Exporting Hazards:

U.S. shipments of used lead batteries to Mexico take advantage of lax environmental and worker health regulations

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Occupational Knowledge International
and Fronteras Comunes

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About OK International:

Occupational Knowledge International (OK International) is a non-governmental organization (NGO) dedicated to improving public health in developing countries through innovative strategies to reduce exposures to industrial pollutants. Based in the U.S., the organization works in partnership with governments, businesses and NGOs to address inequities in environmental standards. The focus of our work includes efforts to prevent lead poisoning from exposures to lead battery manufacturing, battery recycling, and mining, and to eliminate the use of lead in paint. The organization has experience working to improve environmental controls in lead battery manufacturing and recycling in India, China, Bangladesh, Vietnam, Cameroon, Senegal, and Mexico. OK International worked cooperatively with the lead battery industry and other stakeholders to develop the Better Environmental Sustainability Targets (BEST) certification standard to reward battery companies that meet minimum standards for emissions and product stewardship. The organization also brings the technical resources to measure exposures, find solutions, and clean up the environment in order to protect public health.

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Fronteras Comunes is a non-governmental organization (NGO) founded in 1998 in Mexico City to work for environmental justice. The organization's focus is on issues related to environmental pollution caused by chemical substances and hazardous waste. Fronteras Comunes works to strengthen community participation to respond to environmental threats in order to achieve healthy and sustainable communities. Fronteras Comunes seeks to influence Mexico's environmental management of toxic substances and to improve compliance with national and international laws that protect the environment and human health. It also participates in various national and international committees to help develop public policies that are economically viable, socially just, and environmentally sustainable.

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Executive Summary

Considerable attention has been paid in recent years to transboundary shipments of hazardous waste including used electronic products that are intended for recycling or disposal in developing countries with few environmental controls. However, this report documents the growth of authorized exports from the U.S. to Mexico of a potentially more hazardous waste stream that has received very little attention or scrutiny. We examine the fate of used lead acid batteries (ULABs) that are being exported to Mexico for recycling and the potential impacts on public health and the environment.

Despite international agreements and treaties governing this trade and addressing environmental issues of mutual concern, we have found that these batteries are being recycled in Mexico under less stringent standards, resulting in significantly higher occupational and environmental exposures. Given the considerable differences in environmental and occupational regulations between the U.S. and Mexico, this report raises serious concerns about the contribution of ULABs from the U.S. to lead poisoning south of the border.

Our findings are summarized below:

- In 2010, exports of used lead batteries from the United States to Mexico increased 112% from the previous year.
- Approximately 12 percent of used lead batteries generated in the U.S. are exported to Mexico.
- The regulatory level for airborne lead at lead battery recycling plants in Mexico is ten times higher than in the U.S. Actual airborne lead emissions reported by lead battery recycling plants in Mexico are approximately 20 times higher than from comparable plants in the U.S.
- Twice as much lead is exported to Mexico in used batteries than is exported in all the electronic waste (e-waste) exported from the U.S.
- The Permissible Exposure Limit for airborne lead in the work place is three times higher in Mexico than in the U.S.
- Average blood lead levels among workers as reported by a recycling plant in Mexico are five times higher than the average reported by a U.S. recycler.
- Less than half of all approved Mexican recyclers have reported any lead emissions to the RETC (Registro de Emisiones y Transferencia de Contaminantes). The lack of complete information has hampered efforts to assess the full extent of the problem in Mexico.
- Exports of used lead batteries to Mexico are not tracked with a waste manifest system and may be diverted to unlicensed recycling facilities.

This report documents how differences in regulations and enforcement have created an uneven playing field between the U.S. and Mexico. Given these major disparities in environmental and occupational standards, government-to-government intervention under the NAFTA framework should be initiated. Additional enforcement is also needed to close unauthorized plants and to bring Mexican companies into compliance with existing laws on emissions reporting under RETC.

I. Introduction

Concerns about hazards from lead battery recycling activities have grown in recent years as a steady stream of reports describing widespread lead poisoning from these operations emerge from many developing countries. In the United States new regulations are forcing lead battery recycling plants to invest in advanced pollution controls to meet even more stringent standards for airborne lead emissions. At that same time, the exports of used lead batteries from the U.S. to Mexico have increased significantly. The purpose of this report is to investigate the current state of lead battery recycling in Mexico and the role of the U.S. battery exports in this market. Additionally, this report will provide background on the environmental, economic, and health impacts of the lead battery recycling industry in Mexico. Finally we contrast U.S. and Mexican standards that apply to this industry.

The Mexican battery market is the smallest and least developed in North America. However, increases in battery demand in Mexico have outpaced the region as a whole over the past decade, due both to the nation's population growth and extensive investment in automotive and other battery manufacturing plants by foreign firms.

The processing of used lead acid batteries (ULABs) for secondary lead has also grown in Mexico over the past decade. It is reported that around 80 percent of all ULABs in Mexico are recovered and recycled.[1] A significant number of ULABs are also imported into Mexico for recycling. Mexico prohibits imports of ULABs for final disposal into landfills, but imports are permissible if notification is given and they are sent to authorized recycling facilities. In 2010, imports of ULABs into Mexico totaled 236,746,892 kg representing an increase of 112 percent from the previous year.[2]

While the U.S. and Mexico have regulatory structures requiring notification from companies on proposed shipments of ULABs across the border, facilities that recycle ULABs operate under far different standards in these countries. Emissions from lead battery recycling plants in Mexico are approximately 20 times higher than from comparable plants in the U.S. In addition, occupational lead exposure standards are three times higher in Mexico than in the U.S. There is also concern that a portion of the exported ULABs entering Mexico may end up in unlicensed recycling facilities with even less stringent worker protections and environmental controls.

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.[3] At least 80% of all lead production goes into batteries.[4]

[1]Basel Convention, First meeting of the steering committee on the project Preparation of a regional strategy for the environmentally sound management of used lead acid batteries in Central America, Colombia, Venezuela and the Caribbean island states, December 2003.

[2]United States International Trade Commission, USITC Interactive Tariff and Trade Data Web, available at: http://dataweb.usitc.gov/scripts/user_set.asp. Accessed: March 2011.

[3]Fewtrell L, Kaufmann R, Pruss-Ustun A., "Lead: Assessing the Environmental Burden of Disease at the National and Local Level" WHO Environmental Burden of Disease Series, No. 2, 2003.

[4]International Lead and Zinc Study Group, Statistics Database,"End Uses of Lead" Available at: http://www.ilzsg.org/static/enduses.aspx?from=2 Accessed: December 2010.

Lead poisoning causes symptoms ranging from a loss of neurological function to death depending upon the extent and duration of exposure. In children, moderate lead exposure is responsible for a significant decrease in school performance, lower IQ scores, increased aggression and violent behavior. The resulting irreversible mental impairment affects the ability to learn and is associated with a loss of lifetime income. Adults also impacted by chronic and acute lead exposures suffer neurological damage, reproductive effects, anemia, kidney damage, high blood pressure and other ailments.

The information contained in the report was collected through exhaustive research conducted simultaneously in the U.S. and Mexico. OK International and Fronteras Comunes conducted interviews with government agencies, battery recycling company representatives, environmental consultants, nongovernmental agencies, and obtained information from public agencies through databases and publications. Government documents were also obtained through the Freedom of Information Act (FOIA) from the U.S. Environmental Protection Agency (EPA) and through 34 requests to 21 Mexican ministries and local port authorities under the INFOMEX system of the Federal Institute to Access Public Information (Instituto Federal de Acceso a la Información Pública/IFAI).

II. Lead Battery Manufacturing and Recycling in Mexico

From 2007 to 2009, Mexico's total domestic primary lead production increased from 137,133 metric tons to 143,838 metric tons.[5] Global lead production in 2009 totaled 4.29 million metric tons, 3.4 percent more than in 2008.[6] However, Mexico only produced 3 percent of global lead production that year. The top lead producing states in Mexico are Zacatecas (45.7% of total) and Chihuahua (30.1% total).

There is little data available on the secondary production of lead obtained from recycling ULABs in Mexico. However, in Mexico, the capacity of secondary lead recycling far exceeds reported primary production. Some of Mexico's largest lead battery manufacturers operate their own recycling plants with the output used to manufacture new lead batteries.[7] Mexico ranks fifth worldwide in lead production and battery manufacturing accounts for more than 75% of Mexico's lead consumption.[8]

The largest lead battery producer in Mexico is Enertec with approximately a 75% market share in Mexico.[9] Operating as a subsidiary of the U.S. Company Johnson Controls Inc., Enertec brands in Mexico include LTH, America, Full-Power, Diener

[5]National Institute of Statistics and Geography, Metals Industry Statistical Database, Available at: http://www.inegi.org.mx/. Accessed: November 2010.

[6]U.S. Geological Survey (USGS), "Mineral Commodity Summary: Lead" January 2010, January 2011.

[7]Commission for Environmental Cooperation, "Practices and Options for Environmentally Sound Management of Spent Lead acid Batteries within North America" December 2007. Available at: http://www.cec.org/Storage/61/5350_SLABs-final-dec07_en.pd. Accessed: December 2010.

[8]Ibid.

[9]Llera RG, "Integrated Electronic Waste Management in Mexico: Law, Technology, and Public Policy", Dissertation submitted to Massachusetts Institute of Technology, June 2004. http://dspace.mit.edu/bitstream/handle/1721.1/17717/56429517.pdf?sequence=1Accessed: May 2011.

and Cronos, Monterrey, Hitec, and Nation Wide. Johnson Controls Mexico currently has four battery manufacturing plants and two recycling plants.

In 2007, an estimated 6.5 million ULABs were generated in Mexico.[10] The exact number of these ULABs that were collected for recycling is unknown; however a 2007 report by the Commission for Environmental Cooperation (CEC) indicates that the majority of ULABs in Mexico are being recycled.[11] With the current price of lead on the international exchange at around $2,500/ton USD, and retail outlets offering a substantial incentive to consumers for returning ULABs, there are sufficient economic incentives to recycling ULABs in Mexico.

Enertec has recently opened the newest battery recycling facility in the country in Garcia, Nuevo Leon with a capacity of 252,000 metric tons/year. The next largest plant is the Corporacion Pipsa with a capacity of 104,760 metric tons/year. Mexico has authorized 21 plants with a capacity of 864,003 metric tons of lead batteries to be recycled per year (see Appendix A).

Although Johnson Controls manufactures lead batteries in both the U.S. and Mexico, it only has lead battery recycling facilities in Mexico at this time. In contrast, Exide, the largest lead battery manufacturer in the U.S. has six recycling facilities in the U.S. and none in Mexico.

Modern recycling plants use mechanical means to crush lead batteries and then separate out components as follows:[12]

a. The plastic casing and lead batteries are crushed, and the main components (polypropylene, lead oxide and lead metal) are separated. Water is generally used to separate these components.

b. The lead-containing components are melted down in rotary kilns.

c. Battery acid (and water used in the process) passes to the onsite water treatment plant and is often recycled.

By contrast, small recycling plants and informal recycling operations rely on manual labor to dismantle batteries, the waste acid is often dumped on the ground, and the plastic cases are often burned as a fuel additive or mixed with lead components in the furnace. Efficiencies of lead recycling operations vary greatly as do the adequacy of pollution control technology used to trap lead and other pollutants.

In contrast to most U.S. States, Mexico has no mandatory lead battery take back requirement. As a result a mixture of formal and informal mechanisms are used to take back used batteries. Presently, the following systems are currently used in ULAB collection in Mexico:

1. User ➤ Repair Shop ➤ Authorized Recycler (Unauthorized Recycler also possible)
2. User ➤ Authorized Distributor ➤ Authorized Recycler
3. User ➤ Landfill ➤ Unauthorized Recycler

[10]The National Recyclers Institute in Mexico (INARE), "Accumuladores de baterias usadas" 2007. Available at: http://www.inare.org.mx/acumuladores.htm Accessed: December 2010.
[11]Commission for Environmental Cooperation, "Practices and Options for Environmentally Sound Management of Spent Lead acid Batteries within North America" December 2007. Available at: http://www.cec.org/Storage/61/5350_SLABs-final-dec07_en.pd. Accessed: December 2010.
[12]Johnson Controls website, Available at: http://www.autobaterias.com.mx/reciclaje.htm. Accessed: November 2010.

We conducted an informal survey to determine the financial incentives being offered to buy back used lead batteries by large and small retail shops and small-scale waste collectors in April 2011. Interviews with these businesses indicates that retail stores are offering a discount towards a purchase of a new battery ranging from $9.00 to $14.00 USD in exchange for turning in a used battery. Waste collectors specializing in a range of recyclable commodities are also willing to pay for used batteries at rates in the upper end of this range. Large retailers, including U.S. companies Wal-Mart and AutoZone, are also all offering a significant financial discount to consumers for turning in a used battery at the time of sale or within a designated time frame (generally within 30 days). In fact the rates being offered by retailers in Mexico are approximately twice that offered by the same retailers in the U.S. In the U.S. take back incentives for used lead batteries are based on mandatory incentives in individual state laws which range from $5.00 to $10.00 USD.[13]

For example, Comercializadora de Acumuladores y Metales S.A. de C.V. (CAMSA) in Mexico City is a large automotive battery distributor for Enertec in Mexico. CAMSA is also a SEMARNAT authorized battery collection center. Johnson Controls sells batteries to CAMSA and has a policy that for each battery sold, one battery must be returned for recycling at a Johnson recycling plant. As an incentive, CAMSA provides a discount of $13.00 USD off of their sale price of batteries to their customers in exchange for returning their ULAB. The company also collects ULABs from companies and individuals. For each ULAB that CAMSA delivers to Enertec, the recycling plant pays CAMSA $15.30 USD in return. Enertec must also cover the transportation costs.

Due to their dual role as a collector, CAMSA estimates that they sell approximately 11,000 batteries per month while they are sending around 60,000 ULABs to Enertec for recycling. CAMSA indicates that the quantity of ULABs that they are recycling has increased dramatically since they instituted this incentive system.[14]

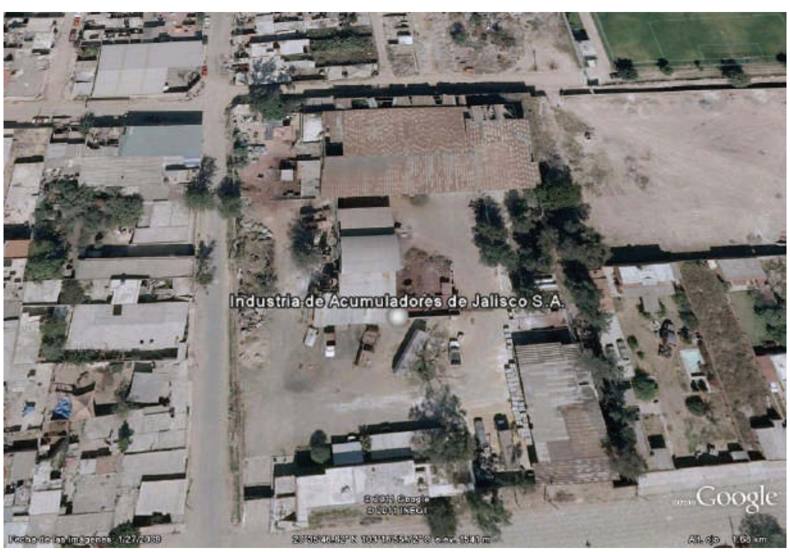
Recovering lead from used batteries provides further economic incentives in that it is much less energy intensive than producing primary lead from ore. The production of secondary lead requires 35-40% less energy than needed to produce primary lead.[15] The creation of secondary lead by recycling ULABs further eliminates the need for importing lead ore from other countries. Recycling lead also greatly reduces greenhouse gas emissions associated with mining and primary smelting.

Despite the presence of an organized battery collection and recycling program with participation by large operators, lead battery recycling is still being done by informal sector businesses operating without government approval in Mexico. For example, in the Guadalajara area (Tlaquepaque) we identified a lead battery recycling facility, Industria de Acumuladores de Jalisco, S.A. dE C.V. that has no current authorization according to SEMARNAT. The plant is located in a mixed residential area and the site is adjacent to an outdoor food market (see Figures 1 and 2 below).

[13]Battery Council International, Available at: http://www.batterycouncil.org/LeadAcidBatteries/BatteryRecycling/StateRecyclingLaws/tabid/120/Default.aspx Accessed: May 2011.
[14]Interview with CAMSA owner Cesar Vásquez. December 10, 2010. Mexico City.
[15]European Lead Sheet Industry Association. Lead Sheet Producers Respond to Copenhagen. 2009.

Figure 1.
Perimeter wall of unauthorized lead battery recycling facility Industria de Acumuladores de Jalisco.

Figure 2.
Location of unauthorized lead battery recycling facility Industria de Acumuladores de Jalisco in mixed residential neighborhood in La Duraznera, Tlaquepaque.



Unfortunately, recycling lead from used batteries cannot be done safely unless adequate pollution controls are in place to minimize emissions and reduce employee exposures. Based on the emissions data summarized in this report, and interviews with industry representatives, exposures from Mexican recycling plants are likely causing lead contamination in surrounding communities and workers are being over exposed.

In Mexico there have been at least three instances of widespread lead poisoning and environmental contamination around a primary smelter and two battery recyclers. In 2001, following reports of lead poisoning among children living in Torreon, Mexico near the Met-Mex Peñoles smelter, the U.S. Center for Disease Control (CDC) tested 367 children in the area surrounding the plant. The agency found that 20% of the children had blood lead levels greater than 10 ug/dL, and 5% of the children had blood lead levels greater than 20 ug/dL. In the areas closest to the lead smelting site, 33% of the children had blood lead levels greater than 10 ug/dL and 12% had levels greater than 20 ug/dL.[16] More recently exposure levels have declined to a geometric mean of 9.8 ug/dL among children age 2-17 – a level that is still approximately five times higher than the level in the U.S.[17]

Metales y Derivados, a U.S. battery recycler located outside of Tijuana, was closed in 1994 due to environmental violations. Following the closure of the plant, the site was abandoned and left contaminated with an estimated 6,000 metric tons of lead slag, waste sulfuric acid, and a mix of other heavy metals. Over 10,000 people were residing in the area immediately surrounding the abandoned plant. In 1998 Environmental Health Coalition (EHC) and the Colectivo Chilpancingo Pro Justicia Ambiental filed a petition under provisions of NAFTA to the Commission for Environmental Cooperation (CEC) to examine the abandoned site. In February of 2002, the factual record was released to the public and validated community health concerns about site contamination from the abandoned recycler. The record demonstrated that levels of lead in the surface soil at the site were 551 times higher than the U.S. Environmental Protection Agency Preliminary Remediation Goal for residential soil. In 2004 additional cleanup was initiated and the ownership of the property was transferred to the State of Baja California.[18] The work was finally completed in 2009.[19]

In 1991, the Alco Pacifico battery recycling plant, also in Tijuana, was closed by the Secretariat of Urban Development and Ecology(SEDUE) and issued an abatement and cleanup order. The company closed in 1992, leaving over 11,000 m3 of soil contaminated with lead and other heavy metals. The owner of the plant and the RSR Corporation, the U.S. company that contracted for recycling lead batteries at the plant, were the subject of successful legal action in the U.S. courts which recovered some of the cleanup costs.[20] Reports indicate that the site was never properly remediated.[21] No information was available on the status of the court sanctioned medical monitoring or the current site status.

[16]BU.S. Center for Disease Control, "Blood Lead Levels and Risk Factors for Lead Poisoning Among Children in Torreón, Coahuila, Mexico, Final Report" Available at: http://www.bvsde.paho.org/bvsea/fulltext/torreon.pdf. Accessed: January 2011.
[17]M.F. Soto-Jime´nez, A.R.Flegal, "Childhood lead poisoning from the smelter in Torreon, Mexico" Environmental Research 111, 2011, pg 590–596.
[18]U.S. Environmental Protection Agency, Available at: http://www.epa.gov/Border2012/metales-cleanup.html. Accessed: May 2011.
[19]U.S. Environmental Protection Agency,"U.S.-Mexico Environmental Program-Border 2012" 2009. Available at:http://www.epa.gov/Border2012/news/NCM-Fact-Sheet-English.pdf. Accessed May 2011.
[20]TED Case Studies, "El Florido Power Plant and Pollution" Available at: http://www1.american.edu/TED/florido.htm. Accessed: May 2011.
[21]National Environmental Justice Advisory Council, "Unheard Voices from the Border: A Report on Environmental Justice in the U.S.-Mexico Border Region From the Past to the Future" 2003. Available at: http://www.epa.gov/compliance/ej/resources/publications/nejac/nejac-ej-border-report.pdf. Accessed January 2011.

ULAB Collection, Transport and Storage

The collection, transport and storage of waste lead acid batteries present potential health and safety risks if improperly managed. As these activities involve multiple parties, including battery retailers, consumers, scrap dealers, manufacturers, and recyclers, it can be challenging to coordinate the proper management of used lead batteries in the take-back process. Every lead battery manufacturer, transporter, and recycler should have a written health and safety plan governing the procedures for collection, storage and transport of used batteries.

During collection, transport, and storage, the potential release of sulfuric acid present in lead batteries poses the greatest potential risk. This liquid contains substantial levels of lead and is highly corrosive. Battery acid may cause burns or damage the eye. In addition, environmental contamination of land, and ground and/or surface water will occur in the event of a spill of this material.

As there is no system to track individual shipments of used lead batteries across the Mexican border, it would be very challenging to conduct inspections specifically of transport and packaging practices for this trade. No Mexican or U.S. effort to inspect shipments for possible transport violations across the border was uncovered in our investigation.

III. Legislation and regulations concerning lead acid batteries in Mexico

Mexico has a large number of laws and regulations addressing used lead batteries, lead pollution, hazardous waste, and recycling practices. Appendix C summarizes the relevant legislation governing provisions of the applicable laws. Below is a brief summary of the laws and regulations concerning hazardous waste, occupational, health and environmental provisions. These standards are then compared to U.S. regulations.

Hazardous Waste Regulations Concerning Lead Batteries in Mexico

Lead acid batteries are considered hazardous waste under the General Law for the Prevention and Management of Hazardous Waste.[22] This law stipulates that ULABs must be addressed by management plans that are developed by the federal government, although it may involve states and municipalities.[23] Currently Mexico does not have a national ULAB management plan, but under this law private companies are also responsible for developing and implementing such plans that cover their operations and may be implemented locally, regionally, or nationally.[24]

[22]Semarnat. General Law for the Prevention and Management of Waste (Ley General para la Prevención y Gestión Integral de los Residuos), Article 5, Section XXXII and XXIX, Article 31, Section IV. Available at: http://www.diputados.gob.mx/LeyesBiblio/pdf/263.pdf
[23]Semarnat. General Law for the Prevention and Management of Waste Regulation (Ley General para la Prevención y Gestión Integral de los Residuos), Articles 27-34. Available at: http://www.diputados.gob.mx/LeyesBiblio/pdf/263.pdf
[24]Semarnat. General Law for the Prevention and Management of Waste Regulation (Reglamento de la Ley General para la Prevención y Gestión Integral de los Residuos), Article 16. November 30, 2006.

These management plans must detail the type of waste and their operations.[25] ULAB recyclers must register their management plans with SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales) and provide the name of the recycler, the type of management plan and hazardous waste for recycling.

The following environmental laws and regulations apply to lead battery recyclers:

1) The **Law of Ecological Balance and Environmental Protection in Evaluation of Environmental Impact (5/30/2000)** (Reglamento de la Ley General del Equilibrio Ecológico y la Protección al Ambiente en Materia de Evaluación del Impacto Ambiental) governs the construction and operation of plants that recycle or dispose of hazardous waste, including ULAB recyclers. Under this law and the General Law for the Prevention and Management of Hazardous Waste (Ley General para la Prevención y Gestión Integral de los Residuos/LGPGIR), authorization from the Ministry of Environment and Natural Resources is needed to construct a new recycling facility. Similarly, authorization is required for transport, including the import and export, of hazardous waste. Facilities recycling hazardous waste must follow SEMARNAT procedures regarding effluent, air emissions and pollution controls. If the environment of a particular site is contaminated, the owner is responsible for its remediation. This law also stipulates that ULABs may only be imported into Mexico for recycling and recovery, and not for final disposal into landfills.

2) The **General Law on the Prevention and Integrated Waste Management** (Ley General para la Prevención y Gestión Integral de los Residuos/LGPGIR) Lead acid batteries are considered by Mexican law as a hazardous waste[26] and recycling is regulated as hazardous waste subject to a management plan[27] under the category "motor vehicle batteries containing lead." The LGPGIR Regulation indicates that waste from the manufacture of electric batteries and accumulators are federally regulated.[28]

3) The **Official Mexican Standard on Hazardous Waste-052-SEMARNAT-2005** (Norma Oficial Mexicana NOM-052-SEMARNAT-2005) establishes the characteristics and identification for classifying hazardous waste and lists specific types of hazardous waste. Under this standard, the waste product generated from the manufacturing of lead acid batteries is considered toxic and must be managed as such.

4) The **Official Mexican Standard NOM-001-SEMARNAT-1996** (Norma Oficial Mexicana NOM-001-SEMARNAT-1996) establishes maximum permissible limits of contaminants in wastewater discharge. The maximum limits (monthly average) for lead are as follows:

a. Rivers and natural and artificial reservoirs: 0.5 mg/L for use in agricultural irrigation, 0.2 mg/L for urban public use, and protection of aquatic life;
b. Coastal waters: 0.20 mg/L to fisheries, navigation and other uses, 0.5 mg/L for recreation, 0.2 mg/L for estuaries; and

[25]Semarnat. General Law for the Prevention and Management of Waste Regulation (Reglamento de la Ley General para la Prevención y Gestión Integral de los Residuos), Article 24.
[26]Semarnat. General Law for the Prevention and Management of Waste Regulation (Ley General para la Prevención y Gestión Integral de los Residuos), Article 5, SectionXXXII, Article 31, Section IV.
[27]Semarnat. General Law for the Prevention and Management of Waste Regulation (Ley General para la Prevención y Gestión Integral de los Residuos), Article 5, Section XXI.
[28]Semarnat. General Law for the Prevention and Management of Waste Regulation (Reglamento de la Ley General para la Prevención y Gestión Integral de los Residuos), Article 32, Section XXII.

c. Land: 5 mg/L for use in agricultural irrigation and 0.2 mg/L for natural wetlands.

5) The **Official Mexican Standard NOM-002-SEMARNAT-1996** (Norma Oficial Mexicana NOM-002-SEMARNAT-1996) establishes the maximum permissible limit for discharges to urban or municipal sewage systems. The maximum limit (monthly average) for lead must not exceed 1.0 mg/L.

6) The **Official Mexican StandardNOM-004-SEMARNAT-2002** (Norma Oficial Mexicana NOM-004-SEMARNAT-2002) establishes maximum limits for contaminants in sludge and biosolids from the cleaning of urban sewage systems, municipal water treatment plants and waste water treatment plants. The maximum permissible limit for lead on a dry weight basis is 300 mg/kg (excellent) and 850mg/kg (good).

7) The **Official Mexican Standard NOM-147-SEMARNAT/SSA1-2004** (Norma Oficial Mexicana NOM-147-SEMARNAT/SSA1-2004) establishes criteria for determining concentrations of soil contaminated with certain heavy metals including lead. The maximum concentration limit for soil for agricultural use is 400 mg/kg and 750 mg/kg for soil for industrial use.

Occupational Regulations

In Mexico, there is only one specific occupational health regulation related to lead exposure. There are no explicit requirements that employee exposures be monitored with regular blood lead level tests and no provisions for removing workers from high exposure areas who are over exposed to lead. Blood lead monitoring is standard international practice and a legal requirement throughout most of the world. Without occupational regulations limiting blood lead levels, workers may be unknowingly suffering progressive health effects from high levels of lead that can go undetected for years.

One lead battery recycling company interviewed for this report indicated that average blood lead levels of workers in their plant are 55 ug/dl or five times the average level reported by a U.S. lead battery recycler. In addition, they indicated that workers are rotated out of high exposure areas if BLLs exceed 70 ug/dl, whereas U.S. regulations require workers to be removed from exposure to lead if BLLs exceed 50 ug/dl.

Under the Ministry of Labor, the **Occupational Health in Areas where Chemicals are Handled, Transported, Processed or Stored NOM-010-STPS-1999** (NORMA Oficial Mexicana NOM-010-STPS-1999, Condiciones de seguridad e higiene en los centros de trabajo donde se manejen, transporten, procesen o almacenen sustancias químicas capaces de generar contaminación en el medio ambiente laboral) regulation establishes measures to protect workers from occupational exposure to chemical substances, including lead in the work place. This standard mandates the maximum airborne lead exposure limit. The maximum permissible exposure limit for lead is 150ug/m3 calculated at 8 hours per day, 40 hours per week. Under this standard, the employer must provide annual medical exams to the workers exposed to lead.

Health and Environmental Regulations

The general population may also be exposed to lead from contact with contaminated household dust soil, water and air. Regulations limiting lead exposure outside of occupational settings are summarized here:

The **Environmental Health Criteria for Evaluating Lead in Ambient Air NOM-026-SSA1-1993** (Norma Oficial Mexicana NOM-026-SSA1-1993 Salud Ambiental. Criterio para Evaluar la Calidad del Aire Ambiente, con Respecto al Plomo) limits the allowable concentration for lead in ambient air to 1.5 μg/m^3 over a three month period.

The Ministry of Health regulation on Blood Lead Limits for the Non-Occupationally Exposed Population NOM-199-SSA1-2000(Norma Oficial Mexicana NOM-199-SSA1-2000, Salud Ambiental. Niveles de plomo en sangre y acciones como criterios para proteger la salud de la población expuesta no ocupacionalmente) specifies that the exposure limit for blood lead concentration in children and pregnant and lactating women is 10 µg/dl. The exposure limit for the remaining non-occupationally exposed population is 25 µg/dl in blood.

Under this standard, if blood lead levels exceed these limits, medical service providers and laboratories performing tests for blood lead determination must notify health authorities. Retesting of overexposed individuals should be conducted and in more severe cases, chelation therapy and hospitalization is recommended. Specific actions for each of these subpopulation groups are detailed in the standard depending on blood lead concentrations.

The Ministry of Health is charged with enforcing the **General Health Regulation Law in the Field of Sanitary Control of Activities, Establishments, Products and Services** (Reglamento de la Ley General de Salud en Materia de Control Sanitario de Actividades, Establecimientos, Productos y Servicios) which established a limit of lead in drinking water at 0.05 mg /L.

Table 1 compares health and environmental standards described above to the corresponding U.S. standard. *It is important to note that the maximum permissible exposure limits for lead in air is ten times higher in Mexico than those in the U.S. (1.5 vs. 0.15 µg/m^3). The occupational airborne exposure limit in Mexico is three times higher than in the U.S. (150 vs. 50 µg/m^3).*

Table 1.
Summary of Mexico and U.S. Lead Standards

STANDARD	MEXICO	UNITED STATES
	Limits	Limits
Occupational Airborne Lead Exposure Limits	150 µg/m^3 (8 hrs per day/40hrs weekly)[29]	50 µg/m^3 (averaged over an 8-hour period)[30]
Occupational Blood Lead Level (employee removed from exposure)	N/A	50 µg/dL[31]
Ambient Lead Air Quality Standard	1.5 µg/m^3 (three month arithmetic average)[32]	0.15 µg/m^3 (rolling 3-month average) 1.5 µg/m^3 (quarterly average)[33]
Drinking Water Standard	50 µg/l[34]	15 ppb[35]
Maximum permissible limits for lead in wastewater discharges (to sewer)	1.0 mg/L (monthly average)[36]	Set locally
	1.5 mg/L (daily average)[37]	Set locally
	2.0 mg/L (immediate)[38]	Set locally
Blood lead level of concern: Children	10 µg/dl[39]	10 µg/dL[40]
Blood lead level of concern: Pregnant and lactating women	10 µg/dl[41]	5 µg/dL[42]

[29]Ministry of Labor, NOM-010-STPS-1999, "Occupational Health in Areas where Chemicals are Handled, Transported, Processed or Stored" (Condiciones de seguridad e higiene en los centros de trabajo donde se manejen, transporten, procesen o almacenen sustancias químicas capaces de generar contaminación en el medio ambiente laboral) Available at: http://asinom.stps.gob.mx:8145/upload/nom/10.pdf. Accessed: November 2010.
[30]Occupational Health and Safety Administration, 1910.1025, "Lead Standard" Available at: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10030. Accessed: December 2010.
[31]Ibid.
[32]Mexican Official Standard, NOM-026-SSA1-1993, "Environmental Health Criteria for Evaluating Lead in Ambient Air" (Salud Ambiental. Criterio para Evaluar la Calidad del Aire Ambiente, con Respecto al Plomo) Available at:http://bibliotecas.salud.gob.mx/gsdl/collect/nomssa/index/assoc/HASH01af.dir/doc.pdf#search=%22[plomo]:DC%20%22, Accessed: November 2010.
[33]Environmental Protection Agency, 40 CFR part 50, National Ambient Air Quality Standards. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_08/40cfr50_08.html Accessed: December 2010.
[34]Ministry of Health, "General Health Regulation Law in the Field of Sanitary Control of Activities, Establishments, Products and Services"(Reglamento de la Ley General de Salud en Materia de Control Sanitario de Actividades, Establecimientos, Productos y Servicios) Article 213.Available at:http://www.salud.gob.mx/unidades/cdi/nom/compi/rlgsmcsaeps.html
[35]U.S. Environmental Protection Agency, Maximum Contaminant Level (MCL).
[36]Ministry of Environment and Natural Resources, NOM-002-SEMARNAT-1996, "Establishing the Maximum Permissible Contaminants in Wastewater Discharge to Sewers" (Que Establece lo Limites Maximos Permisibles de Contaminantes en las Descargas de Aguas Residuales a los Sistemas de Alcantarillado Urbano o Municipal) Available at: http://portal.semarnat.gob.mx/leyesynormas/normas/Normas%20Oficiales%20Mexicanas%20vigentes/NOM-ECOL-002.pdf Accessed: November 2010.
[37]Ibid.
[38]Ibid.
[39]Ministry of Health, NOM-199-SSA1-2000. "Regulation on Blood Lead Limits for the Non-Occupationally Exposed Population" (Salud Ambiental. Niveles de plomo en sangre y acciones como criterios para proteger la salud de la población expuesta no ocupacionalmente) Available at: http://www.salud.gob.mx/unidades/cdi/nom/199ssa10.html. Accessed: November 2010.
[40]U.S. Center for Disease Control, Child Blood Lead Level.
[41]Ministry of Health, NOM-199-SSA1-2000. "Regulation on Blood Lead Limits for the Non-Occupationally Exposed Population" (Salud Ambiental. Niveles de plomo en sangre y acciones como criterios para proteger la salud de la población expuesta no ocupacionalmente) Available at: http://www.salud.gob.mx/unidades/cdi/nom/199ssa10.html. Accessed: November 2010.
[42]Centers for Disease Control and Prevention recommends that BLLs should be maintained at this level for occupationally exposed women who are or may become pregnant.

IV. International Agreements

In addition to Mexican laws and regulations regarding the recycling, waste management, and movement of ULABs, Mexico has some related international agreements concerning hazardous waste and chemical management. Imports and exports of ULABs and waste components from ULABs are governed under the agreements highlighted below:

North American Free Trade Agreement (NAFTA)

Both the U.S. and Mexico are members of NAFTA which, along with trade liberalization, has a potential role in the management of the transboundary movement of hazardous and potentially hazardous materials, including ULABs. Although NAFTA does not set out specific guidelines governing the movement or recycling of ULABs, the agreement indicates that all members shall pursue equivalence in regards to human health standards.[43] In addition, the Commission for Environmental Cooperation was established under a side accord to NAFTA to specifically address environmental issues of mutual concern. Therefore, NAFTA may potentially be used to address the disparity between environmental and occupational health standards in the U.S. and Mexico.

La Paz Agreement

The La Paz Agreement, effective February 1984, is an agreement between the U.S. and Mexico to cooperate in protecting and improving the environment in the border area of the two countries. This agreement governs all transboundary movements of hazardous waste including ULABs between the two countries. It restricts shipments of hazardous waste and hazardous substances, including ULABs, between the countries without prior authorization. Under this agreement, the designated authority of the country of export (EPA in the U.S. and SEMARNAT in Mexico) must notify the designated authority of the country of import of shipments of hazardous waste. The consent of the country of import is required and a copy of the notification must be present with each shipment. It is the duty of the responsible party to cleanup any environmental damage from the improper handling or transport of waste in these exchanges.

Basel Convention

The Basel Convention is an international agreement initiated in 1989, governing the transboundary movements of hazardous waste and material for recovery or disposal. Mexico has been one of the 172 countries party to the Basel Convention since 1992. ULABs are considered hazardous waste under the Convention specifying that a consent to export must first be given by recipient countries.

OECD Decision concerning the Control of Transboundary Movements of Waste Destined for Recovery Operations

This OECD decision establishes a control system for the transboundary movements of wastes destined for recovery operations. OECD member countries cannot send hazardous waste to a non OECD member under this decision.

Stockholm Convention on Persistent Organic Pollutants (POPs)

In 1994 POPs became effective in Mexico. The goal of this convention is to protect human health and the environment from persistent organic pollutants (POPs). Secondary lead smelting can generate POPs through air emissions of dibenzo-p-dioxins and dibenzofurans (PCDDs / PCDFs).

[43] North American Free Trade Agreement, "International Standards and Standardizing Organization" Chapter 7, Article 713. Available at: http://usinfo.org/law/nafta/chap-073.stm.html Accessed: December 2010.

Strategic Approach to International Chemicals Management

The Strategic Approach to International Chemicals Management (SAICM) is an international committee working to achieve sound management of chemicals and toxic metals throughout their life cycle. Mexico is a voluntarily participant in SAICM although only limited work has been conducted through this program including efforts to eliminate lead in Mexican pottery and the testing of lead levels in paints.

These international laws are intended to ensure that hazardous waste, including lead batteries, are not exported from wealthy countries to the developing world in order avoid the costs of environmental and occupational standards. If equivalent regulations are in place and equally enforced on both sides of the border, then these agreements allow for this ongoing trade in ULABs with prior consent of the parties. In the case of used lead battery shipments to Mexico, it appears that the growing gap in standards and performance measures noted in this report have not received adequate attention under these international mechanisms.

V. Lead Emissions Reporting

Mexico's Pollutant Release and Transfer Register, also known as the RETC (Registro de Emisiones y Transferencia de Contaminantes) is a database where companies are required to report industrial emissions of 104 listed chemicals, including lead. These records detailing emissions of pollutants to water, air and land, as well as transfers to recycling, treatment, disposal and sewage are publicly available.

The RETC is comparable to the Toxics Release Inventory (TRI) in the U.S., which compiles data on toxic releases and waste management activities reported annually by specificcompany location. It does however differ from TRI in that the chemicals generally have a different mandatory reporting threshold under RETC. Lead and its compounds must be reported to RETC and TRI according to the following criteria:

RETC:

a. Manufacturing, Processing or Use: ≥ 5 kg/year;
a. Emissions: ≥ 1 kg/year.

TRI:

a. Manufacturing and Processing Capacity: ≥ 100 lbs/year
a. Employment: Companies with 10 or more employees (or 20,000 hours of employment per year)

Our review of the available data from secondary lead recycling plants indicates that improvements are needed in industry reporting practices under RETC. Twenty-one companies are authorized by SEMARNAT to recycle ULABs (see Appendix A). Of these, only nine reported any lead emissions to RETC. Two new facilities have not yet reported emissions and nine additional lead battery recyclers reported no emissions for the three years from 2006-2008. One additional authorized recycler, Organización Metal Vert in San Luis Potosí, (with an authorized capacity of 3,600 and 11,016 metric tons) had provided carbon dioxide emissions data to RETC but without reporting any lead emissions. The following table summarizes the reports from authorized ULAB recyclers in Mexico that provided emissions data over a three-year period from 2006 through 2008:

Table 2.

Authorized Mexican ULAB Recyclers Reporting Lead Emissions and Transfers to RETC (2006-2008)

FACILITY NAME	LOCATION	AUTHORIZED CAPACITY 2010 (Metric Tons)	SOURCE	2006 (kg)	2007 (kg)	2008 (kg)
Electrica Automotriz Omega, Planta Dr. Gonzalez	Dr. González, Nuevo Léon	94,000	Air	N/A	1,627	N/A
Enertec México,Planta Ciénega Planta Cienega de Flores	Cienega de Flores, Nuevo Léon	30,600	Air	4,022	N/A	11,012
			Water	23	N/A	15
			Land	23	N/A	N/A
M3 Resources México	Reynosa, Tamaulipas	50,000	Air	N/A	N/A	73
			Water	N/A	N/A	5
Oxidos y Pigmentos Mexico	Tijuana, Baja California	12,400	Air	508	58	332
Recicladora Industrial de Acumuladores	Santa Catarina, Nuevo Léon	110,400	Air	200	65,643	12,628
			Water	N/A	60	N/A
			Final Disposal	N/A	9,364,026	N/A
Aleaciones Metalúrgicas	León, Guanajuato	7,425	Air	46	N/A	43
Corporación Pipsa	García, Nuevo León	104,760	Water	0.29	0.41	1
Hornos de Fundición	Ciudad Valle Hermoso, Tamaulipas	3,000	Water	N/A	N/A	0.18
			Reuse	N/A	N/A	313
			Recycling	N/A	N/A	1,067,160
Reciclajes y Destilados Monterrey	García, Nuevo León	4,267	Water	N/A	0.07	N/A
Source: RETC/SEMARNAT						

Among the nine authorized recycling facilities that reported under RETC for the 2006–2008 period (see Table 2), a total of 9,364,026 kg of lead was sent by a single recycling facility for "final disposal" in 2007. Another facility sent 1,067,160 kg of lead for recycling in 2008. The others reported collective emissions to the air of 96,192 kg, 105 kg of emissions to water: and 23 kg of emissions to land as summarized in Appendix E.

The data that is reported to the RETC, as exemplified by Table 2 above, is inconsistent and in many cases incomplete. For example, Enertec, Ciénega de Flores Plant reported air lead emissions as 19 kg in 2004, 17,889 kg in 2005, did not report for 2007 and then reported 11,012 kg in 2008. A review of these company reports indicates that authorized recycling facilities are not consistently reporting to the RETC and in some cases the amounts reported are suspect. Table 3 lists nine companies that are authorized recyclers, but have not submitted any RETC reports for lead emissions during this time period.

The lack of reporting and the inconsistencies noted above make it difficult to fully assess the extent of lead emissions from lead battery recycling in Mexico. The RETC regulation states that companies failing to report, or those that report false or incorrect information, will be punished with "appropriate administrative sanctions"[44] with the specific penalty determined by the seriousness of the offense. However, there is no record of penalties ever being imposed for a company failing to report, despite evidence that less than half of the authorized lead battery recyclers submitted any reports during this time.

Table 3.
Authorized Mexican ULAB Recyclers Without RETC Reports (2006-2008)

COMPANY NAME	LOCATION	PRINCIPAL ACTIVITY/ COMMENTS	ANNUAL AUTHORIZED CAPACITY (Metric Tons)
Metalurgic Xicohtencatl	Tlaxco, Tlaxcala	ULABs, battery plates, oxides and lead sulfate	65,515
South American Metals	Ciudad Juárez, Chihuahua	ULABs	24,000
Versisa	Soledad Graciano Sánchez, San Luis Potosí	ULABs	16,000
Sion Acumuladores	El Salto, Jalisco	ULABs and industrial waste containing lead	7,500
Industrial Mondeo	Naucalpan de Juárez, Estado de México	Non-ferrous metals from ULABs	7,200
Dian Procesos Metalúrgicos	Tlajomulco, Jalisco	ULABs, lead scrap and slag generated from the smelting furnace	4,320
Eric Odranoel Bobadilla Quintero	Morelia, Michoacán	ULABs and lead scrap	3,000
Productos Metalúrgicos Poblanos	Huejotzingo, Puebla	ULABs	2,000
Productos Metalúrgicos Salas	Aguascalientes	ULABs	15,000
Source: RETC/ SEMARNAT			

[44]RETC Regulation, Article 13.

In addition, the following facilities have not provided any RETC data to date because they only recently started operations:

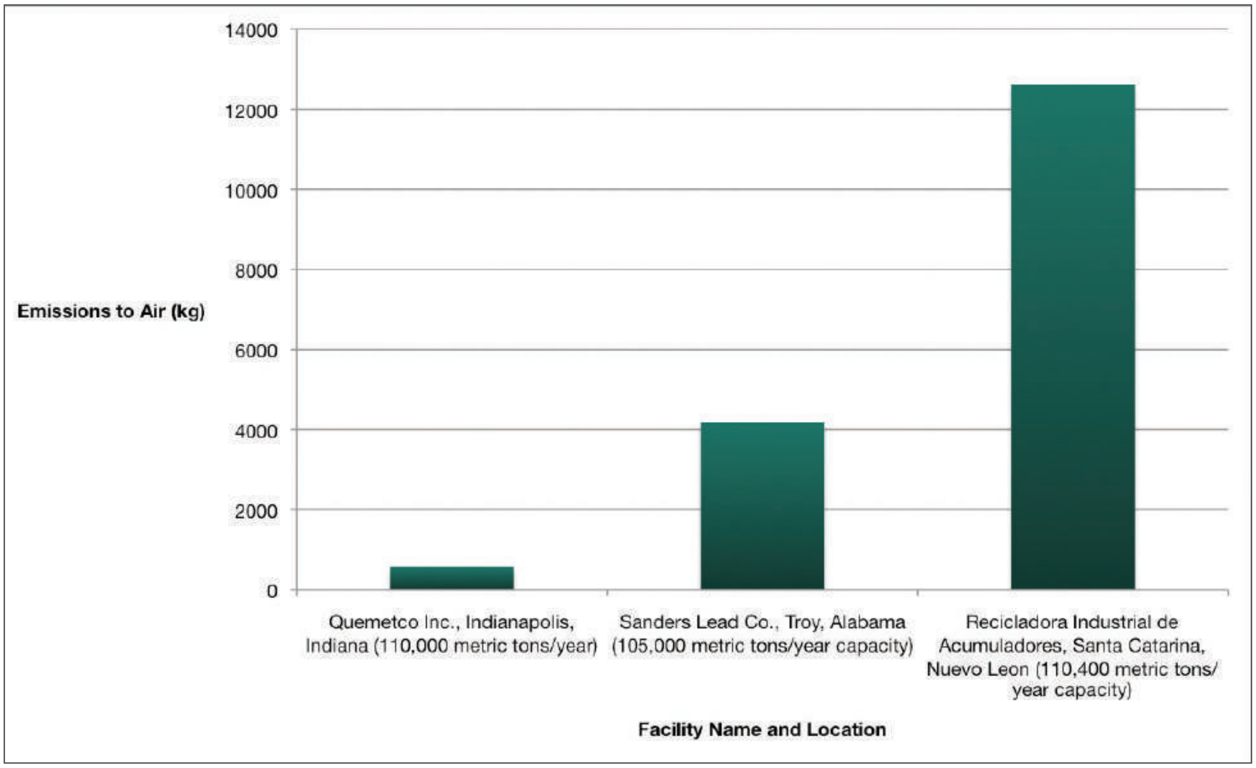
1. LA Batería Verde in Tezoyuca, Estado de México with an authorized capacity for 36,000 metric tons/year; and

2. Enertec/Johnson Controls in García, Nuevo Leon with and authorized capacity for 252,000 metric tons/year.

Comparing Emissions from Lead Battery Recycling Plants in the U.S. and Mexico

Due to the similar nature of lead battery recycling operations, plants of comparable size and capacity with similar pollution control technology can be expected to have similar emissions. Therefore, we compared reports of air emissions from similar sized plants for 2008 when both the U.S. and Mexico had the same ambient air standard (1.5 $\mu g/m^3$). Our comparison shows that reported emissions from lead battery recycling plants in Mexico are approximately 20 times higher than from plants of similar capacity in the U.S. Figure 3 compares air emissions from two U.S. plants and one Mexican plant with capacities ranging from 105,000 to 110,400 metric tons/year. Figure 4 compares air emissions from a U.S. plant with a capacity of 32,000 metric tons to a Mexican facility of 30,600 metric tons. The reported air emissions from these plants are also listed in Table 10 in Appendix D.

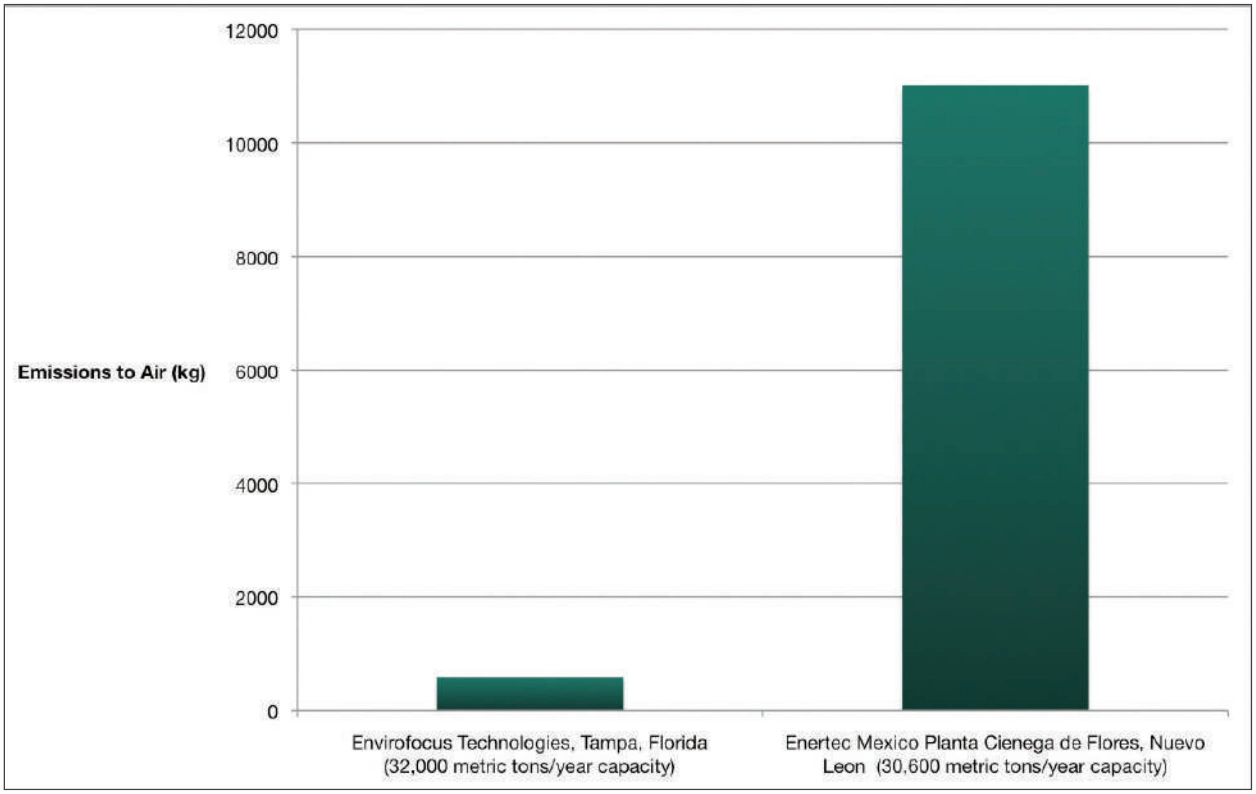
Figure 3.
Air Emissions from Recycling Facilities with Large Recycling Capacity Reporting to RETC (Mexico)[45] and TRI (U.S.),[46] 2008



[45]SEMARNAT, Industrial Hazardous Waste Recycling, Available at: http://tramites.semarnat.gob.mx/index.php?option=com_wrapper&view=wrapper&Itemid=443. Accessed: May 2011.
[46]Environmental Protection Agency, Toxic Release Inventory Explorer Online Database, Available at: http://www.epa.gov/triexplorer. Accessed January 2011.

Figure 4.

Air Emissions from Recycling Facilities with Medium Recycling Capacity Reporting to RETC (Mexico)[47] and TRI (U.S.),[48] 2008



Treatment of Lead-Containing Hazardous Waste

In addition to the facilities registered to recycle ULABs, Table 4 lists five additional Mexican companies that are registered to treat hazardous waste from lead battery manufacturing and recycling. The capacity of these five plants totals over 60,000 metric tons per year. Additionally, there is one company, Tecnologia Ambiental Especializada that is authorized as a waste landfill with a capacity of 335,803 tons for slag generated in the production or recycling of batteries.[49]

The extent to which Mexican lead battery recyclers generate slag and other hazardous waste is not very clear from the RETC reports. However, the Enertec Cienega de Flores smelter claims to utilize a process with a soda ash flux to obtain a non-hazardous slag residue that is being disposed of in a non hazardous, sanitary landfill at one-tenth the price of hazardous waste disposal. We have not identified any independent verification of these claims.

[47]SEMARNAT, Industrial Hazardous Waste Recycling, Item 1, Available at: http://tramites.semarnat.gob.mx/index.php?option=com_wrapper&view=wrapper&Itemid=443. Accessed: May 2011.

[48]Environmental Protection Agency, Toxic Release Inventory Explorer Online Database, Available at: http://www.epa.gov/triexplorer. Accessed January 2011.

[49]SEMARNAT, Industrial Hazardous Waste Recycling, Item 2, Available at: http://tramites.semarnat.gob.mx/index.php?option=com_wrapper&view=wrapper&Itemid=443. Accessed: December 2010.

[50]International Lead Management Center, "Environmentally Sound Management of Lead acid Batteries in the Caribbean and Central America" 2002, Available at: http://www.ilmc.org/Basel%20Project/Dominican%20Republic/Technical%20Reports/PDF/Titling%20rotaries%20and%20slag.pdf. Accessed: May 2011.

Table 4.
Other Mexican Authorized Companies Handling Lead Waste

FACILITY	LOCATION	TYPE OF WASTE	AUTHORIZATION YEAR	CAPACITY (Metric Tons)
Oxidos y Pigmentos Mexicanos	Tijuana, Baja California	Lead and lead oxides	2014	12,400
Cuprosa	Guadalajara, Jalisco	Copper, nickel, lead	2012	18,000
Industrias Deutsch	Cuautitlán, Estado de México	Lead	Indefinite	7,200
Guilsil	Iztapalapa, Distrito Federal	Copper slag, Lead bronze, brass, leaded brass	2018	11,520
Estaño Electro	Tlanepantla, Estado de México	Copper, tin, lead, aluminum	2010	14,400

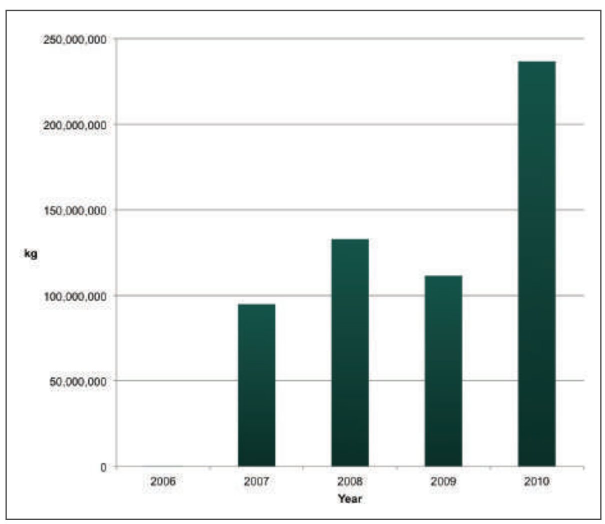
Source: DGGIMAR. SEMARNAT. Available at: http://tramites.semarnat.gob.mx/index.php?option=com_wrapper&view=wrapper &Itemid=443. Accessed: December 2010.

VI. U.S. – Mexican Trade in ULABs

Exports of used batteries from the U.S. to Mexico have increased in recent years as have the proportion of all such exports going to Mexico. In fact, in 2010, 75% of all ULABs and lead scrap exported by the U.S. was sold to Mexico, versus 39% in 2008, as indicated in Table 5. These exports represent approximately 12 percent of all used lead batteries generated in the U.S. (see Appendix G).

Figure 5 shows the dramatic increase in ULAB exports from the U.S. to Mexico since 2006. Exports began to spike in 2008 just as the EPA announced the revised national air quality standard for lead. In 2010, exports of ULABs from the U.S. into Mexico increased by 112 percent from the previous year. These 236,746,892 kgs of lead batteries had a declared value of $53,760,877 USD. The lead content of these exported ULABs is almost two times the weight of the lead contained in all the electronic waste (e-waste) exported from the U.S. (see Appendix F).

Figure 5.
ULAB* Exports from U.S. to Mexico



*HTS Code: 8548100540
Source: U.S. International Trade Commission

Table 5.
ULAB and Lead Scrap Exports from the U.S. to Mexico (2008 - 2010)

YEAR	EXPORTS TO MEXICO (kg)	TOTAL U.S. EXPORTS (kg)	% OF U.S. EXPORTS GOING TO MEXICO
2008	137,059,983	344,810,013	39%
2009	122,567,422	278,633,658	44%
2010	237,389,769	314,489,956	75%
Source: U.S. International Trade Commission, http://www.usitc.gov/ * Material classified under the following HTS codes: 7802000030, 7802000060, 8548100540, 8548102500			

As noted the export of used lead batteries from the U.S. is legal and batteries destined for recycling are not considered a hazardous waste, but are subject to certain restrictions. The Resource Conservation and Recovery Act (RCRA) exempts ULABs from hazardous waste manifest requirements.

Starting in 2010 EPA required companies or individuals exporting ULABs to provide advance notice to the agency. In Mexico, ULAB imports are only tracked by annual authorizations of the intent to import and there is no information on the actual shipments or the amount of material imported. Although notices of the intent to export are collected by both the Mexican and U.S. governments, there is no system to monitor the ultimate destination of ULABs that enter into Mexico from the U.S.

The lack of any tracking system renders the existing notification system meaningless. For example, in 2009, ten recyclers were authorized by the Mexican government to import 418,056 metric tons of ULABs (See Table 6). The U.S. accounted for over 90 percent of Mexico's total import authorizations totaling 406,200 metric tons. However, it appears that less than a third of this amount was actually shipped to Mexico (122,855 metric tons) based on the U.S. International Trade Commission data (see Figure 5). Aside from the U.S., only two other countries (Honduras and Costa Rica) sent notifications to SEMARNAT to seek permission to export small quantities of ULABs into Mexico.

In 2010, Mexican authorities received notices for imports of 464,642 metric tons from the U.S. In contrast U.S. EPA received notifications for exports to Mexico totaling 456,520 metric tons. The table in Appendix B compares notification amounts provided to Mexican and U.S. authorities and matches the intended exporters and importers. As noted in the Appendix, although the overall totals are fairly consistent, there are differences in notification quantities between individual shippers and their intended recipients.

Table 6.
Mexico ULAB Import Authorizations by Country (2009)

COMPANY	AMOUNT (Metric Tons)	ORIGIN COUNTRY	TOTAL AMOUNT (Metric Tons)
Corporación Pipsa	5,730	U.S.	62,400
	18,270		
	38,400		
Electrica Automotiz	23,000	U.S.	31,000
	3,000		
	5,000		
Enertec México	10,000	U.S.	171,350
	1,700	Honduras	
	550	Costa Rica	
	5,000	Puerto Rico	
	1,700	Honduras	
	2,400	Costa Rica	
	30,000	U.S.	
	120,000	U.S.	
M3 Resources Mexico	48,000	U.S.	48,000
Organization Metal Vert	3,500	U.S.	3,500
Oxidos y Pigmentos	5,000	U.S.	5,000
Productos Metalúrgicos Salas, S.A. DE C.V.	3,000	U.S.	3,000
Recicladora Industrial de Acumuladores	4,000	U.S.	88,506
	1,000	U.S.	
	27,000	Puerto Rico	
	27,000	U.S.	
	506	Costa Rica	
	2,000	U.S.	
South American Metals	5,000	U.S.	5,000
Versisa	300	U.S.	300
TOTAL	**418,056**		**418,056**

Source: SEMARNAT.

In 2009, two companies were authorized by SEMARNAT to export batteries from Mexico. Exide was permitted to send 960 metric tons of ULABs to the U.S. and Inmobiliara Jorpi de Juarez was permitted to send 1,512 metric tons. In 2010, Exide was the only company permitted to send ULABs to the U.S.[51]

Illegal Movement of ULABs

Authorities in the Mexican Federal Environmental Protection Agency (Procuraduría Federal de Protección al Ambiente/ PROFEPA), have indicated that exports of ULABs intended for China have been repeatedly stopped and returned by authorities in Hong Kong. SEMARNAT was warned that ULABs had been shipped from the Pacific Ocean ports of Lázaro Cárdenas in Michoacán and Manzanillo in Colima with incorrect customs codes to disguise the shipments as "scrap metal" or plastic. In one case Hong Kong authorities returned 19 shipping containers with an approximate weight of 760 metric tons of lead acid batteries that were leaking acid as a result of the poor packaging. Profepa identified that the exporter was located in Puebla, Mexico but the consignee for this shippment was located in the United States. However, no investigation was made to identify the country of origin of the lead batteries or the originator of the shipment. In another case in 2007 PROFEPA investigated 22 shipping containers labelled as PET plastic and found that only 3 of them contained plastic. In recent years there have been an on-going number incidents where unauthorized shipments of ULABS were detected and returned to Mexico.

VII. Conclusion

Used batteries exported to Mexico are contributing to occupational and environmental exposures in excess of permissible levels in the U.S. Given the difference in regulatory standards, and the even larger disparities in performance identified between U.S. recyclers and their Mexican counterparts, we believe that ULABs are being exported by businesses to gain competitive advantage from operating in a less regulated environment. It is more economical to recycle lead in facilities with fewer pollution controls and where workers are more highly exposed. It is unlikely to be coincidence that the cross border trade in ULABs increased rapidly since the U.S. lowered it ambient air standard in 2008.

The change in the U.S. law to lower the ambient air standard has incurred significant costs on lead battery recycling facilities who are investing millions to upgrade emission control equipment during the current phase-in period. If Mexico maintains its current regulatory structure, this disparity will likely impact the availability of ULABs and the ability of U.S. plants to operate efficiently. Over time ULAB exports have the potential to cause further consolidation of the U.S. recycling industry as the supply of ULABs is further constrained.

The differences in standards outlined in this report may diverge further if the U.S. Occupational Safety and Health Administration (OSHA) moves to update the current occupational limits that came into effect in mid 1970s. Already Cal-OSHA has initiated a process to lower its lead standard.

[51]SEMARNAT, Industrial Hazardous Waste Recycling, Available at: http://tramites.semarnat.gob.mx/index.php?option=com_wrapper&view=wrapper&Itemid=443. Accessed: May 2011.

In Mexico the continued growth in ULAB imports may have even greater impact by increasing the quantity of lead processed and subsequent emissions from recycling plants. Increasing exposures to workers and the general population imposes costs to society from the resulting increase in learning disabilities, mental retardation, loss of lifetime economic productivity, health care costs, and costs linked to behavior and violence that result in higher crime and incarceration. These costs are not borne by recycling businesses benefiting from this international trade in ULABs.

Experience in the U.S. in recent years has shown that significant improvements can be made in reducing environmental impacts and occupational exposures associated with lead battery recycling. This experience has demonstrated that controlling lead emissions is both technologically possible and economically feasible in this industry.

The disparity between U.S. and Mexican regulations, and the even larger differences in actual performance in key environmental measures, are resulting in unnecessary lead contamination and exposures in Mexico. We believe that government-to-government intervention under the NAFTA framework should be initiated to narrow the gap in national standards governing environmental emissions and occupational exposures. Action should be taken by the U.S. government to demand improvements in regulating lead recycling industries in Mexico. Additional enforcement action is also needed on the part of the Mexican government to ensure protection of worker health, reduction of pollution in impacted communities, full compliance with the required emissions reporting by all lead industries under the RETC law, and the immediate closure of unauthorized lead battery recycling companies.

Appendices

Appendix A: Table 7. Mexican Authorized ULAB Recycling Companies

Appendix B: Table 8. Authorized Imports/Exports of ULABs from U.S. to Mexico, 2010

Appendix C: Table 9. Mexican Legislation on Lead acid Batteries

Appendix D: Table 10. Air Emissions (Stack and Fugitive) from recycling facilities in Mexico and U.S. reporting to RETC (Mexico) and TRI (U.S.), 2008

Appendix E: Table 11. Total emissions reported by authorized Mexican recyclers (2006-2008)

Appendix F: Table 12. Total Lead Content of e-waste Generated in the U.S. in 2010

Appendix G: Percentage of Lead in ULABs Exported from the U.S. to Mexico

Table 7.
Mexican Authorized ULAB Recycling Companies

STATE	FACILITY	CITY	CAPACITY (Metric Tons)
Nuevo León	Enertec, Planta Cienega de Flores	Ciénega de Flores	596,027
	Enertec, Planta Garcia	García	
	Corporación Pipsa		
	Reciclajes y Destilados Monterrey		
	Recicladora Industrial de Acumuladores	Santa Catarina	
	Eléctrica Automotiz Omega	Dr. González	
Tlaxcala	Metalurgic Xicohtencatl	Xicotencatl	65,515
Tamaulipas	Hornos de Fundición	Ciudad Valle Hermoso	53,000
	M3 Resources	Reynosa	
Estado de México	Industrial Mondeo	Naucalpan de Juárez	43,200
	La Batería Verde	Tezoyuca	
Chihuahua	South American Metals	Cuidad Juárez	24,000
San Luis Potosí	Versisa	Soledad de Graciano Sánchez	16,000
	Organization Metal Vert	San Luis Potosí	3,600
			11,016
Aguascalientes	Productos Metalúrgicos Salas	Aguascalientes	15,000
Baja California	Óxidos y Pigmentos	Tijuana	12,400
Jalisco	Sion Acumuladors	El Salto	11,820
	Dian Procesos Metalúrgicos	Guadalajara	
Guanajuato	Aleaciones Metalúrgicas	León	7,425
Michoacán	Eric Odranoel Bobadilla Quintero	Morelia	3,000
Puebla	Productos Metalurgicos Poblanos	Huejotzingo	2,000
TOTAL	**21**		**864,003**

Source: DGGIMAR. SEMARNAT.

Table 8.
Authorized Imports/Exports of ULABs from U.S. to Mexico, 2010

MEXICAN AUTHORIZATIONS			U.S. AUTHORIZATIONS		
Mexican Importer	Location	Amount (Metric Tons)	Amount (Metric Tons)	U.S. Exporter	Location
Corporación Pipsa, S.A. de C.V.	García, Nuevo León	20,000	38,000	INTL Commodities Inc.	New York, NY
Eléctrica Automotriz Omega, S.A. de C.V.	Dr. González, Nuevo Léon	8,000	3,000	Cantu Brothers Enterprises	Laredo, Texas
			5,000	Greenwich Metals Inc	Greenwich, Connecticut
Enertec México, S. DE R. L. de C.V. Planta Cienega de Flores	Ciegna de Flores, Nuevo Leon	171,300	5,000	Biosafe Products Corp	Puerto Rico
			120,000	Johnson Controls Battery Group	San Antonio, Texas
			30,000	Johnson Controls Battery Group	Yuma, Arizona
Enertec México, S. DE R. L. de C.V. PlantaGarcía.	García, Nuevo León	180,000	130,000	Johnson Controls Battery Group	San Antonio, Texas
M3 Resources México, S. de R. L. de C.V.	Reynosa, Tamaulipas	48,000	73,920	M3 Resources USA LLC	Birmingham, AL
Recicladora Industrial de Acumuladores, S.A. de C.V.	García, Nuevo León	36,320	7,800	INTL Commodities Inc	New York, NY
			40,000	East Penn Manufacturing	Lyon Station, Pennsylvania
Versisa, S.A. DE C.V.	Soledad Graciano Sanchez, San Luis Potosí	1,022	3,800	INTL Commodities Inc	New York, NY
TOTAL		**464,642**	**456,520**		

Source: Authors elaboration with information from DGGIMAR.SEMARNAT. Available at: http://tramites.semarnat.gob.mx/index.php?option=com_wrapper&view=wrapper&Itemid=443Accessed: December 2010.

Table 9.
Mexican Legislation on Lead acid Batteries

LEGISLATION	LGEEPA*	LGPGIR**	RLGPGIR***
Hazardous waste definition	Article 3, Section XXXII	Article 5, Section XXXII, Article 31 Section IV	___
Federal jurisdiction	Article 5, Section VI	Article 7, Section VI; Article 17	___
Recycling	___	Article 17; Article 28, Section 1	Article 49, Section III
Environmental Impact Statement	Article 28, Section IV, XIII; Article 30	___	___
Waste management federal authorization; imports and exports	Article 153	Article 1, Section XI; Article 50; Section X	___
Timeframe validity for federal authorization	___	___	Article 58, Article 59
Incineration ban	___	Article 67, Section IX	___
Repair and remediation responsibilities when a site becomes contaminated	Article 152 Bis	Article 68; Article 69	___
Types of management plans	___	Article 28	Article 16; Article 24
Imports	Article 142; Article 153	Article 86	Article 107; Article 108; Article 115; Article 117
Imports: Remediation responsibilities when a site becomes contaminated	___	Article 91	___
Imports: Deadline for authorization	___	___	Article 110; Article 111
Illegal imports	___	Article 92	___
Hazardous Waste Tracking System (Sistema de Rastreo de ResiduosPeligrosos SIRREP)	___	Article 88	___

Source: *LGEEPA: Ley General del EquilibrioEcológico y la Protección al Ambiente
**LGPGIR: Ley General para la Prevención y Gestión Integral de los Residuos
***RLGPGIR: Reglamento a la Ley General para la Prevención y Gestión Integral de los Residuos

Table 10.

Air Emissions (Stack and Fugitive) from recycling facilities in Mexico and U.S. reporting to RETC (Mexico)[52/53] and TRI (U.S.),[54] 2008

FACILITY AND LOCATION	RECYCLING CAPACITY (Metric Tons/Year)	TOTAL RELEASES OF LEAD TO AIR (kg)
Quemetco Inc. Indianapolis, Indiana, USA	110,000	571
Sanders Lead Co. Troy, Alabama, USA	105,000	4,167
Recicladora Industrial de Acumuladores Santa Catarina, Nuevo León, México	110,400	12,628
Envirofocus Technologies Tampa, Florida, USA	32,000	592
Enertec México S de RL de CV PlantaCiénega Ciegega de Flores, Nuevo León, México	30,600	11,012

[52]SEMARNAT, Industrial Hazardous Waste Recycling, Available at: http://tramites.semarnat.gob.mx/index.php?option=com_wrapper&view=wrapper&Itemid=443. Accessed: May 2011.
[53]SEMARNAT. RETC Database. Available at:http://app1.semarnat.gob.mx/retc/index.html. Accessed: December 2010.
[54]Environmental Protection Agency, Toxic Release Inventory Explorer Online Database, Available at: http://www.epa.gov/triexplorer. Accessed January 2011.

Table 11.
Total emissions reported by authorized Mexican recyclers (2006-2008)

YEAR	EMISSIONS/kg			TRANSFERS/kg	
	Air	Water	Land	Final Disposal	Total
2006	4,730	23	23	n/d	4,776
2007	67,328	60	n/d	9,364,026	9,431,414
2008	24,045	20	n/d	n/d	24,065
Source: RETC Database. SEMARNAT. 2010					

[52]SEMARNAT, Industrial Hazardous Waste Recycling, Available at: http://tramites.semarnat.gob.mx/index.php?option=com_wrapper&view=wrapper&Itemid=443. Accessed: May 2011.
[53]SEMARNAT. RETC Database. Available at:http://app1.semarnat.gob.mx/retc/index.html. Accessed: December 2010.
[54]Environmental Protection Agency, Toxic Release Inventory Explorer Online Database, Available at: http://www.epa.gov/triexplorer. Accessed January 2011.

Comparing ULAB and e-waste Exports from the U.S.

In 2010, according to U.S. ITC data, 236,746,892 kg[55] of ULABs (HTS Code: 8548100540) were exported from the U.S. to Mexico. Assuming that 65%[56] of the battery is composed of recoverable lead, we multiply the total exports by .65 to arrive at a total of 153,885,480 kg of lead exported from the U.S. to Mexico in ULABs.

We used EPA data[57] to calculate the weight of ewaste destined for recycling for the same year. A total of 111,009,433 kg of lead in electronic waste (computers, televisions, keyboards, cell phones) was recycled. It is estimated that 61%[58] of all ewaste collected in the U.S. for recycling is exported. Approximately 67,715,754 kg of lead in e-waste was exported from the U.S. to the rest of the world for processing.

Therefore, more than twice as much lead is exported to Mexico in used batteries than is exported in all e-waste exported from the U.S.

E-waste calculations

In order to determine the amount of lead in each piece of electronic equipment, the following calculations were used:

- 4 lbs of lead in an average size television monitor[59]
- 11 kg of lead in a car battery[60] ➤ 24.25 lbs of lead in a car battery
- 2.2 lbs of lead in an average 17-inch computer monitor[61]
- 380 million cell phones ➤ 100 – 200 metric tons of lead[62] ➤ 220,460 – 440,920 lbs of lead ➤ 0.0006 0.0012 lbs of lead per cell phone (average: 0.0009lbs)
- 3.8 lbs of lead in desktop personal computer[63]

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[55]U.S. International Trade Comission, http://dataweb.usitc.gov/

[56]Battery Council International, NATIONAL RECYCLING RATE STUDYPrepared by:SmithBucklin CorporationMarket Research and Statistics GroupChicago, Illinois, August, 2009.

[57]EPA, Statistics on the Management of Used and End-of-Life Electronics. Available at: http://www.epa.gov/epawaste/conserve/materials/ecycling/manage.htm

[58]"Managing Electronic Waste: Issues with Exporting E-Waste", Congressional Research Service, 2010, page 12.

[59]United States Government Accountability Office (GAO), Report to the Chairman, Committee on Foreign Affairs. “ELECTRONIC WASTE: EPA Needs to Better Control Harmful U.S. Exports through Stronger Enforcement and More Comprehensive Regulation” August 2008.

[60]Gearhart J, Griffith C, Mills K. “ Getting the Lead Out: Impact of and Alternatives for Automotive Lead Uses” . July 2003, page 4. www.cleancarcampaign.org/GettingLeadOut.pdf

[61]Ca.gov, Calrecycle (http://www.calrecycle.ca.gov/Archive/IWMBPR/2001/August/031.htm)

[62]Environmental Report of Nokia Corporation 2002. Page 33. Available at: http://www.wtosz.org/exportalert/UploadFile/20051020env_report_2002.pdf?AutoID=10496&SiteID=12

[63]“ Just say no to E-waste: Background document on hazards and waste from computers” . Silicon Valley Toxic Coalition. http://www.svtc.org/cleancc/pubs/sayno.htm

Approximately 18% of all e-waste is recycled,[64] leaving the remaining 82% for disposal into landfills. Table 12 shows how we calculated the total weight of lead in e-waste recycled in the U.S. in 2010[65] based on EPA data showing the number of units of waste generated in each product category.

Table 12.
Total Lead Content of e-waste Generated in the U.S. in 2010

Electronic Item	Desktops	Laptops	Computer Monitors	Televisions	Mice/ Keyboards	Cell Phones	**Total**
Number of Items	32,201,000	20,690,000	14,044,000	24,786,000	82,195,000	52,500,000	**226,416,000**
Recycled (18%)	5,796,180	3,724,200	2,527,920	4,461,480	14,795,100	9,450,000	**40,754,880**
Lead Content Recycled (lbs)	22,025,484	3,537,990	5,561,424	17,845,920	1,479,510	8,505	**50,458,833**

[64]Electronics Waste Management in the United States, Approach1. U.S.EPA, July 2008, page 32. Accessed online :http://www.epa.gov/osw/conserve/materials/ecycling/faq.htm#recycled

[65]EPA, Statistics on the Management of Used and End-of-Life Electronics. Available at: http://www.epa.gov/epawaste/conserve/materials/ecycling/manage.htm

Percentage of Lead in ULABs Exported from the U.S. to Mexico

The U.S. consumed 1,500,000 metric tons of lead in 2010.[66] Given that approximately 87% of all lead is used to produce lead acid batteries,[67] in 2010 around 1,305,000 metric tons of lead was used for lead battery manufacturing. Assuming a one-to-one replacement of used batteries, the weight of lead for recycling is approximate to the weight of lead in of all U.S. battery production per year.

The total weight of lead in batteries exported to Mexico is 153,885 metric tons (see Appendix F). We divide 153,885 metric tons by total weight of lead used to produce batteries, 1,305,000 metric tons, to arrive at a total of 12% of all U.S. lead being exported to Mexico in lead batteries.

[66] U.S. Geological Survey (USGS), "Mineral Commodity Summary: Lead" January 2011.
[67] Ibid.