated operation that pollutes the environment and is a major source of excessive human lead exposure. In Vietnam's Hung Yen province, lead pollution from one village's informal recycling has led to 500 people suffering from chronic illness, and twenty-five children suffering from neurological disorders.

The Vietnamese Revised Environmental Law 2005 stipulates that manufacturers of lead batteries shall be responsible for taking back used batteries (Article 67). However, no regulations have been drafted to stipulate how lead batteries will be collected. Our work with the Vietnam Environmental Protection Agency (VEPA) informed them of other international regulatory models that can be employed and presented them with policy options for formulating such regulations. All collection schemes examined begin with the premise that manufacturers are responsible for overseeing battery collection. Our work focused on collection mechanisms that are the most appropriate alternatives in the Vietnam context.

BEST implementation is beginning in Vietnam and we have conducted training and awareness sessions with both auto companies and lead battery companies. We have seen that, in some cases, these sessions are the first time that manufacturers have engaged suppliers in discussions about environmental practices. After meeting with senior management of one of the world's largest vehicle manufacturers at their plant in Vietnam, the company sent a letter to their local lead battery supplier seeking information on emissions and lead battery collection efforts. This triggered a response from the battery company: a commitment to make improvements in wastewater treatment, improve air emission controls, and other environmentally responsible practices. Engaging stakeholders and raising awareness is the first step to implementing BEST standards.

Conclusion

Environmental and occupational health from lead exposure is increasingly threatened by increased motorization, industrialization, and penetration of off-grid power sources in rapidly industrializing countries. The consequence of many "green" technologies is increased reliance on lead acid batteries in regions with poor recycling infrastructure and relatively high economic incentive to participate in informal manufacturing and recycling activities. Regulations in the battery sector are difficult to enforce in most developing countries because of weak institutions and resource limitations. As such, lead pollution is silently decreasing educational opportunity and future development potential.

Producer responsibility models have been successfully employed in other sectors related to toxic waste, and we propose that a similar model can be successfully applied to battery production. BEST certification is a way to improve battery production practices by independently auditing battery manufacturers to ensure that their workers and the environment are protected from their operations. Responsible battery consumers (vehicle companies, industry, etc) create demand for BEST-labeled batteries by mandating the use of certified batteries, creating a market for batteries that internalizes the environmental costs of their production.

The BEST certification, launched in 2008, has been introduced in India and Vietnam. As companies come forward for certification, the BEST program has the potential to significantly improve the work conditions and environmental impacts of lead battery production. This process starts with stakeholder buy-in and requires industry to identify and acknowledge the importance of reducing lead exposures to the population and its workforce, followed by action to reduce environmental emissions and improve work conditions. Capacity building and education is important and engaging local academic institutions to help champion this policy product and educate the future generation of policy makers is important to this program.

There are many unknowns related to identifying the need and solutions for sustainable lead battery manufacturing. While anecdotal evidence of severe lead pollution is abundant, there have been few quantitative analyses of the informal industry. Several activities could improve the viability of BEST deployment. More research is needed to identify the extent of the informal battery recycling industry through aggregate material flow analysis. Emission rates of lead and CO₂ from the informal and formal sectors should be quantified and compared to identify the extent of the improvement. Spatial analysis should be conducted to target and prioritize lead pollution hot spots. Finally, institutional and educational support needs to be provided to help develop model policy and battery take-back mechanisms, assisting the public and private sectors. With buy-in from the various stakeholders, BEST has the potential to significantly improve lead battery manufacturing and thus protect workers and the public from the negative effects of lead poisoning.

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