HAZARDOUS TRADE?

An Examination of US-generated Spent Lead-acid Battery Exports and Secondary Lead Recycling in Canada, Mexico, and the United States

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Secretariat of the Commission for Environmental Cooperation

Publication Details
Publication type: Independent Secretariat Report (Article 13)
Publication date: April 2013
Original language: English

ISBN 978-2-89700-024-0 (print), 978-2-89700-025-7 (electronic)
Disponible en español: 978-2-89700-026-4 (versión impresa), 978-2-89700-027-1 (versión electrónica)
Disponible en français: 978-2-89700-028-8 (version imprimée), 978-2-89700-029-5 (version électronique)

Legal deposit—Bibliogèque et Archives nationales du Québec, 2013
Legal deposit—Library and Archives Canada, 2013

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Printed in Canada on Rolland Enviro 100 paper containing 100% post-consumer fiber and produced using biogas energy. This paper is certified EcoLogo, Processed Chlorine-free and FSC recycled.

100%

FSC SW-COC-1501

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Commission for Environmental Cooperation
Comisión para la Cooperación Ambiental
Commission de Coopération Environnementale

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Preface

The last seven years have seen a large increase in exports of spent lead-acid batteries (SLABs) from the United States to Mexico, where the lead in these batteries is recycled to produce refined lead for use in new batteries. Today, 30–60 percent of all batteries recycled in Mexico come from the United States. In Mexico, SLAB recycling occurs in a regulatory environment with less stringent controls on lead pollution and the protection of workers and public health than in the United States, and in which recycling facilities demonstrate a wide range of environmental practices, processes and control technologies.

This report is an independent assessment by the Secretariat of the Commission for Environmental Cooperation (CEC) on the environmental hazards associated with the increase in SLAB exports to Mexico, as well as the more general environmental management of the battery recycling sector in Mexico. It considers the implications of this trade relative to the environmental principles and provisions of both the North American Free Trade Agreement (NAFTA) and its affiliated North American Agreement on Environmental Cooperation (NAAEC).

This report speaks to two such principles. The first principle—embodied in NAAEC, the agreement that established the CEC and that provides for such Secretariat reports—is that, in pursuit of continent-wide trade and investment as enabled by NAFTA, comparative advantage should not be sought on the basis of lower environmental standards or lax enforcement. In response to a general concern that NAFTA might trigger "downward harmonization" or a race to the bottom and the creation of so-called pollution havens, NAAEC set out ambitious goals to protect the environment and to enhance compliance with and the enforcement of environmental laws throughout the region, thereby obliging the governments of Canada, Mexico and the United States (the Parties to the CEC) to ensure that their laws and regulations provide for high levels of environmental protection.

The second principle is that Canada, Mexico and the United States should cooperate in the protection and enhancement of North America's environment. Thus NAAEC obliges the CEC Parties to cooperate on the continuing improvement of those laws and regulations and to develop greater comparability of environmental technical regulations and standards.

In the spirit of NAAEC, our recommendations underline the opportunity for cooperation. Specifically, the Parties to NAAEC, the North American battery and secondary lead industry, and public stakeholders have an opportunity to continue to improve the relevant laws and regulations and their enforcement and to share the human health and positive environmental outcomes that come from ensuring that the highest possible standards apply to the handling and recycling of lead-acid batteries across all three countries. Moving forward, we respectfully submit that, to the extent that we raise the bar across North America to equivalent levels of environmental and health protection, we can, in this instance, avoid development that may seek to exploit lower environmental standards. To the contrary, with continent-wide high standards and enforcement, trade and economic development can play an important role in protecting human health and the environment in North America.

Evan Lloyd
CEC Executive Director, 2010–2012

Acknowledgments

This report was developed under the direction of Evan Lloyd, my predecessor as CEC Executive Director, and co-authored by Mr. Lloyd and Mr. Tim Whitehouse, president of the Cyan Environmental Group. In addition to their contribution, I would like to acknowledge the many individuals and organizations that contributed to the development of this report. The Secretariat especially appreciates the efforts of Guillermo Roman, an independent consultant at the *Centro Interdisciplinario para Prevención de la Contaminación, A.C.*, who led the research efforts in Mexico for the report. Ana Teresa Alvarado, Wesley Engers and Tayyaba Waqar also assisted in the development of this report.

We are particularly grateful to the following companies for explaining to us the processes, control technologies and protocols used in their facilities, as well as issues specific to their industry: *Dian Procesos Metalurgicos*, East Penn Manufacturing, Exide Technologies, *Industrial Mondelo*, Johnson Controls Inc. (JCI) and its staff in the United States and its subsidiary Enertec in Mexico, *La Batería Verde*, M3 Corporation, Newalta, *Recicladora Industrial de Acumuladores*, RSR Corporation, Teck, Tonolli Canada, and Xstrata Zinc. We would also like to thank the Battery Council International and the American Battery Recyclers for their input into this study. A number of people involved in the battery collection business in Mexico also shared their insights on this study with us.

The following government officials were instrumental in providing us with information and data. From Environment Canada, we would like to thank Lo Cheng, Emmanuel Mendoza, Jean-Pierre Ntimpirangeza and Robin Tremblay. From Mexico, we would like to thank Karla Acosta, Israel Gordoa, Sergio Herrera, Osvaldo López and Felipe Olmedo from the Office of the Federal Attorney for Environmental Protection (*Procuraduría Federal de Protección al Ambiente*—Profepa); Ana María Contreras, Alfonso Flores, Maricruz Gallegos, Eduardo González and Alberto Villa from the Secretariat of Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*—Semarnat); and Frineé Cano, Leonor Cedillo, Arturo Gavilán and Leonora Rojas from the National Institute of Ecology and Climate Change (*Instituto Nacional de Ecología y Cambio Climático*—INECC). From the US Environmental Protection Agency, we would like to thank Laura Coughlan, Jana Tatum and Nathan Topham.

Several nongovernmental organizations provided valuable input into this report. We are grateful to Marisa Jacott and Adriana Camarena from Fronteras Comunes; Perry Gottesfeld and Kate Durand from Occupational Knowledge International; and Diane Cullo from Slabwatchdog.

We also thank CEC staff members Marco Heredia, Eduardo Viadas, Jeff Stoub, Orlando Cabrera, and the editors, Sabra Ledent, Johanne David, Jacqueline Fortson, Douglas Kirk, and the translators who made this report readable.

Irasema Coronado
Executive Director
CEC Secretariat

Executive **Summary**

The Secretariat of the Commission for Environmental Cooperation (CEC) initiated this study in response to concerns that some US-generated spent lead-acid batteries (SLABs) are being exported to Mexico for recycling to avoid the costs of the stricter environmental and health protection laws prevalent in the United States. Specifically, concerns have been raised that because the United States strengthened its ambient air standards for lead in 2008, there has been a surge of SLAB exports to Mexico. Some argue that this surge has increased the danger of lead exposure to workers and the people living near certain recycling operations in Mexico. Moreover, it is asserted that this practice undermines the competitiveness of the US-based lead recycling industry.

How SLABs are managed is an important public health, environmental and economic issue. A consensus now exists in the scientific community that there is no "safe" threshold for levels of lead in the blood. Lead can be absorbed into the human body and cause toxicity to the nervous system, heart, kidneys, bones and reproductive organs. Lead exposure can be particularly damaging to fetuses, infants and children. Lead is more easily absorbed into their bodies, and their tissues are more vulnerable to its damaging effects.

When carried out properly—as evident in the best practices of the North American lead recycling industry—the recycling of SLABs has been an environmental success story. In Canada, Mexico and the United States, SLAB recycling rates are near 100 percent—the highest rate for any product in the North American economy. In addition to high recycling rates, highly sophisticated pollution control technologies and management practices now provide ways for battery recycling facilities, called secondary lead smelters, to minimize lead emissions and protect the health of their workers. However, improperly managed lead recycling operations, even on a very small scale, can have devastating effects on the health of workers and the surrounding communities.

Industry Overview in North America

In the United States, eight companies operate 15 domestic secondary lead smelters that in 2011 produced an estimated 1,200,000 metric tons (t) of recycled lead, also called secondary lead. In Canada, three secondary smelters and two facilities that combine primary and secondary smelting produced 167,042 t of secondary lead in 2010. In Mexico, the 25 authorized secondary smelters have a permitted capacity to recycle 1,337,171 t of SLABs. Reliable secondary lead production figures are not available for Mexico, but US and Mexican industry sources believe that many Mexican facilities are currently operating at no more than 50 percent of their permitted capacity. If this is indeed the case, and given that lead-acid batteries contain about 60 percent lead alloy by weight, then Mexico may be producing some 401,151 t of lead annually.

In the United States and Canada, increasingly stringent environmental regulations have led to steady improvements in technologies and practices. The ever-stricter environmental performance requirements have in turn increased capital costs and contributed to consolidation and efficiencies of scale in the secondary smelting and battery recycling sectors. These changes have not occurred to the same extent in Mexico.

In Mexico, 15 facilities have a capacity of less than 30,000 t, whereas in the United States and Canada only one facility has an equal or smaller capacity. In addition, although certain new smelters in Mexico have features and management practices common to high-performing facilities, few smelters appear to have the types of controls, processes and technologies necessary to receive a permit in the United States or Canada today.

Key Findings

The research and consultations conducted for this study reveal the following findings:

Levels of Environmental and Public Health Protection

The regulatory frameworks covering secondary lead smelters in the United States, Canada and Mexico do not provide equivalent levels of environmental and health protection. Currently, the United States has the most stringent overall framework, while in Mexico, with significant gaps in its existing regulatory framework, certain emission controls and requirements are the least stringent and need to be augmented.

Tracking the SLAB Trade in North America

- The United States, unlike Canada and Mexico, does not require a manifest to accompany international shipments of SLABs. It also does not require exporters of SLABs to obtain a certificate of recovery from the recycling facility.
- The United States operates a notice and consent system via bilateral agreements with Canada and Mexico that addresses the trade in hazardous waste, including SLABs.
- In 2012, the environmental agencies in Canada, Mexico and the United States began to share electronically export requests and consent documents for hazardous waste exports, including SLABs, through the Notice and Consent Electronic Data Exchange (NCEDE) project. This system is replacing a paper-based system in which governments exchanged notice and consent information by mail, fax and cable.
- At present, the US Environmental Protection Agency (USEPA) manually enters into a database thousands of pieces of information from annual reports submitted by exporters of SLABs.

Exports of US-generated SLABs

Global US Exports

- According to USEPA data, in terms of the global volume of SLABs exported by the United States, Mexico is the leading destination (68 percent), followed by Canada (19 percent) and Korea (13 percent).
- Our review of US Census Bureau data indicates that US exporters are sending SLABs to 47 countries where USEPA has no record of having obtained consent from those countries to receive the SLABs.

US-Mexico Trade in SLABs

- According to USEPA data, in 2011 the United States exported 389,539,362 kilograms (kg) of SLABs to Mexico. According to data from the US Census Bureau, in 2011 the United States exported 342,186,978 kg of SLABs to Mexico and imported 191,341 kg.

- The USEPA export figure is 47,352,382 kg higher than the US Census Bureau figure, indicating that exporters of SLABs may not be correctly classifying that quantity of SLABs under the Harmonized Tariff Schedule (HTS) code system.
- According to our estimates, between 2004 and 2011, US exports of SLABs to Mexico increased by 449–525 percent.
- Most of the increase in SLAB exports to Mexico is attributed to the business development and supply chain management of Johnson Controls Inc. (JCI), a US-based, globally diversified company. In 2004, JCI acquired *Ciénega*, a smelter in the municipality of Ciénega de Flores, Nuevo León, near Monterrey, Mexico, and began directing both US- and Mexican-generated SLABs to that facility for recycling. In 2011, JCI opened a secondary smelter, *García*, in the municipality of García in the greater Monterrey metropolitan area. According to USEPA data, in 2011 JCI's operations at Ciénega accounted for 43 percent of all SLAB exports to Mexico, with García accounting for 31 percent.
- The remaining 26 percent of the authorized exports of US-generated SLABs are being sent to seven facilities in three states in Mexico (Nuevo León, Baja California, and Tamaulipas). These seven facilities imported 100,669,466 kg of SLABs in 2011.
- We estimate that in 2011 between 12 and 18 percent of all lead in US-generated SLABs was recycled in Mexico, and that between 30 and 60 percent of all SLABs recycled in Mexico came from the United States.

US-Canada Trade in SLABs

- According to Environment Canada data, in 2011 the United States was a net exporter of SLABs to Canada by 86,987,630 kg. Between 2004 and 2011, net exports to Canada increased 221 percent.
- Two secondary lead smelters, one in Ontario, Tonolli Canada, and one in Quebec, Newalta, accounted for about 93 percent of these imports from the United States in 2011.
- Industry sources and regulatory authorities have informed the CEC Secretariat that they do not believe US Census Bureau data are a reliable indicator of the historical trade in SLABs to Canada prior to 2010. We concur in that assessment. Our review indicates that prior to 2010 some US exporters were improperly classifying SLAB exports under the HTS code 8548102500.
- We estimate that in 2011 US net exports to Canada represented about 4 percent of all lead in US-generated SLABs and about 31 percent of Canadian secondary lead production.

Data Reliability and Compliance in the United States

- The Secretariat's research has revealed data discrepancies that may indicate two compliance issues warranting further review by the appropriate US government agencies. The magnitude and relative importance of these issues were previously unknown to regulatory agencies.
  - First, as noted previously, our review of USEPA and US Census Bureau data indicated that 47,352,382 kg of SLABs were

exported to Mexico in 2011 without having the proper HTS code applied.
- Second, also as noted previously, our review of US Census Bureau data indicates that exporters are sending SLABs to countries from which USEPA has no record of having obtained SLAB export consent. To the extent this has occurred, it would be a violation of US law and potentially a violation of the importing countries' laws.

Data Reliability Across North America

- In addition, we note that data on the import and export volumes compiled within both the US and Mexico by different agencies—in Mexico by Semarnat and Profepa, and in the United States by the USEPA and US Census Bureau—are not consistent. Moreover, national cross-border accounts in all three countries do not accord with shipping or receiving volumes from either sending or receiving countries. Agencies responsible for such monitoring within and across borders need to work together to identify and improve the availability, accuracy, and comparability of data across North America.

Permitting Secondary Lead Smelters in North America

- In Canada, Mexico, and the United States, secondary lead smelters operate under permits or licenses that contain conditions that are enforceable against the facility.
- In Canada, the provinces issue permits, based on provincial law, that reflect a collaborative process between the regulator and the regulated entity.
- In Mexico, the federal government issues operating permits for secondary lead smelting facilities, based on federal environmental statutes. These permits specify operational conditions, processes and technologies, and address issues such as environmental impacts, licensing requirements for air emissions, and the management of hazardous waste.
- In the United States, state governments issue pollution discharge permits under the authority of federal environmental statutes. Although the federal government sets minimum standards, state requirements may, in most instances, exceed the federal requirements.

Environmental Standards and Performance in Mexico for SLAB Recycling

- Notwithstanding Mexico's permitting process, important gaps remain in its overall regulatory framework, as well as with respect to the prevailing environmental and public health standards in the United States and Canada. Specifically, Mexico
  - lacks regulations that establish lead emission limits from stacks and that contain requirements to control fugitive emissions;
  - lacks regulations that require secondary lead smelters to have management plans to address stormwater discharges and releases of lead to the soil;
  - has not finalized regulations that would address outstanding hazardous waste management plans in the industry;
  - has not issued an official standard (*Norma Oficial Mexicana* —NOM) addressing the construction, operation and closure of secondary lead smelters;
  - has yet to complete a standard for the characterization and remediation of sites contaminated with lead (and other pollutants); and
  - lacks a mandated protocol for the medical removal of workers whose blood lead levels equal or exceed a specified threshold.
- The United States strengthened its ambient air standard for lead in 2008. Thus today Mexico's ambient air standard is 10 times less stringent than that in the United States.
- Moreover, Mexico's network of ambient air monitoring is incomplete. Air quality data for lead concentrations near all secondary lead smelters are unavailable, and no data are publicly available on stack emissions from secondary lead smelting facilities.
- The requirement that companies report pollution release data is not applied and enforced consistently across the secondary lead smelting industry. Over 50 percent of the secondary lead smelters in Mexico have not reported their lead emissions to Mexico's pollutant release and transfer register, the *Registro de Emisiones y Transferencia de Contaminantes* (RETC) program.

- Finally, although some companies in Mexico indicate that they strive to meet US standards, the Secretariat is unable to evaluate the performance of individual facilities and to assess the health risks to workers and the general population from lead emissions caused by secondary lead smelting facilities in Mexico. This situation stems from the absence of publicly available performance data on lead emissions and the lead concentration in the ambient air near secondary lead smelters, and on the overall blood lead levels of workers in the industry.

Recommendations

The CEC Secretariat recommends that the governments of Canada, Mexico and the United States adopt six broad goals to address the findings presented in this report. For each of these goals, we have offered specific steps that governments can take to help realize them. These recommendations are designed to improve the management of information across North America and to ensure that adequate measures are in place to protect workers and the general public from the lead emitted during the recycling of spent lead-acid batteries in Mexico.

1 Raise the Bar (North America)

The appropriate government entities in Canada and Mexico should commit to achieving levels of environmental and health protections in the secondary lead industry functionally equivalent to those in the United States. Raising the bar across North America to equivalent levels will avoid the development of pollution havens and provide greater protection for the public and for the environment.

2 Improve Trade Compliance Efforts (North America)

Canada, Mexico and the United States should streamline and improve the flow of notice and consent information and the tracking of SLABs. Specifically:

- The United States should require the use of manifests for each international shipment of SLABs, and it should require exporters to obtain a certificate of recovery from the recycling facility.
- Canada, Mexico and the United States should cooperate to allow the regulated community to submit export requests electronically.

Photo: Profepa

- Finally, Canada, Mexico and the United States should work together to share the import and export data maintained by their respective environmental and border agencies. This information sharing could be used to identify trends that may require a policy response or that may raise compliance issues.

Photo: Profepa

The goals of these recommendations are to reduce administrative burdens, improve data quality, make it easier to provide data to environmental enforcement and border protection agencies for compliance purposes, facilitate the adoption of emerging tracking technologies, and help the governments provide more timely, reliable, and coherent information on what crosses their national borders.

3 Close Information and Performance Gaps (Mexico)

Mexico should establish a regulatory framework that covers the entire industry and provides public health and environmental protections equivalent to those in the United States. The following points are applicable to this framework:

- It should be based on performance data from the completion or establishment of a comprehensive monitoring system to measure lead air emissions from every secondary lead smelter. More specifically,
  - performance data, including average stack emissions and ambient air lead concentrations near smelters, should be collected by competent environmental authorities and compared across the entire sector;
  - performance data should be provided to environment and health authorities at the federal, state and municipal levels, as well as to the public, on a periodic and timely basis; and
  - performance data should be compared against Mexico's existing ambient air standard of 1.5 micrograms per cubic meter ($\mu g/m^3$) to identify the most pressing gaps in meeting this standard.
- It should establish standards for stack and fugitive lead emissions, functionally equivalent to those in the United States.
- It should adopt an ambient air lead standard that is functionally equivalent to that of the United States.
- A medical removal limit (a requirement that workers whose blood lead levels equal or exceed a certain standard must be temporarily removed from situations of further exposure) should be included in the requirement to test the blood lead levels of workers in the battery recycling and manufacturing sectors.
- Secondary lead smelting facilities should be required to have stormwater management plans, and standards and criteria should be issued for the development of hazardous waste management plans.

- Clear standards should be established for the construction, operation and closure of secondary lead smelters.
- A standard should be established for the characterization and remediation of sites contaminated with lead. In line with this, a policy mechanism should be established to ensure secure funding, sound management, and appropriate oversight of remediation of contaminated sites in Mexico.
- All facilities that undertake secondary lead smelting in Mexico should be required to report pollutant releases and transfers to the federal RETC program.
- Mexico should continue efforts to identify, halt and deter any SLAB recycling and lead recovery operations in the informal or clandestine sector.
- The Secretariat of Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*—Semarnat), the Office of the Federal Attorney for Environmental Protection (*Procuraduría Federal de Protección al Ambiente*—Profepa) and other federal agencies should have sufficient resources to ensure adherence to the law and protect public health and the environment.

4 Ensure Accurate and Comparable Information on Lead Emissions (North America)

- Performance data—including facility-specific stack emission estimates, average ambient lead concentrations and worker blood lead levels as collected by competent environmental authorities in Canada, Mexico and the United States—should be maintained in a central North American repository and be made available to the public.
- Emissions data specific to the secondary lead smelting sector, as reported to each country's respective pollutant release and transfer register (PRTR), should be catalogued and made available to the public via the CEC's North American PRTR initiative.
- CEC support of Mexico's PRTR initiative, the RETC, should continue, to ensure that comprehensive, comparable and quality data are available on the reported releases and transfer of lead by Mexico's secondary lead smelters.

5 Support Best Practices (North America)

The governments of Canada, Mexico and the United States should work together with the North American secondary lead smelting industry and nongovernmental organizations to develop strategies to support the adoption of best practices throughout the region. This effort should include the following:

- Support Mexico in enacting legislation to establish a comprehensive battery stewardship program that requires the 1:1 exchange and recycling of batteries in only the highest-performing facilities. Such legislation would be expected to establish minimum deposit fees and control the return of used batteries to authorized recycling facilities throughout Mexico.
- Given the integrated nature of the SLAB recycling market in North America, ensure trilateral stakeholder input into any new stewardship or voluntary, market-based mechanisms intended to drive continuous improvements in the industry throughout North America.

6 Foster Regional Cooperation and Technical Assistance (North America)

The North American governments, through the CEC or other appropriate venues, should cooperate to ensure:

- a plan of action to share information, technical assistance and best practices in order to assist Mexico in implementing the recommendations contained in this report;
- the highest level of comparable and publicly available information on the performance of the secondary lead smelting sector throughout North America; and
- enhanced cooperation and encouragement of cross-border support and intelligence-sharing on any illegal or unsanctioned traffic in SLABs across North American borders.

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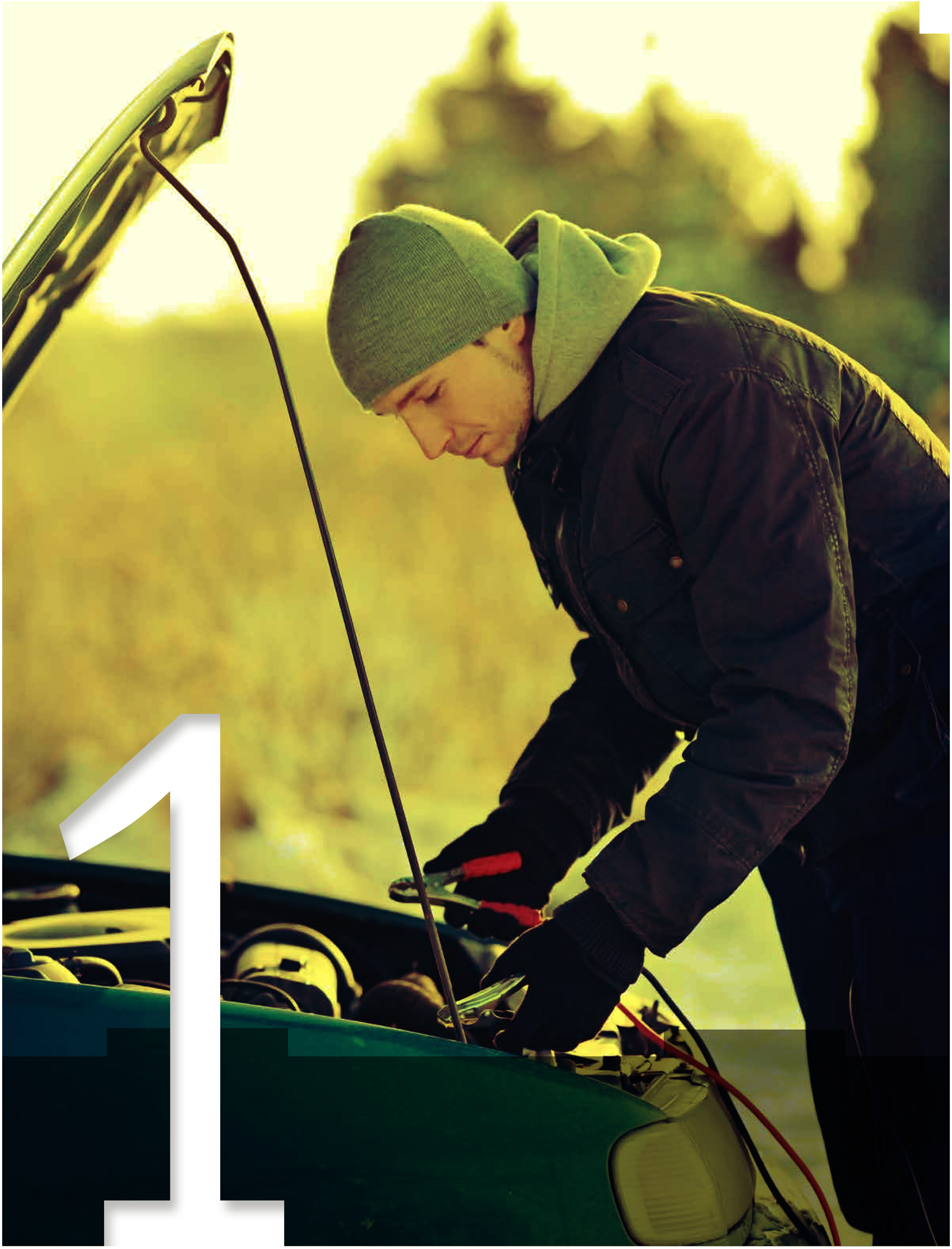

Introduction

The study described in this report examined the transborder movement and recycling of spent lead-acid batteries (SLABs)[1] in North America. The Secretariat of the Commission for Environmental Cooperation (CEC) initiated this study in response to concerns that some US-generated SLABs were being exported to Mexico for recycling to avoid the costs of the stricter environmental and health protection laws prevalent in the United States.

Specifically, some argue that since the United States strengthened its ambient air standards for lead in 2008 and its lead emissions standards at battery recycling facilities in 2012, there has been a surge of SLAB exports to Mexico, increasing the danger of lead exposure to workers and the people living near certain recycling operations in Mexico.[2] Moreover, it is asserted that this practice undermines the competitiveness of the US-based SLAB recyclers, who must comply with costlier environmental regulations than their counterparts in Mexico.[3]

This report examines not only the trends in the North American trade in SLABs, but also the management of SLABs, whether domestically generated or imported, in all three North American countries. One goal of this study is to offer ideas on ways to improve the environmental management of SLABs in Mexico, no matter their origin.

As part of this study, representatives of the CEC Secretariat visited smelters in Canada, Mexico, and the United States. In Mexico, we spoke with numerous government officials and industry representatives, and we both observed and were informed about a wide range of practices, processes and control technologies in the industry.

This report is organized as follows. Chapter 1 describes the process of recycling SLABs, as well as the SLAB recycling industry in North America and its trends. Chapter 2 looks at the North American framework for regulating SLABs, including the international agreements in place and the import and export controls adopted by Canada, Mexico and the United States. Chapter 3 considers the North American trade in SLABs and the problems inherent in the unreliability of data on that trade. It then seeks to answer the question, what is driving US exports to Mexico? The discussion of pollution control and occupational standards in Chapter 4 leads naturally into examination of the environmental performance of the SLAB recycling

1 Spent lead-acid batteries are variously referred to as used lead-acid batteries (ULABs), cores, junks or SLABs. For the sake of convenience, this report has adopted the term SLABs for used, or spent, lead-acid batteries that are sent for recycling.

2 See, for example, Occupational Knowledge International and Fronteras Comunes, *Exporting Hazards: US Shipments of Used Lead Batteries to Mexico Take Advantage of Lax Environmental and Worker Health Regulations,* OKI, Garden Grove, CA, June 2011, <http://www.okinternational.org/docs/Exporting%20Hazards_Study_100611v5.pdf>.

3 Rob Quinn, "US Battery Recycling Is Poisoning Mexico's Kids," *Newser*, 9 December 2011, <http://www.newser.com/story/135035/us-battery-recycling-is-poisoning-mexico-kids.html>. Also see Occupational Knowledge International and Fronteras Comunes, *Exporting Hazards...,* note 2. Also see Elisabeth Rosenthal, "Lead from Old US Batteries Sent to Mexico Raises Risks," *New York Times*, 8 December 2011, <http://www.nytimes.com/2011/12/09/science/earth/recycled-battery-lead-puts-mexicans-in-danger.html>.

Photo: Profepa

industry in Chapter 5. The concluding chapter of this report then presents our findings and recommendations.

This report comes at an opportune time for governments, industry and stakeholders. A renewed focus on secondary lead smelting in Mexico by public health and environmental advocacy groups, a willingness by industry leaders to address these issues, and changes in the economics driving the industry have all combined to provide an opportunity for stakeholders to work together to improve the environmental conditions and impacts of the lead recycling sector in Mexico and the oversight of SLAB recycling management across North American boundaries.

Lead-acid Batteries and the Recycling of SLABs

How SLABs are recycled is an important economic, public health and environmental issue. Today, advanced secondary lead smelters are operating with highly sophisticated pollution control and management systems in order to minimize lead emissions and to protect the health of their workers and that of nearby communities. However, without rigorous environmental controls and management systems, SLAB recycling can result in tremendous, long-lasting harm to workers, communities and the environment.

Lead and Batteries

Because lead is no longer used in many products, lead-acid battery manufacturing is now the most dominant source of lead consumption throughout the world.[4] Lead-acid batteries are a critical source of stored energy in our society. They provide the lowest-cost energy per kilowatt-hour, use a simple technology, and require materials that are relatively abundant. They are used in automobiles, as well as in uninterrupted power supply systems,[5] grid energy storage, off-grid household electric power systems, golf carts and other battery electric vehicles (including hybrid vehicles), and submarines.[6] Most of the world's lead-acid batteries

[4] In the United States, lead-acid batteries account for about 90 percent of lead consumption. See David E. Guberman, *2010 Minerals Yearbook*, Lead (Advance Release) (Washington, DC: US Department of the Interior, US Geological Survey, January 2012), 42.1 and table 7. See <http://minerals.usgs.gov/minerals/pubs/commodity/lead/myb1-2010-lead.pdf>.

[5] Uninterrupted power supply systems are used in telephones and data and computer centers, where they provide emergency power when the main power source fails.

[6] Lead-acid batteries power the electric motors in diesel-electric (conventional) submarines and are used on nuclear submarines.

are automobile starting, lighting, ignition (SLI) batteries. In 2010, SLI shipments in North America totaled 119.6 million units, which included original equipment and replacement-type automotive batteries.[7]

In North America, SLAB recycling rates are near 100 percent,[8] the highest for any product in the economy. The recycling of SLABs provides a critical and stable supply of lead to the battery industry, reduces the need to mine for new lead, and diverts batteries from landfills. This high recycling rate is possible because (1) the cost of recycling lead from batteries is significantly less than the cost of mining and processing lead from ore; (2) lead can be recycled indefinitely without losing its properties; and (3) the infrastructure and economies of scale necessary for collecting and transporting SLABs to recycling facilities exist in all three countries. Because of the ease with which they can be recycled, SLABs are the primary source of new lead for the battery manufacturing industry.[9]

SLABs are recycled at secondary lead smelters,[10] where they are crushed and sorted into plastics, sulfuric acid and lead fractions, which consist of posts, plates and oxides. This process entails the following steps:

- Lead is recycled through a process involving smelting, refining and alloying. Smelting recovers the metallic lead; refining removes the lead's metallic impurities; and alloying is a process that creates the necessary composition of the end product.
- The plastics are usually recycled—on- or off-site—into battery cases or other products.
- The sulfuric acid can be reused in the smelting process, neutralized for disposal, processed in an effluent treatment plant (ETP) or sold.

Smelting entails heating the lead fractions in a furnace. As the lead melts, the impurities, called slag, float to the top of the molten lead and are removed. The molten lead, not yet free of metallic impurities, is either cast into ingots or further refined and alloyed. The battery market, which requires soft lead for the active constituent, lead oxide, and antimonial lead for the grids, bridges and terminals, largely drives how smelters refine and alloy lead.

Public Health Concerns

Lead-acid battery recycling is a dangerous activity that requires extra scrutiny from government regulators. The main danger from SLAB recycling is emissions of lead particles to the environment. Lead emissions occur as stack releases, which are exhaust gases released through stacks as a result of the smelting process,[11] and as fugitive dust emissions, which result from the handling, storage, transfer or other management of lead-bearing materials.[12] Lead can also escape from a secondary lead smelter in water discharges or in solid wastes. Improper occupational controls can expose workers to high levels of lead, who in turn can transport lead particles into their yards and homes via their clothing or vehicles, causing others to be exposed to high levels of lead.[13] Minimizing lead emissions is particularly important because elemental lead will not decay; it will stick to soil particles, where it can persist for hundreds if not thousands of years.[14]

Human exposure to lead occurs via the inhalation of lead particles in the air and through contact with lead particles in dust, outdoor soil, food and drinking water. Human tissue and blood can then absorb these lead particles.[15] Blood lead level (BLL) is used as a biological indicator of recent lead exposure.

> The main danger from SLAB recycling is emissions of lead particles to the environment.

[7] Guberman, *2010 Minerals Yearbook*, Lead, 42.1.

[8] Battery Council International's May 2012 study estimates that the recycling rate in the United States is 98.7 percent. Battery Council International, "National Recycling Rate Study," May 2012. See <http://archive.batterycouncil.org/Portals/0/BCI%20Recycling%20Rate%20Study%202007%20-%202011%20FINAL%20REPORT.pdf>. Studies conducted by the Canadian Battery Association on recycling rates in British Columbia and Manitoba found that more batteries were being collected for recycling than were being sold in those provinces. See <http://recyclemybattery.ca/>. Although the CEC Secretariat was unable to locate recent studies on SLAB recycling rates in Mexico, industry experts and government officials in Mexico believe their recycling rates are near 100 percent. 9 Guberman, *2010 Minerals Yearbook*, Lead, 42.1

[10] A secondary lead smelter is a facility that recycles lead-bearing scrap materials into elemental lead or lead alloys by smelting. A primary lead smelter is a facility engaged in the production of lead metal from lead sulfide ore concentrates through the use of pyrometallurgical or other techniques.

[11] Exhaust gases come from furnaces, dryers and tapping points, and may also contain metal compounds such as lead, arsenic and cadmium, as well as inorganic compounds, which are caused by processes such as the incomplete combustion of coke or the addition of plastics to the furnace emissions.

[12] Definitions, 40 C.F.R. sec. 63.542 (2009), <http://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol9/pdf/CFR-2011-title40-vol9-sec63-542.pdf>.

[13] See note 125 below and its accompanying text.

[14] Agency for Toxic Substances and Disease Registry, Toxicological Profile: Lead, August 2007, 301–304, <http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=96&tid=22>.

[15] Technology Transfer Network, Air Toxics Web Site, Lead Compounds, US Environmental Protection Agency, <http://www.epa.gov/ttnatw01/hlthef/lead.html>.

A consensus exists in the scientific community today that there is no "safe" threshold for BLLs.[16] At low levels of exposure, lead produces a range of adverse effects in humans, beginning with diminishment of IQ and a range of neurobehavioral problems such as attention deficit disorder, reduced hearing acuity and adverse effects on the cardiovascular, renal and immune systems. At high levels, lead poisoning manifests more overt symptoms such as anemia, chronic and acute lead encephalopathy, kidney damage, brain damage and even death.[17] Fetuses, infants and children are more susceptible to lead exposure than adults. Lead is more easily absorbed into their bodies, and their tissues are more vulnerable to the damaging effects of lead. Children are more likely to get lead dust on their hands and put their fingers or lead-contaminated objects into their mouths.[18] Population-wide, the effects of lead exposure can have significant economic and public health consequences.[19]

For adults, in the United States a BLL of 10 micrograms per deciliter (µg/dL) or greater is considered "elevated," and the United States has set a goal of eliminating BLLs above 25 µg/dL.[20] In Canada, the medical intervention level is 10 µg/dL.[21] In Mexico, a BLL of 25 µg/dL in the non-occupational general population triggers medical intervention.[22] Recent studies reveal that even at exposures of less than 10 µg/dL in adults, however, lead can cause renal, cardiovascular and reproductive health problems.[23]

For children, the US Centers for Disease Control and Prevention (CDC) adopted in 2012 a childhood blood lead level reference of 5 µg/dL, based on the 97.5th percentile of the population BLL in children, to identify children and environments associated with lead exposure hazards. In adopting this reference value,

Photo: Profepa

[16] The US Environmental Protection Agency (USEPA) has recognized that, based on the science, no level of lead exposure is considered safe, because some of these health effects, particularly changes in the levels of certain blood enzymes and in aspects of children's neurobehavioral development, may occur at blood lead levels so low as to be essentially without a threshold. See USEPA, "Residual Risk Assessment for the Secondary Lead Smelting Source Category," EPA-HQ-OAR-2011-0344-0160, December 2011, <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2011-0344-0160f>, particularly section 3.2 and Table 3.2-3 and p. 45. This lack of a safe exposure threshold is also acknowledged in the Mexican official standard, NOM-047-SSA1-2011, issued 6 June 2012, <http://dof.gob.mx/nota_detalle.php?codigo=5249877&fecha=06/06/2012>. See sec. 7.1.

[17] Agency for Toxic Substance and Disease Registry, "Toxic Substances Portal—Lead," Public Health Statement on Lead, August 2007. The evaluation focuses on epidemiological evidence at blood lead levels of <10 micrograms per deciliter (µg/dL) because health effects at higher blood lead levels are well established. The definition of an elevated blood lead level is ≥10 µg/dL for both children and adults. See National Toxicology Program (2012), *Health Effects of Low-Level Lead Evaluation* (pre-publication copy) <http://ntp.niehs.nih.gov/?objectid=4F04B8EA-B187-9EF2-9F9413C68E76458E>.

[18] Advisory Committee on Childhood Lead Poisoning Prevention, Centers for Disease Control and Prevention, "Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention," 4 January 2012, 12, <http://www.cdc.gov/nceh/lead/acclpp/final_document_010412.pdf>.

[19] Agency for Toxic Substances and Disease Registry, "Toxic Substances Portal—Lead," Public Health Statement on Lead.

[20] US Department of Health and Human Services, *Healthy People 2010*, 2d ed. (Washington, DC: US Government Printing Office. November 2000), Objective 20-7.

[21] Health Canada, *Final Human Health State of the Science Report on Lead,* February 2013, <http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/dhhssrl-rpec-scepsh/index-eng.php>.

[22] NOM-199-SSA1-2000, <http://www.salud.gob.mx/unidades/cdi/nom/199ssa10.html>.

[23] US Department of Health and Human Services, *NTP Monograph on Health Effects of Low-Level Lead,* table 1.1. xix, <http://ntp.niehs.nih.gov/NTP/ohat/Lead/Final/MonographHealthEffectsLowLevelLead_prepublication_508.pdf>.

the CDC cited a growing body of evidence that even low BLLs are associated with IQ deficits, attention-related behaviors and poor academic achievement, and can have negative cardiovascular, immunological and endocrinal effects on children.[24] In Mexico, a BLL of 10 µg/dL is of concern for children and for pregnant and lactating women.[25] In the United States, a level of 5 µg/dL is of concern for the latter group.[26] Canada does not have a BLL of concern specific to children or pregnant and lactating women other than its medical intervention level of 10 µg/dL.

Lead is not the only public health and environmental concern presented by SLAB recycling. Because of the dangers posed by the sulfuric acid in the batteries, SLABs must also be properly handled during their collection and transportation to secondary lead smelters. The secondary lead smelter itself must have processes in place to safely manage solid wastes, water, plastic casings and sulfuric acid, and to control the emission of other air pollutants such as particulate matter, dioxins, furans and hydrocarbons.

The SLAB Recycling Industry in North America

In North America, the battery recycling industry is in the process of undergoing significant change. Increasingly stringent environmental regulations in the United States and Canada have forced smaller, less capitalized smelters out of business. In addition, vertical integration and internationalization are becoming more common globally and throughout North America. These changes are occurring as secondary lead smelters are in fierce competition for a limited supply of SLABs. This is most pronounced in Mexico, where tight profit margins and an apparent overcapacity are expected to compel some of the smaller, unprofitable smelters to go out of business in the coming years.

Global Market and Price Volatility

The lead recycling industry in North America operates within a global market. The price of refined lead is set in the London Metals Exchange (LME) and, as a global commodity, is subject to ever-shifting demand and supply pressures. In recent years, the international lead market has been characterized by a growing demand from Chinese manufacturers, whose production of consumer electronics, automobiles and battery-powered modes of transport—notably e-bikes—has outstripped their domestic lead production. Notwithstanding commodity price fluctuations, surging Chinese demand has contributed to a general increase in global lead prices over the last 10 years.[27]

Secondary lead, derived principally from SLABs, is the principal ingredient of

[24] See "CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in 'Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention,'" 7 June 2012, <http://www.cdc.gov/nceh/lead/acclpp/cdc_response_lead_exposure_recs.pdf>. The CDC accepted the advisory group's recommendation that the term "level of concern," which had been set at 10 µg/dL, be eliminated from all future agency policies, guidance documents and other CDC publications. See Advisory Committee on Childhood Lead Poisoning Prevention, Centers for Disease Control and Prevention, "Low Level Lead Exposure Harms Children."

[25] NOM-199-SSA1-2000, <http://www.salud.gob.mx/unidades/cdi/nom/199ssa10.html>.

[26] The Centers for Disease Control and Prevention recommend follow-up activities and interventions beginning at blood lead levels of ≥5 µg/dL in pregnant women. Centers for Disease Control and Prevention, *Guidelines for the Identification and Management of Lead Exposure in Pregnant and lactating Women*, Adrienne S. Ettinger and Anne Guthrie Wengrovitz, ed., iv, <http://www.cdc.gov/nceh/lead/publications/leadandpregnancy2010.pdf>.

[27] China will account for about 45 percent of the global lead demand this year, according to Agnieszka Troszkiewicz, "Lead Shortage Looms in '13 on Record Demand for Batteries," Bloomberg News, 15 May 2012, <http://www.businessweek.com/news/2012-05-14/lead-shortage-looms-in-13-on-record-demand-for-batteries#p1>. A lead price graph can be found at <http://www.lme.com/lead_graphs.asp>.

The strong demand for used batteries in North America today means price incentives are sufficient to ensure that almost all SLABs are diverted from the waste stream and collected and sent to a recycler.

refined lead. In the United States, secondary lead accounted for some 91 percent of the 1.25 million metric tons (t) of refined lead produced in 2010.[28]

Among North American lead recyclers, the competition for SLABs is fierce, with the increasing demand driving prices for used batteries to new highs. Industry sources report that in recent months there has been a disconnect between the price of SLABs and the LME price for refined lead. The price of SLABs on the open market has edged close to the price of refined lead, leading to margin compression in supply chains. Lead recyclers dealing with insufficient supplies of SLABs through tolling agreements,[29] vertical integration with battery manufacturers and suppliers, or a captive stream from a reverse distribution system have found that vulnerability to the vagaries of the open market for increasingly expensive SLABs is constraining both profits and their abilities to operate recycling facilities at optimal volumes.

Getting SLABs to the Smelters

In North America, several systems are in place for collecting and transporting SLABs to smelters. The most common is through a reverse distribution system. In this type of system, battery manufacturers have a sales agreement with automobile service centers or retail outlets to collect used batteries at the point of purchase. When the battery manufacturer delivers new batteries, it collects the used batteries and sends them to a secondary lead smelter for the recovery of lead. The refined lead is then returned to the battery manufacturer for use in the production of new batteries. SLABs are also collected through brokers or aggregators. Smaller retailers, service stations and scrap yards often do not have agreements with battery manufacturers. Instead, they may sell SLABs to scrap dealers, who then sell them to smelters. In rare cases, independent automobile service centers may sell batteries directly to nearby smelters, a practice that is most common in Mexico.

The strong demand for used batteries in North America today means price incentives are sufficient to ensure that almost all SLABs are diverted from the waste stream and collected and sent to a recycler. In most parts of North America, a consumer receives US$10–20 for returning a used automotive battery to a retail outlet.[30] In Mexico, however, battery collectors have been known to charge a fee to collect industrial batteries, which are heavier and more difficult to recycle, if the secondary smelter charged them to accept these batteries.

In the United States, a majority of states have enacted laws to incentivize the recycling of batteries by banning the disposal of lead-acid batteries in landfills; establishing a deposit system for new battery sales; requiring retailers, wholesalers and manufacturers to take back SLABs; and making it a violation of law to send SLABs to unlicensed facilities.[31] These statutes help ensure that if the price of lead drops, a regulatory framework and incentives are in place to get SLABs to smelters.

Canada, at the federal level, and Mexico do not have specific laws requiring the collection of SLABs. However, various take-back programs are in place in both countries; examples are British Columbia's lead-acid battery stewardship program[32] and JCI's reverse distribution system in Mexico, which uses an extensive distribution network to collect used batteries from its retailers and other distribution centers.[33]

Secondary Lead Smelters in North America

Table 1-1 lists secondary lead smelters in North America that process spent lead-acid batteries. It also includes pollution release information for 2007–2010, if available, as reported by the facilities and in accordance with national pollutant release and transfer registries (PRTRs). The following maps show the approximate locations of smelters that

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[28] Guberman, *2010 Minerals Yearbook*, Lead, 42.18.

[29] A tolling agreement is an arrangement in which a smelter agrees with a battery manufacturer to smelt the lead from SLABs for a specified fee, or "toll."

[30] When a person buys a new battery and returns an old one, these fees are paid as the return of a deposit or a discount on the price of a new replacement battery.

[31] A summary of US state laws can be found at <http://batterycouncil.org/?page=State_Recycling_Laws>.

[32] See Environmental Management Act, Recycling Regulation (includes amendments up to B.C. Reg. 132/2011, 21 July 2011), <http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/449_2004#Schedule>.

[33] JCI operates a closed-loop distribution chain throughout 30 Mexican states, including collection centers for batteries, as well as a fleet of dedicated trucks and trailers. See <http://www.epa.gov/osw/conserve/materials/ecycling/conference/guillen/guillen-present.pdf>.

TABLE 1-1. Spent Lead-acid Battery Processing Facilities in North America, including Pollution Release Information as Reported for 2007–2010

Facility Name	Location	NAICS*		Capacity (tons)	PRTR ID	PRTR Reported Air Emissions of Lead (and/or its compounds) (kg)			
		Description	Codes			2007	2008	2009	2010
CANADA – NPRI									
1 **Teck Trail Operations** *(primary lead smelter which also consumes SLABs)*	Trail, British Columbia	Non-ferrous Metal (except Aluminum) Smelting and Refining	33141		3802	2,050.33	1,562.87	1,089.21	882.88
2 **Xstrata Zinc – Brunswick Smelter** *(primary lead smelter which also consumes SLABs)*	Belledune, New Brunswick	Non-ferrous Metal (except Aluminum) Smelting and Refining	33141		4024	5,319.60	5,873.70	6,814.40	7,586.00
3 **Newalta**	Ste-Catherine, Quebec	Non-ferrous Metal Foundries	33152		4402	642.38	583.00	545.80	573.94
4 **Tonolli**	Mississauga, Ontario	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149		2256	452.84	419.84	352.24	432.49
5 **Metalex Products Ltd.**	Richmond, British Columbia	All Other Miscellaneous Manufacturing	33999		732	28.00	3.19	3.90	5.01
UNITED STATES – TRI									
1 **The Battery Recycling Company**	Arecibo, Puerto Rico	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	18,268.25 [1]	00612BTTRYRD2KM	74.72	42.38	29.84	48.10
2 **Buick Resource Recycling** *(Doe Run)*	Boss, Missouri	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149		65440BCKSMHIGHW	35,351.18	11,486.77	13,259.41	15,658.01
3 **East Penn Manufacturing Co., Inc.**	Lyon Station, Pennsylvania	Battery Manufacturing and Recycling	33591	167,754 [2]	19536STPNNDEKAR	2,037.17	1,997.62	2,738.34	2,574.14
4 **Exide Technologies, Inc. – Facility 1**	Muncie, Indiana	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	130,000 [3]	46302XDCRP2601W	790.61	469.92	349.72	165.56
5 **Exide Technologies, Inc. – Facility 2**	Vernon, California	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149		90058GNBNC2717S	1,557.58	778.36	275.78	275.78

* NAICS = North American Industry Classification System; a collaborative effort by Mexico's *Instituto Nacional de Estadística y Geografía* (INEGI), Statistics Canada, and the United States Office of Management and Budget (OMB), through its Economic Classification Policy Committee (ECPC), staffed by the Bureau of Economic Analysis (BEA), the Bureau of Labor Statistics (BLS), and the Census Bureau.

TABLE 1-1.

Facility Name	Location	NAICS		Capacity (tons)	PRTR ID	PRTR Reported Air Emissions of Lead (and/or its compounds) (kg)			
		Description	Codes			2007	2008	2009	2010
6 **Exide Technologies, Inc. – Facility 4**	Baton Rouge, Louisiana	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	100,000 [4]	70874SCHYLWESTE	2,948.35	2,857.63	635.03	--
7 **Exide Technologies, Inc. - Facility 5**	Canon Hollow, Missouri	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149		64451SCHYLRRIII	9.07	9.07	9.07	9.07
8 **Exide Technologies, Inc. - Facility 6** *(ceased operations in late 2012)*	Frisco, Texas	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	72,000 [5]	75034GNBNCSOUTH	1,731.82	2,248.46	1,420.65	986.56
9 **Exide Technologies, Inc. - Facility 7** *(will idle facility by 31 March 2013)*	Reading, Pennsylvania	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	208,050 [6]	19605GNRLBSPRIN	1,392.67	910.29	963.25	894.84
10 **Gopher Resource**	Eagan, Minnesota	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	228,636 [7]	55121GPHRS3385S	451.78	619.15	646.01	597.83
11 **Gopher Resource – Envirofocus Technologies**	Tampa, Florida	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	150,000 [8]	33619GLFCS1901N	839.60	591.94	639.52	191.05
12 **Johnson Controls, Inc.** *(began operations in 2012)*	Florence, South Carolina	Battery Manufacturing	33591	174,762 [9]	29506JHNSN346BI	0.00	0.00	0.00	0.00
13 **RSR Corporation, Quemetco – Facility 1**	City of Industry, California	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	241,338 [10]	91745QMTCN720SO	244.03	120.66	10.69	5.08
14 **RSR Corporation, Quemetco – Facility 2**	Indianapolis, Indiana	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	333,046 [11]	46231QMTCN7870W	560.64	571.07	399.16	381.02
15 **RSR** *(Revere Smelting & Refining Corp.)*	Middleton, New York	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	285,583 [12]	10940RVRSMRD2BA	336.11	356.07	284.86	245.85
16 **Sanders Lead Company**	Troy, Alabama	Non-ferrous Metal Rolling, Drawing, Extruding and Alloying	33149	145,000 [13]	36081SNDRSHENDE	3,842.38	4,168.51	2,101.04	1,360.78

TABLE 1-1.

Facility Name	Location	NAICS		Capacity (tons)	PRTR ID	PRTR Reported Air Emissions of Lead (and/or its compounds) (kg)			
		Description	Codes			2007	2008	2009	2010
MEXICO – RETC data available*									
1 **Enertec México, S. de R.L. de C.V.**	Ciénega de Flores, Nuevo León	Non-ferrous Metal (except Aluminum) Smelting and Refining	33141	254,085	EMCLJ1901211	--	11,011.57	8,129.05	6,811.76
2 **Enertec México, S. de R.L. de C.V.** *(began operations in 2011)*	García, Nuevo León			252,000					
3 **Recicladora Industrial de Acumuladores, S.A de C.V.**	Santa Catarina, Nuevo León	Ferrous Metal Foundries	33151	121,804	RIALJ1904811	65,643.00	12,628.00	1,977.00	2,030.00
4 **Corporación PIPSA, S.A. de C.V.**	García, Nuevo León	Waste Collection	56211	104,760	CPILJ1901811 (or: CPILV1901811)	0.00	0.00	166.00	199.00
5 **M3 Resources México, S. de R.L. de C.V.**	Reynosa, Tamaulipas	Non-ferrous Metal Foundries	33152	50,000	MTRBD2803211	--	72.70	--	393.28
6 **Eléctrica Automotriz Omega, S.A. de C.V.**	Planta Doctor González, Nuevo León	Non-ferrous Metal (except Aluminum) Smelting and Refining	33141	94,000	EAOBB1901611	1,627.22	941.60	941.60	
7 **La Batería Verde, S.A de C.V.** *(began operations in 2012)*	Tezoyuca, Estado de México			36,000					
8 **Productos Metalúrgicos Salas, S.A. de C.V.**	Aguascalientes, Aguascalientes	Waste Collection	56211	15,000	PMSRE0100111	--	95.17	111.02	66.08
9 **Óxidos y Pigmentos Mexicanos, S.A. de C.V.**	Tijuana, Baja California	Non-ferrous Metal (except Aluminum) Smelting and Refining	33141	12,400	OPM7L0200421	58.08	332.16	--	0.00
10 **Hornos de Fundición, S.A. de C.V.**	Valle Hermoso, Tamaulipas	Waste Collection	56211	9,500	HFUTF2804011	--	0.00	20.57	0.00
11 **Aleaciones Metalúrgicas, S.A. de C.V.**	León, Guanajuato	Waste Collection	56211	7,425	AMEBD1102011	--	42.89	48.00	42.89
12 **Reciclajes y Destilados Monterrey, S.A. de C.V.**	García, Nuevo León	Waste Collection	56211	4,267	RDMQ71901811	0.00	--	--	--

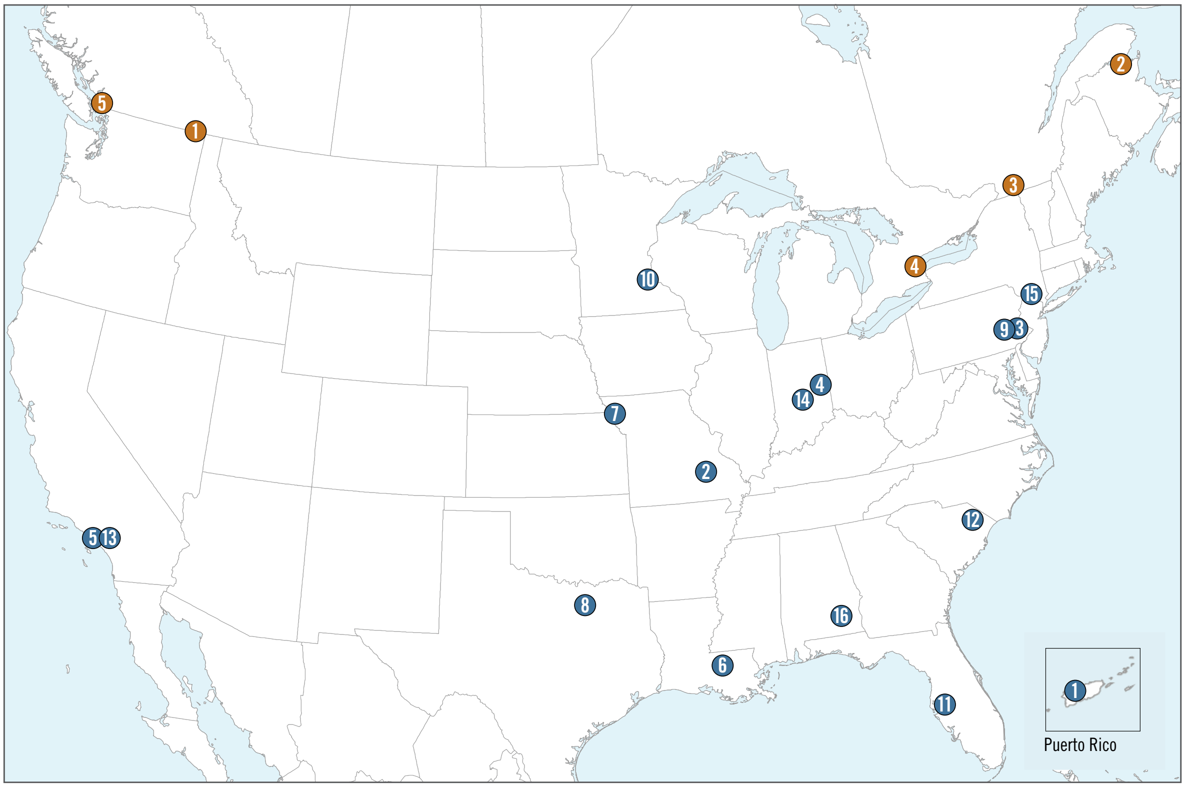
TABLE 1-1.

Facility Name	Location	NAICS		Capacity (tons)	PRTR ID	PRTR Reported Air Emissions of Lead (and/or its compounds) (kg)			
		Description	5 Codes			2007	2008	2009	2010
MEXICO – RETC data not available									
13 **Industrial Mondelo, S. de R.L. de C.V.)**	Naucalpan de Juárez, Estado de México			180,000					
14 **Metalúrgica Xicohténcatl, S. de R.L. de C.V.**	Tlaxco, Tlaxcala			65,515					
15 **South American Metals, S. de R.L. de C.V.**	Ciudad Juárez, Chihuahua			24,000					
16 **Martha Alicia Boites Jiménez**	León, Guanajuato			17,100					
17 **Versisa, S.A. de C.V.**	Soledad Graciano Sánchez, San Luis Potosí (SLP)			16,000					
18 **Omega Solder México, S.A. de C.V.**	San Luis Potosí, SLP			10,700					
19 **Fundametz México, S.A. de C.V.**	San Luis Potosí, SLP			10,094					
20 **Sion Acumuladores, S.A. de C.V.**	El Salto, Jalisco			7,500					
21 **Funofec, S.A. de C.V.**	Tizayuca, Hidalgo			5,100					
22 **Dian Procesos Metalúrgicos, S.A de C.V.**	Tlajomulco, Jalisco			4,320					
23 **Transformadora del Centro de Michoacán "Eric Bobadilla"**	(Morelia, Michoacán)			3,000					
24 **Productos Metalúrgicos Poblanos, S.A. de C.V.**	Huejotzingo, Puebla			2,000					
25 **Industria de Acumuladores Jalisco** *(reportedly closed by Profepa in 2012)*	Tlaquepaque, Jalisco								

Notes: 0.00 kg means the facility reported in the amount of 0 kg; whereas (--) means there is no PRTR report for the facility for the given year/s.
Capacity volumes for Mexico from: <http://tramites.semarnat.gob.mx/images/stories/menu/empresas/rubro1.pdf> (consulted 21/09/2012).

[1] From Title V Permit, unclear if this is actual production or capacity
[2] Maximum Capacity from Title V Permit
[3] May 2010 Operating Permit
[4] Maximum Operating Rate from Title V Permit. This plant is currently idle.
[5] USGS survey information. This facility plans to close by the end of 2012 and transfer the capacity from this facility to other Exide plants.
[6] Maximum rated capacity from Title V Permit
[7] Maximum Operating Rate from Title V Permit
[8] After recent expansion
[9] From Title V Permit
[10] From Title V Permit
[11] From Title V Permit
[12] Estimate provided by RSR to Secretariat
[13] Maximum production capacity from EPA ICR response

MAP **1-1a** Facilities Processing Spent Lead-acid Batteries (SLABs) in Canada and the United States



Canada

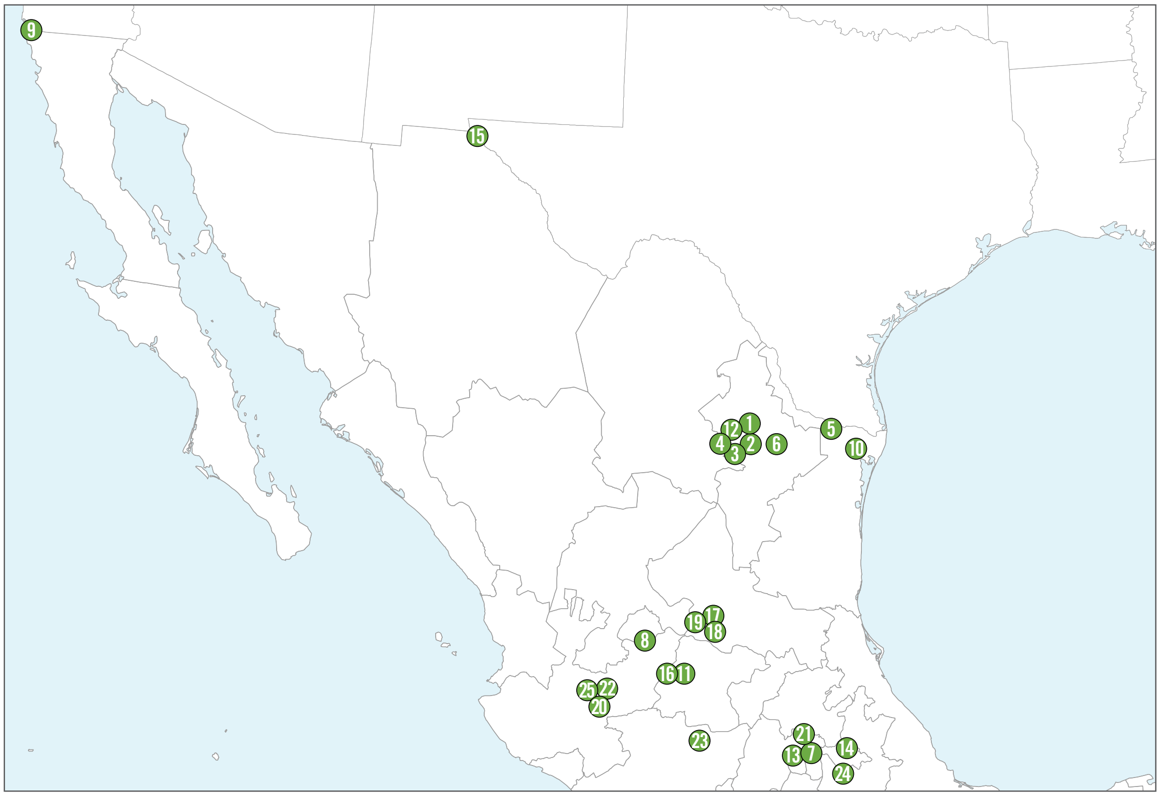
1	Teck Trail Operations	Trail, British Columbia
2	Xstrata Zinc - Brunswick	Belledune, New Brunswick
3	Newalta	Ste-Catherine, Quebec
4	Tonolli	Mississauga, Ontario
5	Metalex Products Ltd.	Richmond, British Columbia

United States

1	The Battery Recycling Company	Arecibo, Puerto Rico
2	Buick Resource Recycling (Doe Run)	Boss, Missouri
3	East Penn Manufacturing Co., Inc.	Lyon Station, Pennsylvania
4	Exide Technologies Inc. - Facility 1	Muncie, Indiana
5	Exide Technologies Inc. - Facility 2	Vernon, California
6	Exide Technologies Inc. - Facility 4	Baton Rouge, Louisiana
7	Exide Technologies Inc. - Facility 5	Canon Hollow, Missouri
8	Exide Technologies Inc. - Facility 6	Frisco, Texas
9	Exide Technologies Inc. - Facility 7	Reading, Pennsylvania
10	Gopher Resource	Eagan, Minnesota
11	Gopher Resource - Envirofocus Technologies	Tampa, Florida
12	Johnson Controls Inc.	Florence, South Carolina
13	RSR Corporation, Quemetco Facility 1	City of Industry, California
14	RSR Corporation, Quemetco Facility 2	Indianapolis, Indiana
15	RSR (Revere Smelting & Refining Corp.)	Middleton, New York
16	Sanders Lead Company	Troy, Alabama

Map reflects US facilities in operation in 2012.

MAP **1-1b** Facilities Processing Spent Lead-acid Batteries (SLABs) in Mexico



Mexico

1	Enertec México, S. de R.L. de C.V.	Ciénega de Flores, Nuevo León
2	Enertec México, S. de R.L. de C.V.	García, Nuevo León
3	Recicladora Industrial de Acumuladores, S.A. de C.V.	Santa Catarina, Nuevo León
4	Corporación PIPSA, S.A. de C.V.	García, Nuevo León
5	M3 Resources México, S. de R.L. de C.V.	Reynosa, Tamaulipas
6	Eléctrica Automotriz Omega, S. A. de C.V.	Planta Doctor González, Nuevo León
7	La Batería Verde, S.A. de C.V.	Tezoyuca, Estado de México
8	Productos Metalúrgicos Salas, S.A. de C.V.	Aguascalientes, Aguascalientes
9	Óxidos y Pigmentos Mexicanos, S.A. de C.V.	Tijuana, Baja California
10	Hornos de Fundición, S.A. de C.V.	Valle Hermoso, Tamaulipas
11	Aleaciones Metalúrgicas, S.A. de C.V.	León, Guanajuato
12	Reciclajes y Destilados Monterrey, S.A. de C.V.	García, Nuevo León
13	Industrial Mondelo, S. de R.L. de C. V.	Naucalpan de Juárez, Estado de México
14	Metalúrgica Xicohténcatl, S. de R.L. de C.V.	Tlaxco, Tlaxcala
15	South American Metals, S. de R.L. de C.V.	Ciudad Juárez, Chihuahua
16	Martha Alicia Boites Jiménez	León, Guanajuato
17	Versisa, S.A. de C.V.	Soledad Graciano Sánchez, San Luis Potosí
18	Omega Solder México, S.A. de C.V.	San Luis Potosí, SLP
19	Fundametz México, S.A. de C.V.	San Luis Potosí, SLP
20	Sion Acumuladores, S.A. de C.V.	El Salto, Jalisco
21	Funofec, S.A. de C.V.	Tizayuca, Hidalgo
22	Dian Procesos Metalúrgicos, S.A. de C.V.	Tlajomulco, Jalisco
23	Transformadora del Centro de Michoacán "Éric Bobadilla"	Morelia, Michoacán
24	Productos Metalúrgicos Poblanos, S.A. de C.V.	Huejotzingo, Puebla
25	Industria de Acumuladores Jalisco	Tlaquepaque, Jalisco

Photo: Profepa

process SLABs in Canada and the United States (Map 1-1a) and Mexico (Map 1-1b).

In Canada, there are three secondary smelters and two facilities that combine primary and secondary smelting. According to the *2010 Minerals Yearbook* issued by the US Geological Survey (USGS), secondary lead production totaled 167,042 t in 2010.[34]

In the United States, at the end of 2011, eight companies were operating 15 domestic secondary lead smelters.[35] Because some secondary smelters withhold capacity information as confidential, the CEC Secretariat was unable to determine the estimated US secondary lead production capacity. In 2011, however, secondary smelters in the United States produced about 1,200,000 t of lead.[36]

In Mexico, the CEC Secretariat has identified, based on information provided by Mexico's Secretariat of Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*—Semarnat), 25 authorized secondary smelters with a permitted capacity to process 1,337,171 t of SLABs (see Table 1-1, above).[37] The *2010 Minerals Yearbook* puts Mexico's annual production at 110,000 t, a figure that industry sources indicate is low and does not reflect the increased capacity that has come on line in Mexico since 2010.[38] The authorized capacity will always be much greater than actual capacity because industry wants to have growth potential built into its permits. If smelters in Mexico are currently operating in the range of 50 percent capacity, as some industry sources have suggested, Mexico's industry would be processing close to 668,585 t of SLABs each year, and its production levels of lead would be around 401,151 t.[39]

[34] Guberman, *2010 Minerals Yearbook*, Lead, 42.16.
[35] See Table 1-1. The list of 15 smelters producing lead in 2011 does not include Johnson Control's facility in Florence, South Carolina, which began production in 2012. It does include Exide's Frisco, Texas, facility, which Exide closed in late 2012, its Baton Rouge, Louisiana, facility, which is currently not recycling batteries and is conducting minimal recycling operations, and Exide's Reading, Pennsylvania, facility, which Exide plans to close by March 2013.
[36] US Geological Survey, *Minerals Commodity Summaries, 2012* (Washington, DC: US Department of the Interior, US Geological Survey, January 2012), p. 90.
[37] The list of secondary smelters in Table 1-1 includes facilities registered as recyclers, as well as smelters. Information provided by Semarnat, e-mail from Óscar Trejo Cuevas, Subdirector of *Licencia Ambiental Única*, to Marco Heredia, CEC Secretariat program manager, 26 October 2012.
[38] Guberman, *2010 Minerals Yearbook*, Lead, 42.6.
[39] Lead-acid batteries are usually between 58 and 65 percent lead alloy by weight. This estimate of 401,151 t was derived by taking 60 percent of 668,585.

In North America, many companies have some level of vertical integration or otherwise have established continental supply chains.

In addition to authorized capacity, industry sources have suggested that an unknown number of small, unregulated secondary lead smelters are operating in Mexico. The CEC Secretariat is unable to document the extent of such activity, although the Office of the Federal Attorney for Environmental Protection (*Procuraduría Federal de Protección al Ambiente*—Profepa), Mexico's environmental enforcement agency, forced the closure of at least one unauthorized secondary lead smelter in 2012 and has undertaken various actions, including inspections of transportation, storage, recycling and import/export documentation for SLABs or lead. A summary of Profepa's inspection and enforcement action in 2011 and 2012 SLAB imports and handling is presented in Appendix 1.

Industry Trends

Over the last 40 years, the SLAB recycling business in the United States has undergone significant consolidation. In 1969, the United States had 154 smelters, including five primary plants, and 18 manufacturers and foundries that produced 547,849 t of lead.[40] In 2011, by contrast, 15 secondary smelters produced about 1,200,000 t of lead in the United States.[41]

Increasingly stringent environmental regulations have increased capital costs and process improvements, which in turn have been a factor in forcing smaller and less profitable or lower-capitalized smelters out of business.

The remaining smelters are demonstrating higher environmental performance, as well as greater volumes and efficiencies of scale. Although the absolute numbers of individual smelters have greatly contracted, globally as well as in North America, the overall capacity of the remaining operations has increased substantially. This in turn has increased the competition to secure sufficient numbers of SLABs to provide for efficient recycling and supplies of refined lead for battery manufacturing.

The same consolidation and industrial transition that have occurred in both Canada and the United States may also be on the verge of occurring in Mexico, albeit for different reasons. Mexico's 25 authorized smelters have a permitted capacity ranging from 2,000 to 254,000 t per year. Of these smelters, 15 have a capacity of less than 30,000 t. During the CEC Secretariat's interviews with industry officials and others in conjunction with this study, many representatives of smelters in Mexico and lead analysts indicated that smaller smelters are having difficulties obtaining SLABs at a price and in a quantity to make their operations profitable. Indeed, many reported operating at no more than 50 percent capacity. Several industry observers believe that, because of the diminishing margin between the cost of SLABs and the LME price of lead, together with the apparent overcapacity in the Mexican industry, industrial consolidation appears unavoidable, and many of the unprofitable smaller smelters will be forced out of business in the coming years.

Vertical integration and internationalization are also becoming more common in the industry.[42] In North America, many companies have some level of vertical integration or otherwise have established continental supply chains. For example, four major North American battery manufacturers—Exide

[40] Donald E. Moulds, "Lead" in: Bureau of Mines, *Minerals Yearbook Metals, Minerals, and Fuels 1969* [1968 data], Vol. 1–2, 1969, p. 627 (citing production of 603,900 short tons, which is equivalent to 547,849 metric tons using a conversion of 0.90718474), available at University of Wisconsin, Ecology and Natural Resources Collection, <http://digicoll.library.wisc.edu/cgi-bin/EcoNatRes/EcoNatRes-idx?type=turn&entity=EcoNatRes.MinYB1969v1and2.p0635&id=EcoNatRes.MinYB1969v1and2&isize=M>.

[41] See notes 35 and 36.

[42] Vertical integration, which occurs when battery manufacturers own the smelters and control the networks that collect and transport SLABs to the smelter, either directly or through contracts, is a way in which battery manufacturers can control costs and acquire the flexibility they need to manage their supply of SLABs.

Technologies Manufacturing Company (Exide), Johnson Controls Inc. (JCI), East Penn Manufacturing and *Grupo Gonher de México* (Gonher)—have vertical integration in their supply chains. Exide, the second-largest lead-acid battery manufacturer in the world, operates seven battery manufacturing plants[43] and six secondary lead smelters in the United States.[44]

JCI, the largest battery manufacturer in the world, produces batteries at plants in the United States and in Mexico. As part of its integrated North American business, it operates two secondary lead smelters in Mexico and one in the United States. In Mexico, it maintains a system of retailers that sell and replace JCI-produced batteries. East Penn Manufacturing operates a battery manufacturer and a smelter in Pennsylvania.[45] In Mexico, it maintains a tolling agreement with *Recicladora Industrial de Acumuladores, S.A. de C.V.* (RIASA), a division of Gonher. Under this agreement, SLABs are shipped from the United States to Gonher's secondary lead smelter near Monterrey, Nuevo León, and refined lead is returned to Pennsylvania. Gonher, for its part, also manufactures batteries adjacent to its Monterrey smelter.[46] M3 Resources of Birmingham, Alabama, operates a smelter in Reynosa, Mexico, under Mexico's temporary import regime program—IMMEX—previously known as the *maquiladora* program.[47]

Photo: Profepa

43 Exide Technologies, "Exide's Worldwide Facilities," <http://www.exide.com/en/about/locations.aspx>. Exide's secondary lead smelter in Frisco, Texas, will close in late 2012.

44 America's Battery Recyclers, "Member Recycling Companies," <http://www.americasbatteryrecyclers.com/association.html>.

45 See <http://www.dekabatteries.com/>.

46 For RIASA, see <http://www.grupogonher.com/_ScriptLibrary/XSite.Esp/GrupoGonher/riasa.htm>.

47 Interview with Tom Mayfield, president, M3 Resources USA LLC, 15 August 2012.

2

International Framework for Managing the Trade in SLABs

In Canada, Mexico and the United States, SLABs are considered hazardous waste.[48] The trade in SLABs is therefore subject to bilateral agreements between the United States and Canada and the United States and Mexico.

This framework provides for a notice and consent process, which allows countries to object to the shipment of hazardous waste. Despite this framework, one important difference between the countries is that the United States, unlike Canada and Mexico, does not require a hazardous waste manifest to accompany each shipment of SLABs.

International Agreements

The United States has separate bilateral agreements with Canada and Mexico on trading hazardous waste because the United States is not a party to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.[49] The convention states that parties to the convention, such as Mexico and Canada, should not trade with nonparties to the convention unless a bilateral agreement is in place.[50]

In addition to these bilateral agreements, all three countries are members of the Organisation for Economic Co-operation and Development (OECD). OECD has adopted a number of decisions on the movement of hazardous waste that apply to member countries. One OECD decision requires contracts between the exporter and the recycling facility and the use of "movement documents" or manifests to accompany hazardous waste shipments.[51] It also requires facilities recycling the waste to provide notice of receipt of the wastes and issue a "certificate of recovery" upon completion of recycling.[52] The United States does not follow this decision because, as noted, it does not require manifests to accompany SLAB shipments or other hazardous waste destined for recovery, and it does not require recycling facilities to issue a certificate of recovery upon completion of recycling.

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48 SLABs exhibit characteristics of toxicity and corrosivity. In addition, the sulfuric acid in SLABs can volatilize and explode.

49 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, <http://www.basel.int/convention/about.html>.

50 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, art. 4, 5 May 1992, General Obligations, Text of the Basel Convention, <http://www.basel.int/text/con-e-rev.doc>.

51 Organisation for Economic Co-operation and Development, "Decision of the Council Concerning the Control of Transboundary Movements of Wastes Destined for Recovery Operations," OECD Doc. C (2001) 107/FINAL, 14 June 2001 (amended 2002, 2004, 2005, 2008), ch. II(D)(2), Case 1(j), <http://webnet.oecd.org/oecdacts> (hereafter OECD Decision).

52 Ibid.

Import and Export Controls

The US-Canada[53] and US-Mexico[54] agreements establish procedures for a government-to-government export notice and consent process for the shipment of hazardous waste, including SLABs. This process consists of the following steps:

- An exporter must submit a "notice of intent" to export SLABs to the environmental authority of the country in which the exporter is located. This notice lists the type and anticipated amount of waste to be shipped, the receiving facility and the specified time period of up to 12 months.
- The exporting country's environmental authority forwards the notice of intent to the importing country, which can consent or object to the shipments.
- The importing country then sends the approval or objection back to the exporting country's environmental authority.
- The exporting country's environmental authority sends the approval (in the form of a consent or a permit) or the objection to the exporter.

Although the US-Canada agreement presumes consent if no objection or conditions are imposed within 30 days of receipt of notice,[55] in practice, the US does not presume consent and requires that Canada provide written consent before an Acknowledgement of Consent document is issued to the US exporter.[56] In the US-Mexico agreement, notification must be provided to the designated government authority at least 45 days prior to shipment, and consent is not presumed if a government fails to respond to the notice.[57] In addition, a copy of the notification has to be sent "simultaneously through diplomatic channels."[58]

In 2012, the environmental agencies in Canada, Mexico and the United States began to share electronically export requests and consent documents for hazardous waste exports, including SLABs, through the Notice and Consent Electronic Data Exchange (NCEDE) project. This system is replacing a paper-based system in which governments exchange notice and consent information by mail, fax and cable.[59]

In each of the three countries, exporters of SLABs must report back to the environmental authority on an annual basis on the amounts of SLABs exported, as well as the destination country and recycling facility.

In 2012, the environmental agencies in Canada, Mexico and the United States began to share electronically export requests and consent documents for hazardous waste exports, including SLABs, through the Notice and Consent Electronic Data Exchange (NCEDE) project.

Transporting SLABs

In each of the three countries, handlers that store SLABs must adhere to the standard management practices prescribed in regulations. Transport regulations include requirements for when hazardous materials placards must be placed on a vehicle, how the SLABs must be wrapped and stacked, and what hazardous material documentation must accompany the shipment.[60]

In Canada and Mexico, a hazardous waste manifest[61] must accompany each shipment. In the United States, SLABs are also categorized as universal waste, a designation intended to streamline hazardous waste management standards. The universal waste regulations of the US Environmental Protection Agency (USEPA) exempt generators, transporters and disposal facilities handling SLABs from hazardous waste manifesting requirements. USEPA's rationale for establishing this exemption is that it encourages recycling by reducing the regulatory burden on those companies recycling SLABs.[62]

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53 Agreement Between the Government of the United States of America and the Government of Canada Concerning the Transboundary Movement of Hazardous Waste, 28 October 1986, <http://www.epa.gov/osw/hazard/international/can-ada86and92.pdf> (hereafter US-Canada Agreement).

54 Annex III to the Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area, Agreement of Cooperation Regarding the Transboundary Shipments of Hazardous Wastes and Hazardous Substances, 12 November 1986, <http://www.epa.gov/osw/hazard/international/mexico86.pdf> (hereafter US-Mexico Agreement).

55 US-Canada Agreement, Art. Sec. 3(d).

56 Comments received from the USEPA, 21 December 2012, p. 2.

57 US-Mexico Agreement, para. 4.

58 US-Mexico Agreement, para. 1.

59 <http://www.cec.org/Page.asp?PageID=924&ContentID=25234>.

60 Art. 86, *Reglamento to the Ley General para la Prevención y Gestión de los Residuos* (LGPGIR). See <http://www.diputados.gob.mx/LeyesBiblio/regley/Reg_LGPGIR.pdf>.

61 A manifest is a form prepared by generators who transport, or offer for transport, hazardous waste for off-site treatment, recycling, storage or disposal. A paper document with multiple copies of a single form, it contains information on the type and quantity of the waste being transported, instructions for handling the waste, and signature lines for all parties involved in the transport, handling, and disposal process. Each party that handles the waste signs the manifest and retains a copy for itself.

62 See US Environmental Protection Agency, *Hazardous Waste Recycling and Universal Wastes,* Chapter III: Managing Hazardous Waste—RCRA Subtitle C, <http://www.epa.gov/wastes/inforesources/pubs/orientat/rom32.pdf>.

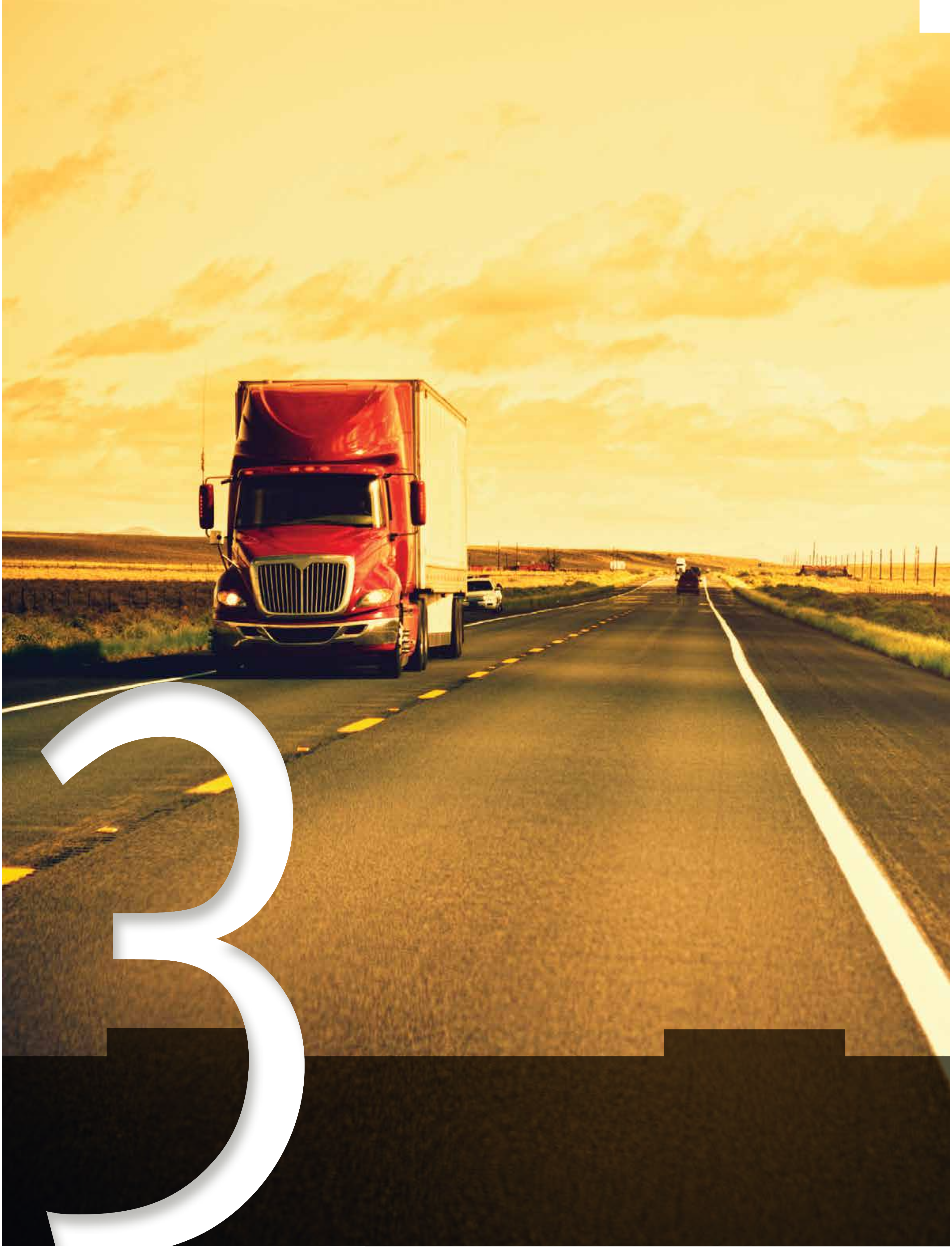
Improving the North American Framework for Managing the Trade in SLABs

Canada, Mexico and the United States could improve the North American framework for managing the trade in SLABs in at least three ways. First, the United States should require the use of manifests for each international shipment of SLABs, and it should require exporters to obtain a certificate of recovery from foreign recycling facilities. This will allow end-to-end tracking of SLAB shipments across borders and help ensure they are recycled in accordance with international authorizations.

Second, the United States should explore the establishment of a system that would allow exporters to submit annual report information electronically. Currently, USEPA maintains paper copies of annual reports that contain information on the amount of SLABs that US companies have exported abroad and the names of the transporters and receiving facilities. (In developing USEPA data for this report, the CEC Secretariat and the USEPA created their own databases and populated them by manually entering thousands of pieces of information from the annual reports.[63]) However, that system is cumbersome and resource-intensive, and it draws resources from the USEPA's goal of ensuring that SLAB exports comply with US law.

Finally, Canada, Mexico and the United States should share the import and export data maintained by their respective environmental and border agencies on an annual basis. This information sharing could be used to identify trends that may require a policy response or that may raise compliance issues.

[63] These data can be found at <http://www.cec.org/slabs>.


3

The North American Trade in SLABs

In order to better understand the trade flows in SLABs, the CEC Secretariat examined trade data from the environmental agencies of all three countries and from the US Census Bureau.[64] Our review of US trade data indicates a rapid increase in exports of SLABs from the United States to Mexico since 2004 and significant data abnormalities that may indicate compliance issues by some companies exporting SLABs from the United States to the rest of the world.

Trade Data

In Canada, Mexico and the United States, companies are required to report import and export information to the national environmental agencies. For its analysis of trade flows of SLABs, the CEC Secretariat collected:

- from Environment Canada, SLAB import and export data for 2002–2011;[65]
- from Mexico's *Secretaría de Medio Ambiente y Recursos Naturales* (Semarnat), SLAB import and export data for 2006–2011 and from the *Procuraduría Federal de Protección al Ambiente* (Profepa) for 2011; and
- from the US Environmental Protection Agency, trade data from mid-July 2010 when USEPA began collecting this information.[66]

In addition, the Secretariat collected US Census Bureau import and export data that have been classified using the Harmonized Tariff Schedule (HTS). The US harmonized system provides two specific classification codes that cover SLABs exported or imported for the recovery of lead: 8548100540, which covers starting, lighting, ignition SLABs, and 8548100580, which covers industrial SLABs.[67]

Figures 3-1–3-4 provide an overview of the US trade data collected by the Secretariat.

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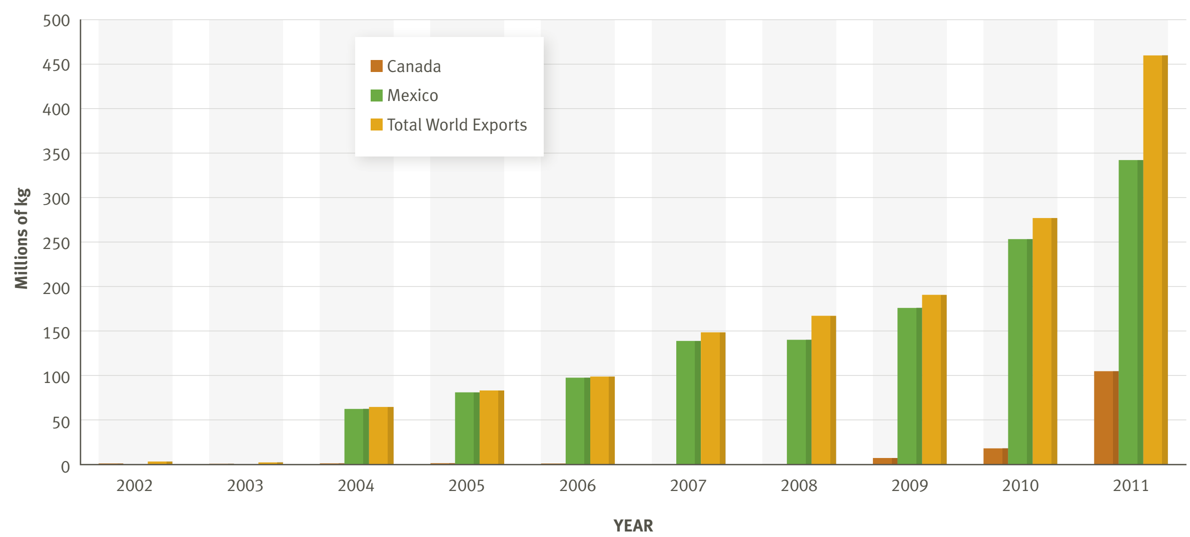
[64] The trade data collected by the CEC Secretariat can be found at <http://www.cec.org/slabs>. The US Census Bureau compiles trade data from information submitted to US Customs and Border Protection, and in the case of exports to Canada, import documents filed with Canadian agencies and forwarded to the US Census Bureau. See US Census Bureau, "About Foreign Trade Programs and Products," <http://www.census.gov/foreign-trade/about/index.html>. The Secretariat purchased its data from the US Census Bureau's subscription service; see US Census Bureau, "Foreign Trade on Electronic Media," <http://www.census.gov/foreign-trade/reference/products/catalog/orderform.html>; and made corrections to those data based upon statistical corrections issued by the US Census Bureau; see US Census Bureau, "Statistical Corrections," <http://www.census.gov/foreign-trade/statistics/corrections/index.html>. The online trade databases found at <http://dataweb.usitc.gov/> and at <http://www.usatradeonline.gov> do not contain these statistical corrections.

[65] Environment Canada collects annual reports from companies and categorizes exports based on United Nations (UN) Codes 2794 (batteries, wet, filled with acid, electric storage) and 2800 (batteries, wet, nonspillable, electric storage). SLABs do not have a stand-alone UN code. These two codes largely overlap with SLABs, although UN Code 2800 can include a wide variety of sealed batteries such as lead absolyte batteries, which would include batteries such as sealed cell batteries with lead in the electronic industry (home alarm system, power supplies unit, road and railroad signal system, etc.).

[66] Applicability and Requirements, 40 C.F.R. sec. 266.80(a) (effective 7 July 2010); OECD requirements: Export Shipments of Spent Lead-Acid Batteries, 75 *Federal Register*, 1236–1262 (8 January 2010), 1244, 1261.

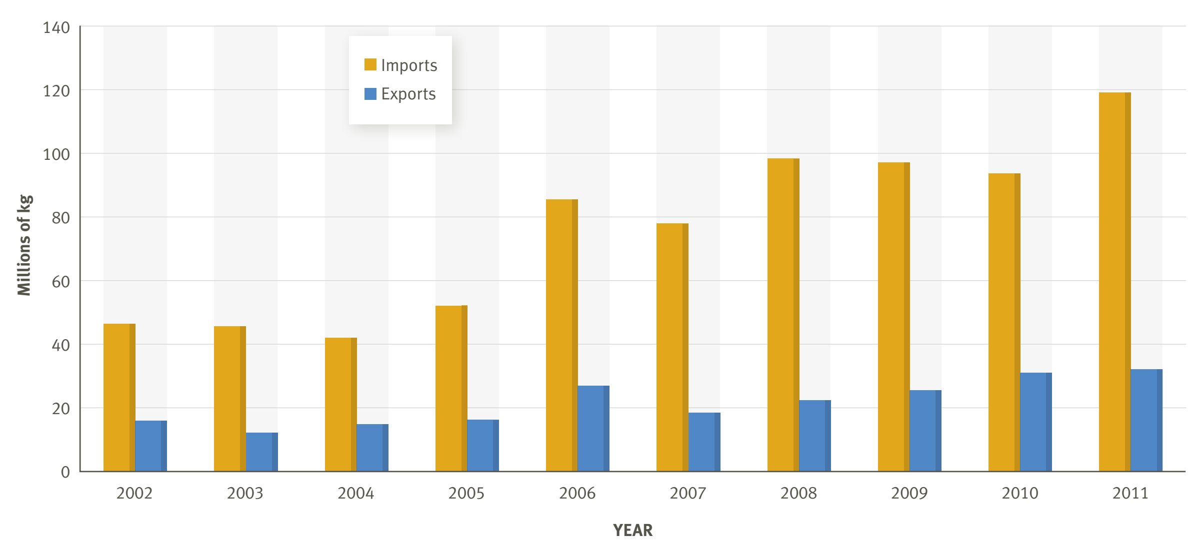
[67] Harmonized Tariff Schedule (HTS) of the United States, <http://hts.usitc.gov/>. The HTS has three other lead scrap–related codes: 7802000030 (lead waste and scrap obtained from lead-acid storage batteries), 7802000060 (lead waste and scrap other than that obtained from lead-acid storage batteries) and 8548102500 (waste and scrap primary cells, primary batteries and electric storage batteries for the recovery of lead, not specified elsewhere).

FIGURE 3-1 US Exports of SLABs to Canada, Mexico and All Other Destinations, 2002–2011



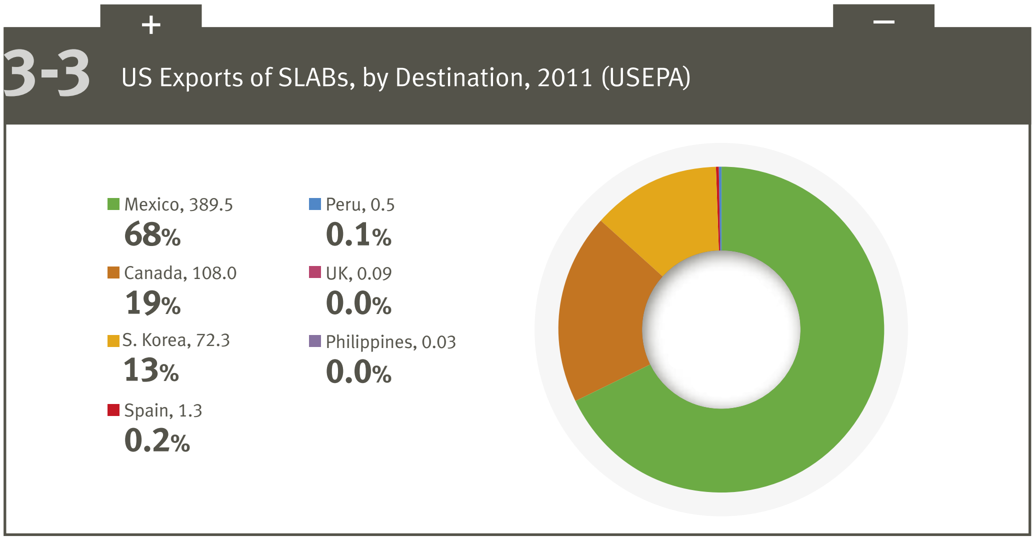
Source: Figure based on compilation of export data collected by US Census Bureau under the harmonized tariff codes 854800540 (starting, lighting, ignition SLABs) and 8548100580 (industrial SLABs).

FIGURE 3-2 Canada: Trade in SLABs to and from the United States, 2002–2011



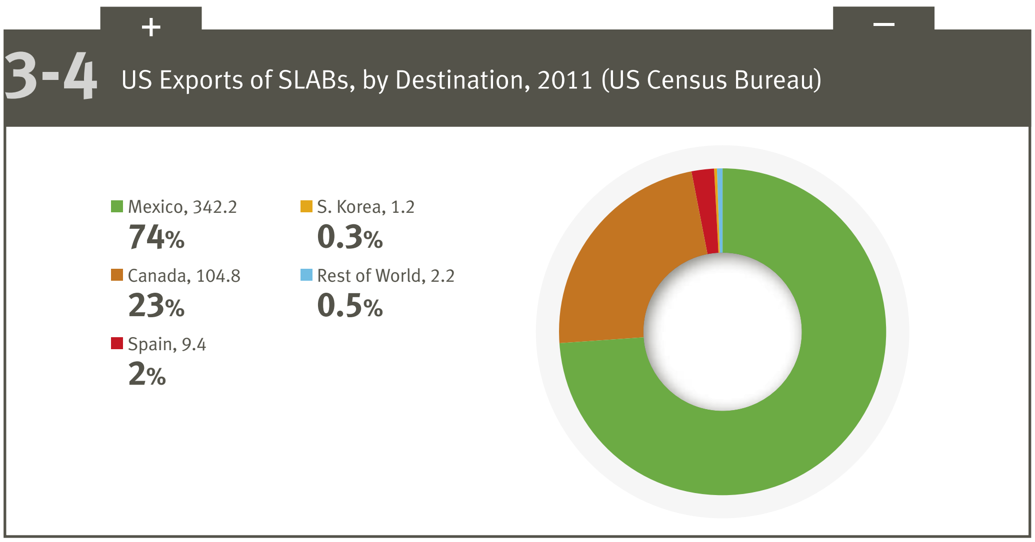
Source: Environment Canada. Figure based on compilation of export/import data collected by Environment Canada based on United Nations (UN) Codes 2794 (batteries, wet, filled with acid, electric storage) and 2800 (batteries, wet, nonspillable, electric storage).

FIGURE **3-3** US Exports of SLABs, by Destination, 2011 (USEPA)



Units: Millions of kg (% of total, rounded).
Source: USEPA. Figure based on compilation of data from annual reports submitted to USEPA by firms exporting SLABs.

FIGURE **3-4** US Exports of SLABs, by Destination, 2011 (US Census Bureau)



Units are: Millions of kg (% of total, rounded).
Source: Figure based on compilation of data collected by US Census Bureau of exports under the harmonized tariff codes 854800540 (starting, lighting, ignition SLABs) and 8548100580 (industrial SLABs).

The sections that follow describe specific findings from the trade data and the data reliability and compliances issues that emerged.

Global US Exports

- In terms of the global volume of SLABs exported by the United States, according to USEPA data, Mexico is the leading destination (68 percent), followed by Canada (19 percent) and Korea (13 percent).
- According to both USEPA and US Census Bureau data, other countries receiving US-generated SLABs in 2011 were Peru, the Philippines, Spain and the United Kingdom. However, US Census Bureau data indicate that SLABs were also shipped to 47 other countries, including China, Colombia, Dominica, Dominican Republic, Germany, Honduras, Jamaica, Panama, Trinidad and Venezuela. USEPA did not have notice and consent information for shipments to these countries.[68]

[68] For a complete list of the 47 countries, see Appendix 2.

US-Mexico Trade in SLABs

- According to USEPA data, in 2011 the United States exported 389,539,362 kilograms (kg) of SLABs to Mexico. According to US Census Bureau data, in 2011 the United States exported 342,186,978 kg of SLABs to Mexico and imported 191,341 kg.
- The USEPA export figure exceeds the US Census Bureau export figure by 47,352,382 kg, indicating that exporters of SLABs may not be correctly classifying 47,352,382 kg of SLABs under the harmonized tariff code system.
- We estimate that from 2004 to 2011[69] US exports to Mexico increased between 449[70] and 525 percent.[71]
- The majority of the increase in SLAB exports is attributed to the business development of JCI. In 2004, JCI's subsidiary in Mexico, Enertec, acquired *Ciénega*, a smelter near Monterrey, Mexico, and began directing SLABs to that facility for recycling. In 2011, JCI opened a new secondary smelter in García, also near Monterrey. According to USEPA data, in 2011 JCI's operations at *Ciénega* accounted for 43 percent of all US SLAB exports to Mexico, and *García* accounted for 31 percent (see Table 3-1).
- The remaining 26 percent of the authorized exports of US-generated SLABs is sent to seven facilities in three states in Mexico (Nuevo León, Baja California, and Tamaulipas). These seven facilities imported 100,669,466 kg of SLABs in 2011.
- We estimate that in 2011, 12–18 percent of all lead in US-generated SLABs was recycled in Mexico,[72] and that 30–60 percent of all SLABs recycled in Mexico came from the United States.[73]

US-Canada Trade in SLABs

- In 2011, according to Environment Canada data, the United States was a net exporter of SLABs to Canada by 86,987,630 kg. It exported 119,144,435 kg of SLABs to Canada and imported 32,156,805 kg of SLABs from Canada. Between 2004 and 2011, US net exports to Canada increased 221 percent.[74]
- Two secondary lead smelters in Ontario (Tonolli Canada) and Quebec (Newalta) accounted for about 93 percent of these imports in 2011 (see Table 3-2).[75]

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[69] Although the CEC Secretariat collected trade data from 2002 to 2011, statistically corrected trade data are not available for 2002 and 2003. See <http://www.census.gov/foreign-trade/statistics/corrections/index.html>. This has relevance for calculating SLAB exports and the accuracy of the US Census Bureau data. For example, between 2004 and 2009 about 95 corrections were made to SLAB export data. According to the Secretariat's calculations, statistical corrections in 2004 resulted in an additional 3,211,248 kg being classified as SLAB exports to Mexico under the 8548100540 code; in 2005, 4,108,877 kg; in 2006, 5,057,829 kg; in 2007, 2,133,244 kg; in 2008, 341,204 kg; and in 2009, 328,936 kg. Because corrections are not available for 2002 and 2003, SLAB exports for the 8548100540 code may have been underreported, as they were from 2004 through 2009.

[70] This percentage increase was calculated using US Census Bureau numbers. In 2004, US Census Bureau data indicate SLAB exports were 62,349,588 kg; in 2011 they were 342,186,978 kg.

[71] This percentage increase was calculated using the US Census Bureau import number for 2004, 62,349,588 kg, and USEPA number for 2011, 389,539,362 kg.

[72] Occupational Knowledge International (OKI) estimates that in 2010, 12 percent of all US lead was being exported to Mexico in lead batteries. See Occupational Knowledge International and Fronteras Comunes, *Exporting Hazards*, appendix G, for OKI's calculations. The CEC Secretariat arrived at a figure of 18 percent, using the following calculation. The lead in batteries consumed domestically from 2007 to 2011 amounted to 14,246,696,956 pounds (Battery Council International, *National Recycling Rate Study,* May 2012, 7), or 6,462,193,036 kg. If the battery lead available from 2007 to 2011 is divided by 5, then 1,292,438,607 kg were available for lead recycling per year between 2007 and 2011. In 2011, according to the US Census, 389,539,362 kg of SLABs were exported to Mexico. Assuming that about 60 percent of each battery contains lead available for recycling, 233,723,617 kg of lead were sent to Mexico for recycling. If 1,292,438,607 kg were available for lead recycling per year in the United States and 233,723,617 kg were going to Mexico, about 18 percent of the lead from SLABs was going to Mexico.

[73] The 30–60 percent was calculated in the following manner. The authorized capacity for process inputs, or SLABs, in Mexico at permitted secondary lead smelters is 1,337,171 t per year. The United States exported 389,539,362 kg of SLABs to Mexico in 2011. If Mexican facilities were operating at full capacity, 389,539,362 kg would be 30 percent of Mexico's authorized capacity of 1,337,171 t, and about 60 percent of Mexico's process inputs if they were operating at half-capacity, or 650,035,000 kg.

[74] See North American SLAB Trade Data at <http://www.cec.org/slabs>.

[75] The CEC Secretariat believes that Environment Canada data more accurately reflect the actual trade in SLABs over time than US Census data. USEPA and Environment Canada have slightly different trade figures (see Figures 3-2 and 3-3). For the purposes of this report, we are using Environment Canada's data. It is possible that exporters of SLABs to Canada from the United States were classifying SLABs under the wrong harmonized tariff code prior to USEPA's implementation of notice and consent requirements and annual report requirements for SLAB exports in 2010.

- At least prior to 2010, US Census Bureau data may not be a reliable indicator of the historical trade in SLABs to Canada. The CEC Secretariat believes that prior to 2010 US exporters sometimes improperly classified SLAB exports under harmonized tariff code 8548102500.[76]
- We estimate that US net exports to Canada in 2011 represent about 4 percent of all lead in US-generated SLABs[77] and that the net export of SLABs from the United States accounted for about 31 percent of Canadian secondary lead production.[78]

These SLAB trade flows between the three countries are shown in Map 3-1.

TABLE 3-1. Facilities in Mexico Receiving Spent Lead-acid Batteries from the United States in 2011

Receiving facility	Government annual report data on US to Mexico SLAB exports/imports (kg)		
	Semarnat	Profepa (approximate volume registered at Sirev)[a]	USEPA
Enertec México, S. de R.L. de C.V.	(Ciénega) 77,483,005	72,318,200	(Ciénega) 168,942,895
	(García) 82,165,474	203,261,640	(García) 119,927,000
	(Total Enertec) 159,648,479	(Total Enertec) 275,579,840	(Total Enertec) 288,869,895
M3 Resources México, S.A. de C.V.	36,041,154	33,476,790	34,983,765
Recicladora Industrial de Acumuladores	20,021,080	40,489,860	26,113,327
Corporación Pipsa, S.A. de C.V.	8,131,680	19,422,610	19,867,870
Óxidos y Pigmentos Mexicanos, S.A. de C.V.	No data cited	8,611,230	9,601,802
Pesquería (previously, Eléctrica Automotriz Omega, S.A. de C.V.)	1,191,836	8,778,980	8,705,664
Omega Solder México, S.A. de C.V.	No data cited	1,287,440	1,286,515
Hornos de Fundición, S.A. de C.V.	No data cited	110,520	110,522
Total, environmental agency data	**225,034,229**	**387,757,270**	**389,539,360**
Total, US Census Bureau data, HTS codes 8548100540 and 854800580			**342,186,978**
Total, US Census Bureau data (total of 5 HTS codes related to lead scrap and lead batteries)[b]			**343,016,255**

Source: Data provided by Semarnat and USEPA and compiled by the Secretariat of the Commission for Environmental Cooperation (available at <www.cec.org/slabs>). Profepa volumes are as reported to the CEC Secretariat in June 2012. See Appendix 3. Differences between Semarnat and US EPA data may stem from a difference in reporting dates according to either the fiscal year in which the authorization was issued or shipment dates.

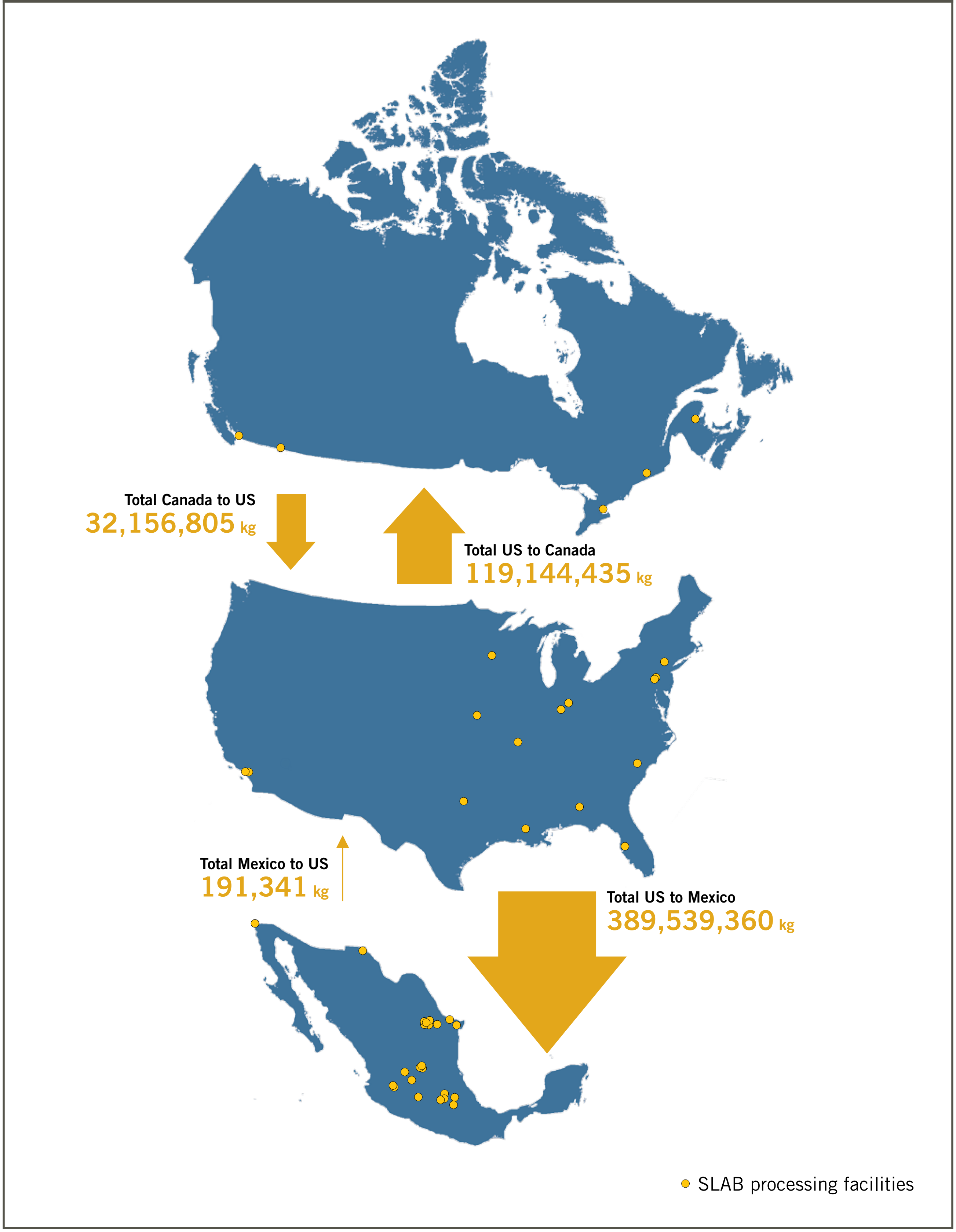
a. *Sistema Institucional del Registro de Verificación* (Sirev)
b. See note 67 and the accompanying text.

[76] In 2006, 2007 and 2008 a large number of exports to Canada were occurring under harmonized tariff code 8548102500, which is a designation for lead-acid batteries not specified elsewhere in the harmonized tariff schedule. Industry sources indicate that exports to Canada consist of almost exclusively automobile batteries (8548100540) and industrial batteries (8548100580) and that exports that occurred under harmonized tariff code 8548102500 were most likely automobile or industrial batteries. See the yearly amounts reported as US exports to Canada at <http://www.cec.org/slabs>, North American SLAB Trade Data, US Census Bureau Trade Data_5_codes_11-16.xlsx, on the tabs for “US Exports,” “Corrections and graphs,” “New data and graphs.”

[77] The net export of SLABs to Canada represents about 52,192,578 kg of lead, using 0.6 kg of lead recoverable from every SLAB (86,987,630 kg x 0.6 = 52,192,578 kg). If 1,292,438,607 kg of lead were available for recycling in 2011 (see note 72), 52,192,587 kg represents 4 percent of lead available for recycling.

[78] This figure was calculated in the following way: an estimated 52,192,578 kg of lead were recoverable from the net export of 86,987,560 kg of SLABs in 2011. According to the *2010 Minerals Yearbook* (<http://minerals.usgs.gov/minerals/pubs/commodity/lead/myb1-2010-lead.pdf>), production of secondary lead in Canada was 167,042 t, or 167,042,000 kg, and 52,192,578 kg is 31 percent of 167,042,000 kg.

MAP 3-1 North American Imports and Exports of Spent Lead-acid Batteries (SLABs), 2011



Source: US EPA, Environment Canada, US Census Bureau.

TABLE 3-2. Facilities in Canada Receiving Spent Lead-acid Batteries from the United States in 2011

Receiving facility	Government data on imports (kg)	
	Environment Canada	USEPA
Newalta	CBI	67,721,066
Tonolli Canada	CBI	32,689,589
KC Recycling*	CBI	5,644,356
Xstrata Zinc, Brunswick Smelter	CBI	1,952,553
Stablex*	CBI	3,520
Total, environmental agency data	**119,144,435**	**108,011,084**
Total, US Census Bureau data, HTS codes 8548100540 and 8548100580		**104,767,399**
Total, US Census Bureau data (total of 5 HTS codes related to lead and lead batteries)		**109,773,061**

Note: CBI = Confidential Business Information.

* Stablex and KC Recycling are not secondary lead smelters and are not listed in Table 1-1. Stablex treats and disposes of hazardous waste and KC recycling processes and extracts lead from batteries for smelting at Teck.

Mexico–Canada Trade in SLABs

The CEC Secretariat did not identify any trade in SLABs between Mexico and Canada.

Data Reliability and Compliance in the United States

The research carried out by the CEC Secretariat revealed data discrepancies that may indicate two compliance issues warranting further review by the appropriate US government agencies. Until this matter was quantified in the course of this research, the magnitude of these two issues was unknown to regulatory agencies in the United States.

First, as noted previously, our review of USEPA data and US Census Bureau data indicated that 47,352,382 kg of SLABs are being exported to Mexico without having the proper harmonized tariff code applied(see Table 3-1).[79]

Second, also as noted previously, our review of US Census Bureau data indicates that exporters are sending SLABs to countries where USEPA has no record of having obtained permission from those countries to receive the SLABs. To the extent this has occurred, it would be a violation of US law[80] and most likely a violation of the importing countries' laws.[81]

Data Reliability across North America

In addition, we note that data on the import and export volumes compiled within both the US and Mexico by different agencies, in Mexico by Semarnat and Profepa and in the US by the USEPA and US Census Bureau, are not consistent. Moreover, national cross-border accounts in all three countries do not accord with shipping or receiving volumes from either sending or receiving countries. Agencies responsible for such monitoring within and across borders need to work together to identify and improve data management issues that exist across North America.

[79] Our review of US Census Bureau data leads us to conclude that this does not appear to be a situation in which the 47,352,382 kg of exports were classified under the wrong lead waste scrap code. The total amount of exports to Mexico under the lead waste scrap codes 7802000030 (lead waste and scrap obtained from lead-acid storage batteries) and 780200060 (lead waste and scrap other than obtained from lead-acid storage batteries) amounted to 829,277 kg, according to US Census Bureau figures.

[80] On 1 July 2005, the secretary of the US Department of Commerce issued 13 U.S.C. 304, 305 and specific regulations in 15 C.F.R. 30.71(b)(3); 73 *Federal Register* 31548.

[81] Any export of hazardous waste to a non-OECD country without consent of the importing country is a violation of domestic and international provisions governing the transboundary movement of SLABs. Refer: Basel Convention Article 6 (1), and 7, and OECD Decision 2001 107 Final, amended by C (2004) 20; C(2005) 141, and (2008) 156.

...the cost gap between US smelters and smelters that operate in Mexico and Canada that are not compelled to follow US standards and practices is likely to grow more pronounced with the new US emissions standards for secondary lead smelters...

What Is Driving US Exports to Mexico?

This discussion of trade evokes a key question underlying this study: what is driving US exports to Mexico? The CEC Secretariat is not able to answer this question definitively. However, the cost gap between recycling batteries in Mexico versus the United States is likely to grow with the implementation of stricter air standards in the United States, making this question more pertinent.

As part of our public comment process, the CEC Secretariat sought comments on two questions designed to help us better understand the driving forces behind SLAB exports from the United States to Mexico and Canada:

- What forces are driving SLAB exports from the United States to Mexico and Canada?
- To what extent are different environmental regulatory requirements and lower compliance costs relative to those of the United States a factor in increasing the recycling of SLABs in Mexico or Canada?

As a result of the aforementioned request for comments the Secretariat received input that reveals no general consensus on the driving forces behind SLAB exports, or whether different environmental regulatory requirements and lower compliance costs are the determining factors in the increase in SLAB recycling in Mexico. These comments are publicly available at <www.cec.org/slabs>. Some commentators assert that the increase in exports to Mexico is driven by weaker environmental regulations and lower compliance costs, as well as lower wages and fixed capital costs, which allow Mexican smelters to pay more for SLABs or offer lower tolling prices than their US counterparts. Others found no significant regulatory compliance cost advantage to operating facilities in Mexico compared with those in the United States, and argued that other factors, including transportation costs and the proximity of the smelters to the SLAB sources and the battery manufacturing facilities are the dominant cost considerations determining where SLABs are recycled. One response noted that the location of operating facilities in Mexico is based on multiple factors, including consumer demand, overall global economic conditions, and maintenance of high-quality, efficient performance throughout a facility's operations.

Based on our research, we would add three observations. First, the trade patterns that have seen steady growth in the export of US-generated SLABs to *both* Mexico and Canada began several years before the most recent tightening of USEPA regulations. Moreover, the fact that the provincial jurisdictions where most SLAB recycling occurs in Canada have stack and fugitive emission requirements and other controls where Mexico has none, reinforces the underlying importance of market and economic drivers for such decisions.

Second, the cost gap between US smelters and smelters that operate in Mexico and Canada *that are not compelled to follow US standards and practices* is likely to grow more pronounced with the new US emissions standards for secondary lead smelters set to take effect in 2014.[82] The USEPA estimates that these standards will require secondary lead smelters to incur additional total annualized costs for control measures and workplace practices of up to US$13.4 million.[83] JCI has estimated that these new regulations will cost the industry $600 million.[84] These costs are in addition to improvements made to comply with the 1994 emissions standards for secondary smelters. At the time, USEPA estimated that those improvements would result in a national annualized cost of $2.8 million, including $1.86 million for the installation of control devices and $0.93 million in monitoring, reporting and recordkeeping costs.[85]

[82] "National Emissions Standards for Hazardous Air Pollutants from Secondary Lead Smelting," 77 *Federal Register* 556 (5 January 2012).

[83] Ibid., 576. In 2009 dollars; costs vary depending on the smelter.

[84] Karen Norton, "Rising Lead Recycling Costs May Prompt Cutbacks," Reuters, 26 March 2012, <http://www.reuters.com/article/2012/03/26/us-metals-lead-environment-idUSBRE82P0HC20120326>. Johnson Controls announced it would raise the price of its lead-acid batteries sold in the United States and Canada by 8 percent because of the rising environmental and safety costs and that it was "investing $162 million in its North American recycling centers to make them compatible with recommended environmental standards." The company said this move was in response to EPA's tightened environmental, health and safety regulations. See "Johnson Controls Raises Battery Prices to Charge Up Margins," *Forbes,* 20 March 2012, <http://www.forbes.com/sites/greatspeculations/2012/03/20/johnson-controls-raises-battery-prices-to-charge-up-margins/>.

[85] "National Emission Standards for Hazardous Air Pollutants from Secondary Lead Smelting," 60 *Federal Register* 32587, 32591 (23 June 1995).

Third, as several industry sources noted to us, in the secondary lead smelting business it is critical to take a 10-year measure of the costs of operation in order to factor in the corrosive consequences of dealing with lead and the need to undertake ongoing maintenance, repairs and capital replacements. In Mexico, where many smelters are undercapitalized, may not be making sufficient profit, and are operating in an environment in which no regulatory requirements are forcing capital repairs or improvements in process technology, some smelters will be unable to maintain—let alone improve—their environmental management.

Because of the lack of public data on the economics of secondary lead recycling in North America, the CEC Secretariat is unable to determine with certainty the extent to which different environmental regulatory requirements and lower compliance costs relative to those of the United States are the deciding factors in increasing the recycling of SLABs in Mexico or Canada. To make this determination, the Secretariat would require data on the environmental costs at each facility in Canada, Mexico and the United States, as well as definitive information on any regional or national capacity constraints and tolling costs that would drive investment and recycling decisions. More specifically, the Secretariat would need data reflecting the cost of purchasing and transporting SLABs to the secondary smelter, the direct cash cost of smelter operations, the direct cash cost of lead refining, the annual capital expenditures required to sustain the smelter operation, and the cost of delivery of the product (the recycled lead) to the customer, including handling, freight, insurance and administrative expenses. These costs, which will vary greatly, will depend not only on regulatory requirements but also on the smelter management practices and the location of the smelter in relation to its customers.

Photo: Profepa

4

Pollution Control and Occupational Standards Across North America

In this chapter, we examine the laws, regulations and policies that cover secondary lead smelters in the United States, the Canadian provinces of Ontario and Quebec, where Tonolli Canada and Newalta are located, and Mexico.

Our examination reveals that in terms of addressing lead air emissions from secondary lead smelters and their effects on workers and surrounding communities, Mexico's regulatory framework is less stringent than that of the United States or Canada. We also note that certain regulatory gaps exist in Mexico within the regulatory framework covering secondary lead smelters.

To provide context for this discussion, Table 4-1 shows the air emissions standards for secondary lead smelters in the United States, Mexico and Canada (Ontario and Quebec). Table 4-2 summarizes some of the occupational health and safety standards for lead that apply to the secondary lead smelters in North America and the non-occupational health lead standards that apply to children and pregnant and lactating women.

TABLE 4-1. Overview of Standards Mandated for Secondary Lead Smelters: United States, Mexico and Canada (Ontario and Quebec)

Air emissions	United States	Mexico	Canada (Ontario* and Quebec**)
End of stack	1.0 mg/dscm max/stack 0.2 mg/dscm facility-wide	No standards	Ontario: Point of Impingement (POI) standards, 0.5 µg/m³ for 24-hour average and 0.2 µg/m³ for 30-day average Quebec: kiln, 30 mg/Rm³; other lead production units, 15 mg/Rm³
Fugitive	Enclosure, negative pressure	No requirement for enclosure, negative pressure	Ontario: Enclosure, negative pressure Quebec: Enclosure, negative pressure
Ambient air	0.15 µg/m³ over 3-month rolling period	1.5 µg/m³ (average over 3-month period)	Ontario: 0.5 µg/m³ for 24-hour average and 0.2 µg/m³ for 30-day average Quebec: 0.1 µg/m³ for 1-year average

*Ontario Ministry of the Environment and ***Ministère du Développement durable, de l'Environnement, de la Faune, et des Parcs du Québec)*

Source: See footnotes 86 to 101 and accompanying text.

Note: mg/dscm = milligrams per dry standard cubic meter; µg/m³ = microgram per cubic meter; mg/Rm³ = milligrams per reference cubic meter.

TABLE 4-2. Select Lead Standards: United States, Mexico and Canada (Ontario and Quebec)

Occupational	United States	Mexico	Canada Ontario/Quebec
Permissible airborne exposure	50 μg/m³ averaged over 8-hour period	150 μg/m³ averaged over 8 hours per day, 40 hours per week	Ontario: 0.05mg/m³ per 8-hour exposure (50 μg/m³) Quebec: 0.05 mg/m³ per 8-hour exposure (50 μg/m³)
Blood lead levels (BLLs), medical removal	60 μg/dL, or 50 μg/dL over an extended time period; industry voluntary standard for removal at 40 μg/dL	No standard	Ontario: 3.38 μmol/L (69.966 μg/dL) (Tonolli's lower standard, 57.9599 μg/dL) Quebec: 400 μg/L (40 μg/dL)
Non-occupational	**United States**	**Mexico**	**Canada**
BLLs of concern in children	5 μg/dL—reference based on the 97.5th percentile of population; no longer using BLL terminology	10 μg/dL	10 μg/dL
BLLs of concern in pregnant and lactating women	10 μg/dL	10 μg/dL	10 μg/dL

Source: See footnotes 109 to 120 and 20 to 25 and accompanying texts.

Note: μg/m³ = micrograms per cubic meter; μmol/L = micromoles per liter; μg/L = micrograms per liter; μg/dL = micrograms per deciliter.

Facility Permitting

In the United States, Canada and Mexico, secondary lead smelters operate under permits or licenses containing conditions that are enforceable against the facility. In the United States, state governments issue pollution discharge permits under the authority of federal environmental statutes. Although the federal government sets minimum standards, state requirements may, in most instances, exceed the federal requirements.

In Canada, the provinces issue permits, based on provincial law, that reflect a collaborative process between the regulator and the regulated entity.

In Mexico, the federal government has sole authority to issue operating permits for secondary lead smelting facilities, based on federal environmental statutes. It is at the permitting stage of the facility that the government evaluates the environmental impacts, including those caused by lead emissions, of the facility in determining whether to issue a permit. Various requirements include:

- acquiring a federal license for air emissions;
- filing a management plan for authorizing SLAB processors that are also lead-acid battery manufacturers; and
- reporting annually all facility operations in what is known as the *Cedula de Operación Anual* (COA), which contains the operational conditions—such as protocols, techniques, technologies and equipment—that the permittee must adhere to in operating the facility.

One important difference between the permitting process in Mexico and those of the United States and Canada is that in Mexico there is no specific standard for lead emissions.

Air Standards

Two types of standards apply to the control and monitoring of emissions in and around secondary lead smelters: emissions standards and ambient air standards. Emissions standards set permissible levels of lead that can be released into the environment from a facility. They require monitoring the air released from a facility's stacks and vents, and they may also establish the specific processes, practices and control technologies that a facility must implement to control fugitive emissions.

Ambient air standards set levels of pollutants considered to be harmful to the public health and the environment. They apply to air quality beyond a smelter's property and may require the facility or a government agency to monitor the air for lead particulates, typically at or near the fence line of the facility. In some jurisdictions, ambient air standards are used to guide permit decisions and to inform the setting of emissions standards but are not enforceable against a specific facility. In other jurisdictions, exceedance of ambient standards at a facility's fence line may trigger the implementation of additional monitoring requirements and enforcement actions.

United States

In January 2012, the USEPA finalized new emission standards for secondary lead smelters. All secondary lead smelters must comply with these standards by January 2014. These standards set a facility-wide, flow-weighted average lead emissions limit from stacks of 0.20 milligrams per dry standard cubic meter (mg/dscm) and an individual stack lead emissions limit of 1.0 mg/dscm for each stack at existing sources.[86] These standards will be 10 times lower than the standards now in place in the United States. To reduce fugitive lead and arsenic emissions, the new regulation will also require facilities to fully enclose all operations within a building operated under negative pressure, to vent emissions through a controlled stack and to implement comprehensive work practices. Those work practices include paving facility grounds, frequently cleaning plant roadways, cleaning vehicles prior to leaving total enclosures, transporting lead-bearing materials within closed containers, and performing maintenance activities within total enclosures. These standards minimize generation of fugitive dust, thereby preventing deposition of lead in areas surrounding secondary lead smelters.[87]

The federal government's ambient air quality standard (National Ambient Air Quality Standard—NAAQS) for lead is 0.15 micrograms per cubic meter (μg/m^3) for a three-month rolling average, which was lowered from 1.5 μg/m^3 in 2008. In the United States, state and local governments have monitoring systems to help determine whether air quality standards for lead are being attained.[88] Federal ambient air standards are not enforceable against facilities. Rather, they are an important tool for regulatory authorities in the United States to make decisions regarding the issuance of permits and the setting of air emissions standards.[89] USEPA's decision to tighten air emissions standards at secondary lead smelters in 2012, for example, was based on a finding that actual lead emissions from secondary lead smelters resulted in modeled concentrations of lead above the lead NAAQS at nine of 15 secondary lead smelters. The USEPA concluded that stack and fugitive emissions of lead from such smelters had to be reduced to provide an ample margin of safety to protect public health.[90]

States in the US that issue emission permits based on the federal standards can also impose standards that are more stringent than the federal requirements. California, for example, requires secondary lead smelters to conduct ambient air monitoring at their fence lines. The two secondary lead smelters in California may not discharge lead emissions that contribute to ambient concentrations exceeding 0.15 μg/m^3, calculated as a 30-day rolling average. If ambient concentrations exceed certain levels below this threshold, the facility must implement additional monitoring and institute a compliance plan.[91]

Canada

In Canada, the federal government has set stack emissions standards for secondary lead smelters,[92] but provincial permit requirements in Ontario and Quebec are more stringent than the federal requirements. Ontario controls industrial emissions by

> One important difference in the permitting process in Mexico and those of the United States and Canada is that in Mexico there is no specific standard for lead emissions.

[86] Standards for Process Vents, 40 C.F.R. sec. 63.543 (a) (2012). For new sources, a lead emissions limit of 0.20 mg/dscm applies to each individual stack at a modified or new facility.
[87] Total Enclosure Standards, 40 C.F.R. sec. 63.544 (2012); Standards for Fugitive Dust Sources, 40 C.F.R. sec. 63.545 (2012).
[88] See US Environmental Protection Agency, "Air Data, Interactive Map," <http://www.epa.gov/airquality/airdata/ad_maps.html>.
[89] When an area is not in attainment, the state must develop a written State Implementation Plan (SIP) for attaining the standard and submit it to USEPA for review and approval. See US Environmental Protection Agency, "State Implementation Plan Overview," <http://www.epa.gov/airquality/urbanair/sipstatus/overview.html>.
[90] "National Emissions Standards for Hazardous Air Pollutants from Secondary Lead Smelting," 77 *Federal Register* 563 (5 January 2012).
[91] South Coast Air Quality Management District (CA), "Emissions Standard for Lead from Large Lead-Acid Battery Recycling Facilities," <https://www.aqmd.gov/rules/reg/reg14/r1420-1.pdf>.
[92] Secondary Lead Smelter Release Regulations, SOR/91-155, Sec. 5, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-91-155/FullText.html>.

setting Point of Impingement (POI) standards that specify the maximum permitted concentration of a pollutant at the points at which it leaves the facility's property.[93] In Ontario, the POI standard[94] and the Ambient Air Quality Criteria[95] are both 0.5 µg/m^3 for a 24-hour average and 0.2 µg/m^3 for a 30-day average. As a condition of its permit, Tonolli Canada, the only secondary lead smelter operating in Ontario, has enclosed all process sources and most material handling sources, and it maintains negative pressure to prevent fugitive dust emissions and restricts lead emissions from baghouse stacks [96] to less than 0.2 milligrams per cubic meter (mg/m^3).[97]

In Quebec, Newalta must meet an ambient air standard of 0.1 µg/m^3 for a one-year average.[98] The lead stack emission level for the kiln is 30 milligrams per reference cubic meter (mg/Rm^3), and other lead production units have emissions levels of 15 mg/Rm^3.[99] In Quebec, lead emissions are evaluated using a dispersion model that takes into consideration all stacks, the height of stacks and buildings, and other factors. All lead production units at Newalta are under negative pressure.[100]


Photo: grwglobal.com

[93] Environmental Protection Act, Ontario Regulation 419/05, Part I (2), <http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_050419_e.htm>.

[94] Ontario Ministry of the Environment, Summary of Standards and Guidelines to Support Ontario Regulation 419: Air Pollution—Local Air Quality, <http://www.ene.gov.on.ca/environment/en/resources/STDPROD_096528.html>.

[95] Ontario Ministry of the Environment, Ontario's Ambient Air Quality Criteria, April 2012, <http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_078686.pdf>.

[96] A baghouse is a fabric filter that removes particulates from air or gas. These filters are installed prior to the air or gas reaching the facility's stack.

[97] Visit to Tonolli Canada and interview with Ross Atkinson, president, Tonolli Canada, 12 June 2012.

[98] *Règlement sur l'assainissement de l'atmosphère,* O.C. 501-2011, s. 164, *Anexe K* (*Normes de qualité de l'atmosphère*), <http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=2&file=%2F%2FQ_2%2FQ2R4_1.htm>.

[99] *Ibid*., article 164, .

[100] E-mail from André Gosselin, senior director, technical services and projects, Newalta, to Tim Whitehouse, consultant, Commission for Environmental Cooperation, 18 September 2012.

Mexico

Mexico does not have a regulatory standard (*Norma Oficial Mexicana*—NOM) that covers lead air emissions from secondary lead smelters. The only emissions standard that applies to the lead smelting sector—among other industries—is for particulate matter (PM) emissions.[101]

The federal government issued an ambient air quality standard in 1993 limiting ambient concentrations of lead to a level of 1.5 $\mu g/m^3$ (average over a three-month period). As in the United States, federal ambient air standards are not enforceable against facilities. Rather, they are, or should be, an important tool for regulatory authorities. Under Mexico's ambient air regulations, federal, state and local authorities are responsible for monitoring and assessing air quality.[102] The monitoring network itself is operated by state governments. However, the network is incomplete, and lead is not consistently monitored in all stations of the network, known as the *Sistema Nacional de Información de Calidad del Aire* (Sinaica).

Other Pollution and Management Standards

In the United States and Canada, federal, state and local laws address issues such as hazardous waste management, stormwater runoff[103] and remediation and cleanup needs at sites contaminated with lead. In the United States, the Superfund program, which requires responsible parties to perform cleanups or reimburse the government for

Photo: Profepa

EPA-led cleanups at hazardous waste sites, provides significant deterrent to lead pollution because it places responsibility on the industry for remediation and cleanup.[104]

Mexico lacks regulations to address stormwater runoff from secondary lead smelters (it is addressed on a case-by-case basis in each facility's permitting process) and releases of lead to the soil. Regulations have also not been finalized to address the development of hazardous waste management plans;[105] methods for determining the hazardous characteristics of waste created as a result of secondary lead smelting;[106] conditions for the construction, operation and closing of facilities; and the process for determining when remediation actions should occur at contaminated sites.[107]

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101 NOM-043-SEMARNAT-1993, <http://biblioteca.semarnat.gob.mx/janium/Documentos/Ciga/agenda/PPD02/NOM-043.pdf>.

102 NOM-026-SSA1-1993, <http://sinaica.ine.gob.mx/>.

103 In the United States, see US Environmental Protection Agency, "Federal Stormwater Management Requirement," <http://www.epa.gov/oaintrnt/stormwater/requirements.htm>; and "Cleanup Regulations and Standards," <http://www.epa.gov/cleanups/regs.html>. For Ontario, see Corporation of the City of Mississauga, Storm Sewer By-Law 259-05 (as amended by 356-10), see <http://www.mississauga.ca/file/COM/stormsewer2011.pdf>; Ministry of the Environment (MOE) Ontario Regulation 511/09, Soil, Groundwater and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act (EPA) (27 July 2009). For Quebec, see Land Protection and Rehabilitation Regulation (c Q-2, r 37), Environmental Quality Act (c Q-2, ss. 31, 31.69, 109.1 and 124.1), <http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=3&file=/Q_2/Q2R37_A.htm>.

104 See US Environmental Protection Agency, "Basic Information: What is Superfund?" <http://www.epa.gov/superfund/about.htm>.

105 Lead-acid batteries will become a hazardous waste when they are no longer capable of storing and providing energy. Mexico's General Act for the Comprehensive Management of Residues (*Ley General para la Prevención y Gestión de los Residuos*—LGPGIR) and its regulations (*Reglamento de la LGPGIR*) mandates the issuance of official standards (*Normas Oficiales Mexicanas*—NOMs) aimed at establishing elements and procedures to be considered in the development of a "Management Plan." See Articles 29, 31 and 32 (IV) of LGPGIR and 17 of its regulations. A draft NOM (PROY-NOM-160-SEMARNAT-2011) was published for public comments on 12 August 2011. See <http://www.dof.gob.mx/normasOficiales/4466/semarnat/semarnat.htm>. The final version of this NOM has not been issued.

106 The NOM providing elements for the characterization and comprehensive management of wastes stemming from the metallurgical industry (this includes secondary refining of lead) and the conditions for construction, operation and closing facilities where these wastes are generated—Article 17 of LGPGIR, and 34 of its regulations—has not been issued.

107 There is no NOM that would provide elements for characterizing contaminated sites, assessing risks to health and the environment, and determining corresponding remediation actions derived from that analysis—Article 78, LGPGIR, regulations 133 and 134. NOM-147-SEMARNAT/SSA1-2004, issued 2 March 2007, establishes the levels of concentrations of different pollutants, including lead, in a contaminated site (see 5.1.1, 5.4.2. and 5.4.7.2); however, it does not exhaustively address procedures for the assessment of risks to health and the environment and types of remediation actions apposite for the level of contamination (see 5.6), <http://www.profepa.gob.mx/innovaportal/file/1392/1/nom-147-semarnat_ssa1-2004.pdf>.

Mexico's Office of the Federal Attorney for Environmental Protection (Profepa) also administers a federal, voluntary environmental auditing and self-regulatory program (*Programa Nacional de Auditoria Ambiental*), commonly known as *Industria Limpia*. The program targets companies that, because of their operations, scope of activities, or industrial sector, may cause significant negative environmental effects or impacts, or could exceed limits established in environmental standards. Companies participating in *Industria Limpia* adhere to terms of reference set forth by federal regulations. In the implementation of these terms of reference, the industrial facility submits a plan of audit for approval by Profepa. The environmental audit is developed by an accredited third-party independent auditor. If the audit reveals issues to be addressed, the company submits a plan of action to Profepa. This plan recommends preventive and corrective actions for areas or operations to avoid adverse impacts on the environment. Once the plan of action is successfully implemented, verified by an accredited third-party independent auditor, and verified again by Profepa, facilities may receive a certificate of Clean Industry (*Industria Limpia*).[108] Details of the status and membership of Mexico's secondary lead recyclers in relation to this program are listed in Appendix 3.

Photo: Profepa

Occupational Health and Safety

Occupational health standards protect workers at secondary lead smelters from exposure to lead. Three different types of occupational standards could apply to secondary lead smelters, depending on the jurisdiction. The first is the permissible exposure level—when the amount of lead in the air exceeds this limit, employers must have their employees wear respirators and protective clothing, and the employer must implement certain housekeeping and hygiene practices. The second is the action level—when airborne exposure exceeds an action level, the employer must institute a medical surveillance program, including testing the blood lead levels of all employees. The third standard sets limits on the amount of lead in a worker's blood stream and requires the employer to take certain steps if a worker's blood lead level exceeds a certain threshold.

In the United States, the permissible airborne exposure limit is 50 µg/m^3 averaged over an eight-hour period.[109] The US action level for lead is 30 µg/m^3 averaged over an eight-hour period for all employees who are or may be exposed at or above the action level for more than 30 days per year.[110] Employees with blood lead levels above 60 µg/dL (the level calling for medical removal protection, MRP), or exceeding 50 µg/dL over an extended period,[111] must be removed from occupational contact with lead until their blood lead levels drop below 40 µg/dL.[112] The industry in the United States has voluntarily agreed to remove employees when their blood levels exceed 40 µg/dL.

108 See <http://www.profepa.gob.mx/innovaportal/file/3946/1/pfpa-saa-152-dtr-01.pdf>.
109 Lead, 29 C.F.R. sec. 1910.1025 (2011), <http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10030&p_text_version=FALSE#1910.1025 (j)>.
110 29 C.F.R. sec. 1910.1025(j)(1)(i).
111 29 C.F.R. sec. 1910.1025(k)(1)(i)(A)(B).
112 29 C.F.R. sec. 1910.1025(k)(1)(i)(B).

Some companies told the CEC Secretariat that they set their MRP even lower than these voluntary levels.

In Ontario, the permissible airborne exposure level for lead is 0.05mg/m³ per eight-hour exposure.[113] Ontario requires that when a worker's blood lead level exceeds 3.38 micromoles per liter (μmol/L), or 69.966 μg/dL, he or she must be removed from the lead exposure.[114] However, Tonolli follows a written practice of removing all employees with blood lead levels higher than 2.8 μmol/L (57.9599 μg/dL), and does not return them to the same area of operation until their blood lead levels fall below 2.4 μmol/L (49.68 μg/dL).[115]

In Quebec, the permissible airborne exposure level for lead is 0.05 mg/m³ per eight-hour exposure.[116] Workers with blood lead levels of 400 μg/L are removed from the source of lead exposure.[117]

In Mexico, the permissible airborne occupational exposure limit is 150 μg/m³ (8 hours per day, 40 hours per week).[118] Mexico has no blood level limit mandating that workers be removed from occupational exposures, although some managers interviewed in Mexico indicated that, following corporate policies, they regularly test and report the blood lead levels of their employees and follow the US action level or other standards for employee removal. A recently issued official standard in Mexico establishes the biological exposure indexes (BEIs) for workers exposed to chemicals, including lead.[119] This standard foresees a general BEI of 30 μg per 100 ml for the BLL of workers in general and 10 μg of lead per deciliter for women. No medical removal protocol or worker removal requirement is associated with implementation of this new standard.[120]

The Environmental Disincentives of Lower Standards

A weaker regulatory framework in Mexico puts those Mexican secondary lead smelters that have made environmental improvements at a competitive disadvantage. This is particularly true for midsize operations without a secure supply of SLABs. In Mexico, where outside of JCI's reverse distribution system, most batteries are bought on the spot market or on the basis of short-term contracts, industry observers note that smelters with less stringent environmental controls, and thus lower environmental costs, routinely outbid those facilities subject to higher levels of environmental protection and costs in the domestic SLAB market. Because of the tight supply of SLABs and the overcapacity of recycling in Mexico, this dynamic creates an unfair market advantage for those smelters with lower environmental costs and may jeopardize the long-term sustainability of those smelters that are trying to improve their environmental performance.

In addition, as noted previously, current market incentives to recycle industrial batteries may not be as strong as they are for automobile batteries. Several industry insiders expressed concerns that companies that use industrial batteries are choosing the lowest-cost and least environmentally appropriate methods to recycle their industrial batteries, which skews the market toward those companies with poorer environmental practices. The CEC Secretariat was unable to independently verify these concerns.

> A weaker regulatory framework in Mexico puts those Mexican secondary lead smelters that have made environmental improvements at a competitive disadvantage.

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[113] Ontario Regulation 833, as amended 149/12 (2013).
[114] Ontario Regulation 490/09 (2010), <http://www.e-laws.gov.on.ca/html/source/regs/english/2009/elaws_src_regs_r09490_e.htm>.
[115] Copy on file with the CEC Secretariat.
[116] O.C. 885-2001, s. 45, Regulation Respecting Occupational Health and Safety, R.S.Q., c. S-2.1, s. 223, Div. VI, Individual Protective Respiratory Equipment, O.C. 885-2001, s. 45 (2001), <http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=3&file=/S_2_1/S2_1R13_A.HTM>.
[117] E-mail from André Gosselin, 18 September 2012.
[118] 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*), <http://asinom.stps.gob.mx:8145/upload/nom/10.pdf>.
[119] In June 2012, the Secretariat of Health in Mexico released a regulation that set a biological exposure index of 30 μg/dl of lead for males and of 10 μg/dl for women. However, the regulation does not set a mandatory removal level for workers. Norma Oficial Mexicana NOM-047-SSA1-2011, effective December 2012, <http://www.dof.gob.mx/normasOficiales/4724/salud/salud.htm>, Environmental Health Biological Exhibition Indexes for the Personnel Occupationally Exposed to Chemical Substances (*Salud ambiental-indices biológicos de exposición para el personal ocupacionalmente expuesto a sustancias químicas*).
[120] Ibid.

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Environmental Performance of the Secondary Lead Smelting Industry

Because of a lack of data, the CEC Secretariat has been unable to specify and document the environmental performance of the SLAB recycling industry in Mexico, how it compares with the performance in the United States or Canada, and the impacts that the industry may have on people living near smelters.

To help understand this issue, in this chapter we examine the public comments the Secretariat received on the impacts of the industry on people living near secondary lead smelters, a selection of known instances of lead poisoning and lead pollution from the lead recycling industry in the United States and Mexico, the available lead air emissions data for Mexico and how they compare with those of the United States, information on lead releases as reported through the pollutant release and transfer registries, and our observations of the industry, based on our visits and discussions.

Impacts of SLAB Recycling on People Living Near Smelters

One goal of this study was to examine concerns around the pollution and health effects impacting people living near certain recycling operations in the [North American] region and notably in Mexico.[121] As part of the public comment process, the CEC Secretariat sought responses to the following question on the pollution outputs and health effects of secondary lead smelting: what are the public health and environmental consequences of the growth in exports of SLABs to Mexico for recycling?

The Secretariat received comments reflecting two different perspectives. Some commentators believed SLAB exports to Mexico for recycling will have negative health impacts because Mexico does not have adequate standards to protect public and worker health from lead poisoning. Others noted, however, that recycling of US-generated SLABs should not result in harm as long as the recycling operations operate in accordance with US standards. Moreover, they pointed out that the development of a modern smelting industry in Mexico would likely improve the environment as new facilities displace the older, inferior smelters and informal sector smelting and melting.

[121] See <http://www.cec.org/slabs>.

In Mexico, very little information is available on lead contamination near smelters.

Examples of Lead Poisoning and Pollution

Examples of the lead poisoning and pollution that can be caused by lead smelting and of the difficulties that arise in addressing this type of pollution can be found in North America. In the United States, more than 300 Superfund sites have lead contamination and more than 70 are a result of smelting or mining.[122] Cleanup actions at these sites have resulted in wide-spread lead-level reductions in children.[123] However, despite this success, lead contamination from facilities can persist, often undetected, for decades. A recent newspaper series in the United States identified, for example, 230 lead smelters, which it called "forgotten factories," that operated mainly from the 1930s to 1960s. Through soil testing, it identified potentially dangerous levels of lead in 21 neighborhoods across 13 states, and high blood lead levels in some children in those communities.[124]

Even with strict emission controls, dangerous levels of lead can be carried into neighboring communities by workers. For example, in a recent case in Arecibo, Puerto Rico, workers at a secondary lead smelter were carrying lead particles into their homes and communities on their clothes and in their cars. The US Centers for Disease Control and Prevention found that among 68 children under the age of 6 years of employees of the battery recycling company, 11, or 16 percent, had confirmed blood lead levels of ≥10 micrograms per deciliter (µg/dL).[125]

Specifically, in this population of secondary lead smelter workers, 85% of vehicle dust samples and 49% of home dust samples exceeded EPA's level of concern on wipe samples, of greater than or equal to 40 µg/ft^2 (430.6 µg/m^2).[126] In comparison, a study of wipe samples taken on composite floor dust collected during an island-wide, cross-sectional blood lead prevalence study in 2010, found only one (0.4%) of 235 households had a lead level exceeding the EPA level of concern. Dust lead levels in homes with children aged under 6 years with BLLs of greater than or equal to 5 µg/dL were more than triple the levels of homes with children with BLLs less than 5µg/dL. As of October 2012, 147 homes and 148 vehicles have been decontaminated. EPA required the company to set up shower facilities for the workers, as well as shoe washes and clean changing areas. The CDC assigned a case manager to provide education, environmental follow-up, and case management of all children with BLLs greater than or equal to 5 µg/dL. On average, children's BLLs have decreased 9.9 µg/dL since they were enrolled in case management.

In Mexico, very little information is available on lead contamination near smelters. One high-profile case that has been closely monitored involves lead poisoning among children living near a primary lead smelter, *Met-Mex Peñoles*, in Torreon, Mexico. In 1999, investigators found that the median lead concentration in soils near that facility was six times the remediation levels for soils in the United States.[127] They also found that of the 367 children tested who lived near the plant, 20 percent had blood lead levels greater than 10 µg/dL, and 5 percent of the children had blood lead levels greater than 20 µg/dL. Thanks to vigorous intervention by government agencies and the company, exposure levels have dropped, although they are still about five times higher than the level in the United States.[128]

Another well-known case, *Metales y Derivados*, involved a US battery recycler

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[122] USEPA Questions/Comments on draft report titled "Hazardous Trade? An examiniation of US-generated Spent lead Acid Battery-exports and secondary lead recycling in Mexico, the United States and Canada," December 21, 2012. The EPA comments are posted at: <http://www.cec.org/Storage/142/16836_EPA_comments_on_CEC_draft_SLABs_report_Dec_21_2012.pdf>.

[123] US Environmental Protection Agency, "Examples of Superfund Site Cleanups," <http://www.epa.gov/superfund/lead/success.htm>.

[124] Alison Young, "Long-gone Lead Factories Leave Poisons in Nearby Yards," *USA Today*, updated 25 April 2012, <http://usatoday30.usatoday.com/news/nation/lead-poisoning>; Alison Young and Peter Eisler, "Some Neighborhoods Dangerously Contaminated by Lead Fallout," *USA Today*, 20 April 2012, <http://usatoday30.usatoday.com/news/nation/story/2012-04-20/smelting-lead-contamination-soil-testing/54420418/1>.

[125] "Take-Home Lead Exposure Among Children with Relatives Employed at a Battery Recycling Facility, Puerto Rico, 2011," *CDC Morbidity and Mortality Weekly*, 30 November 2012, 61(47), pp. 967–70, available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6147a4.htm?s_cid=mm6147a4_e>.

[126] Wipe and blood lead levels of concern and sampling results in this paragraph as given in the CDC report (ibid.) and in the corresponding erratum <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6149a4.htm>.

[127] Marisela Rubio-Andrade, Francisco Valdés-Pérezgasga, J Alonso, Jorge L. Rosado, Mariano E. Cebrián and Gonzalo G. García-Vargas,"Follow-up Study on Lead Exposure in Children Living in a Smelter Community in Northern Mexico," *Environmental Health* (2011), <http://www.ehjournal.net/content/10/1/66>.

[128] US Centers for Disease Control and Prevention, "Blood Lead Levels and Risk Factors for Lead Poisoning Among Children in Torreón, Coahuila, Mexico," <http://www.bvsde.paho.org/bvsea/fulltext/torreon.pdf>.

located outside of Tijuana. The owner of the facility abandoned the plant in 1994 after being cited by the Mexican government for environmental violations. The abandoned site, located adjacent to a community of 10,000 people, contained 6,000 t of lead slag, waste sulfuric acid and a mix of other heavy metals. The attempt to remediate this facility to protect the neighboring community from lead poisoning has involved extensive binational remediation measures spanning over a decade. This remediation effort was prompted by the NAAEC's Article 14/15 process, under which the CEC Secretariat prepared a factual record in response to a citizen's complaints that Mexico was failing to effectively enforce its environmental laws.[129] The Metales y Derivados property is now owned by the state of Baja California as a result of a land-transfer agreement. Also located there is the air quality laboratory for Baja California's *Secretaría de Protección al Ambiente*.

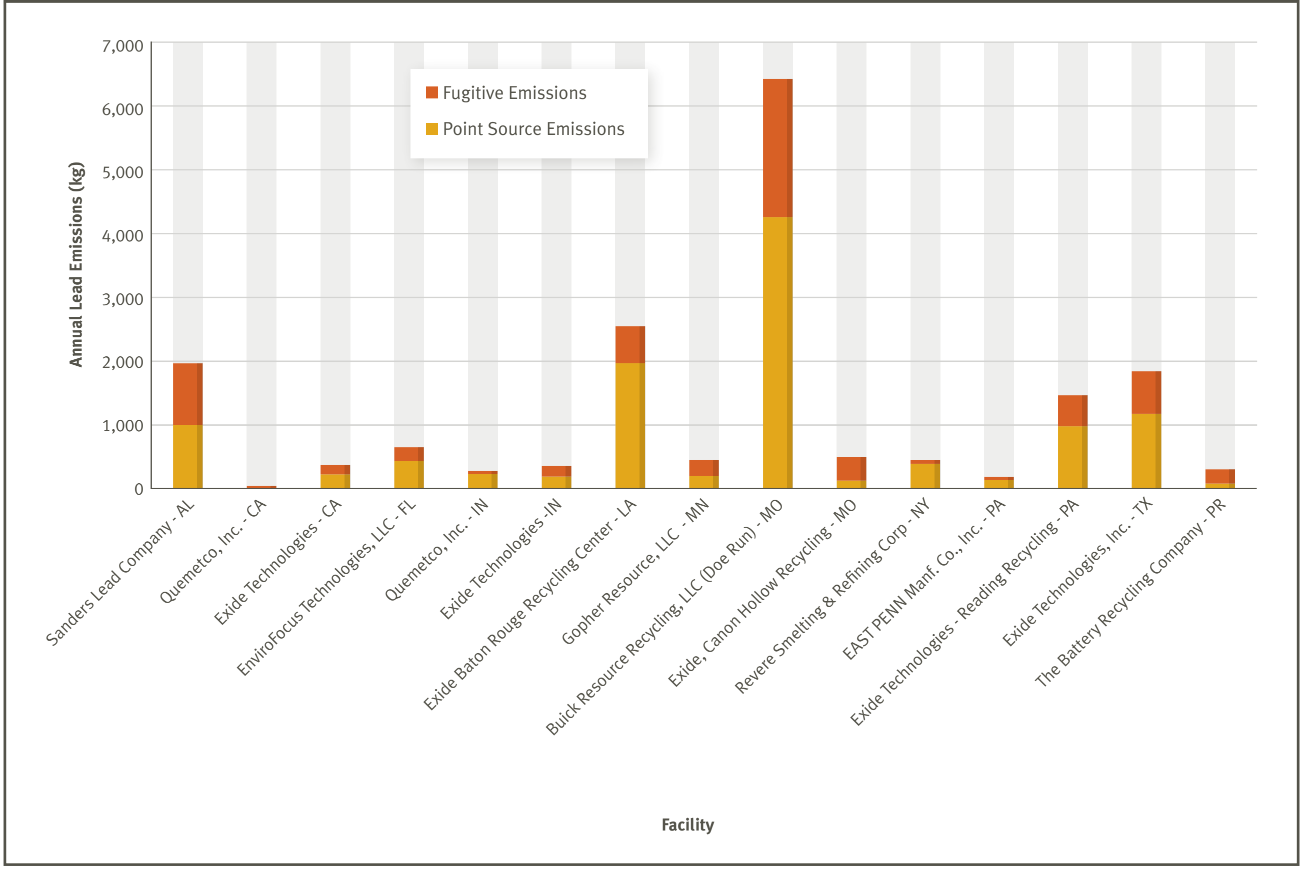
Evaluating Lead Air Emissions

Closely tied to the issue of the impacts of lead recycling on people living near smelters is the overall environmental performance of the SLABs recycling industry. After initiating its study, the CEC Secretariat expanded its scope to gauge the health and pollution impacts of the entire industry in Mexico, not just those smelters receiving US-generated SLABs. Although it is important to consider the performance of the nine secondary smelters that process imported SLABs, it is equally important from an environmental perspective to include the health and pollution impacts of the remaining 16 authorized facilities across Mexico, as well as the small, unauthorized facilities that may be operating in the informal market. As mentioned elsewhere, there is wide variation in the control technologies and operating procedures employed across Mexico among the smelters that recycle US SLABs and those that do not. Moreover, because of the competitive market for SLABs in general, several managers of secondary lead smelters in Mexico that have not yet imported US-generated SLABs have indicated that they would like to do so in the future.

In evaluating lead air emissions, we found that the USEPA has collected comparative performance data on lead emissions and that such data are publicly available. However, in Mexico the same type of information is not collected on a regular basis for all smelters and is not publicly available, making it impossible to assess the actual performance of secondary lead smelting facilities in Mexico and to compare their performance with facilities operating in the United States.

[129] Secretariat, Commission for Environmental Cooperation, *Metales y Derivados*, Final Factual Record (SEM-98-007), <http://www.cec.org/Page.asp?PageID=2001&ContentID=2372&SiteNodeID=547&BL_ExpandID=502>.

FIGURE 5-1 Estimated Annual Lead (Pb) Emissions at US Secondary Smelters for 2006–2010



Source: US Environmental Protection Agency, Development of RTR Emissions Dataset for Secondary Lead Smelting Source Category, EPA-HQ-OAR-2011-0344-0163, December 2011, pp. 6, 12, 13; <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2011-0344-0163>.

Some examples of the US data for secondary lead smelting facilities are presented here. Figure 5-1 shows data collected by the USEPA from secondary lead smelters on their point source emissions (e.g., stacks and vents) from 2006 to 2010.[130] It is an assessment carried out independently of the PRTR reporting requirements described in the next section. Similar government information is not available in Mexico.

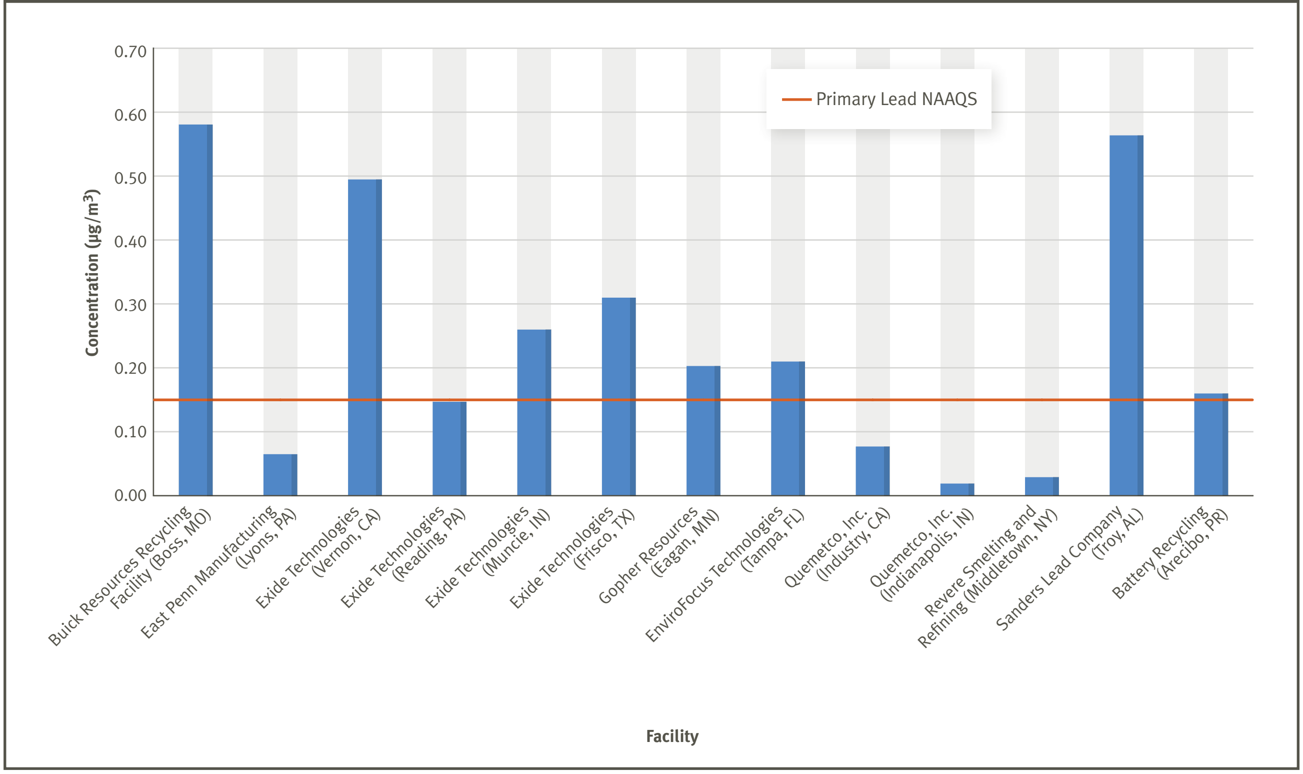
Figure 5-2 presents ambient lead concentrations collected by USEPA at all ambient air monitoring stations near secondary lead smelters and compares that data to the new National Ambient Air Quality Standard of 0.15 μg/m^3.[131] This type of information is not available in Mexico, however. These data have allowed USEPA to evaluate the effectiveness of different pollution control technologies such as fabric filters, Highly Efficient Particulate Air (HEPA) filters, cartridge collectors and the Wet Electrostatic Precipitator (WESP). In a technology review of the secondary lead smelting industry, USEPA assessed facility emissions data to compare outlet lead concentrations from different technologies, as illustrated in Figure 5-3.[132]

[130] Emission estimates developed in support of the recent amendments to the National Emission Standards for Hazardous Air Pollutants from Secondary Lead Smelting. *Development of the RTR Emissions Dataset for the Secondary Lead Smelting Source Category*. Available at <http://www.regulations.gov, Document ID – EPA-HQ-OAR-2011-0344-0163>.

[131] The public can access air quality data for lead at USEPA, "Air Data, Interactive Map," <http://www.epa.gov/airquality/airdata/ad_maps.html>.

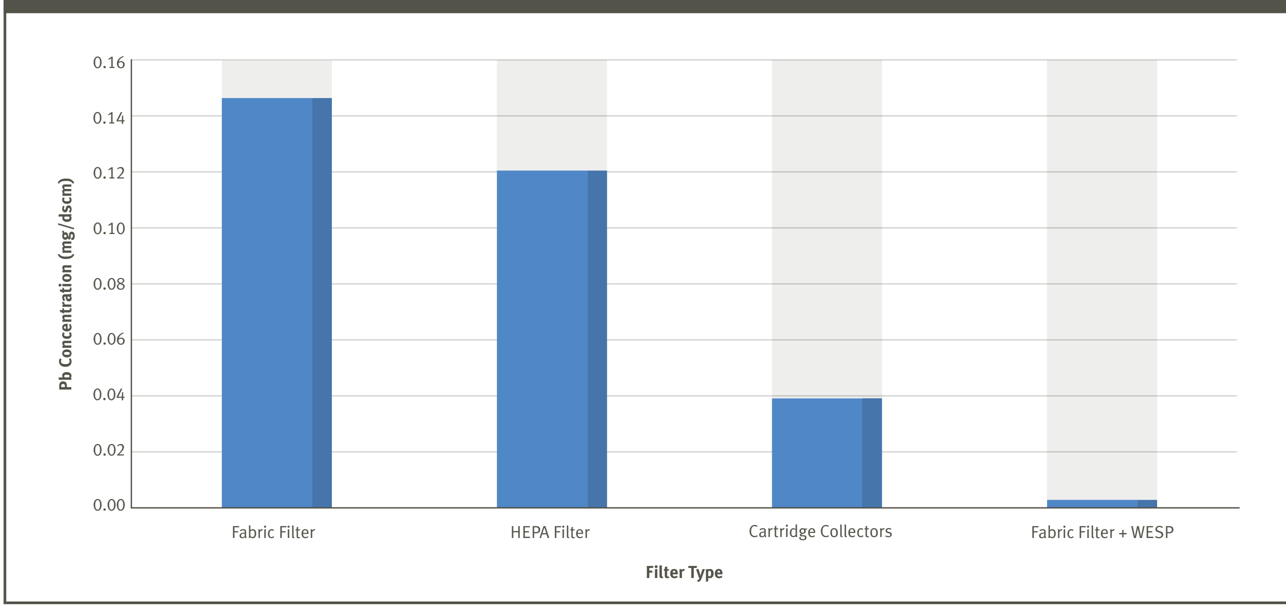
[132] US Environmental Protection Agency, "Summary of the Technology Review for the Secondary Lead Smelting Source Category," EPA-HQ-OAR-2011-0344-0152, December 2011, p. 6, <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2011-0344-0055>.

FIGURE **5-2** Mean of Three-month Rolling Average Lead Concentrations near Secondary Lead Smelting Facilities, 2008–2010



Source: US Environmental Protection Agency, Summary of Ambient Lead Monitoring Data around Secondary Lead Smelting Facilities, EPA-HQ-OAR-2011-0344-0152, December 2011, p. 5.

FIGURE **5-3** Average Outlet Concentration, by Control Technology



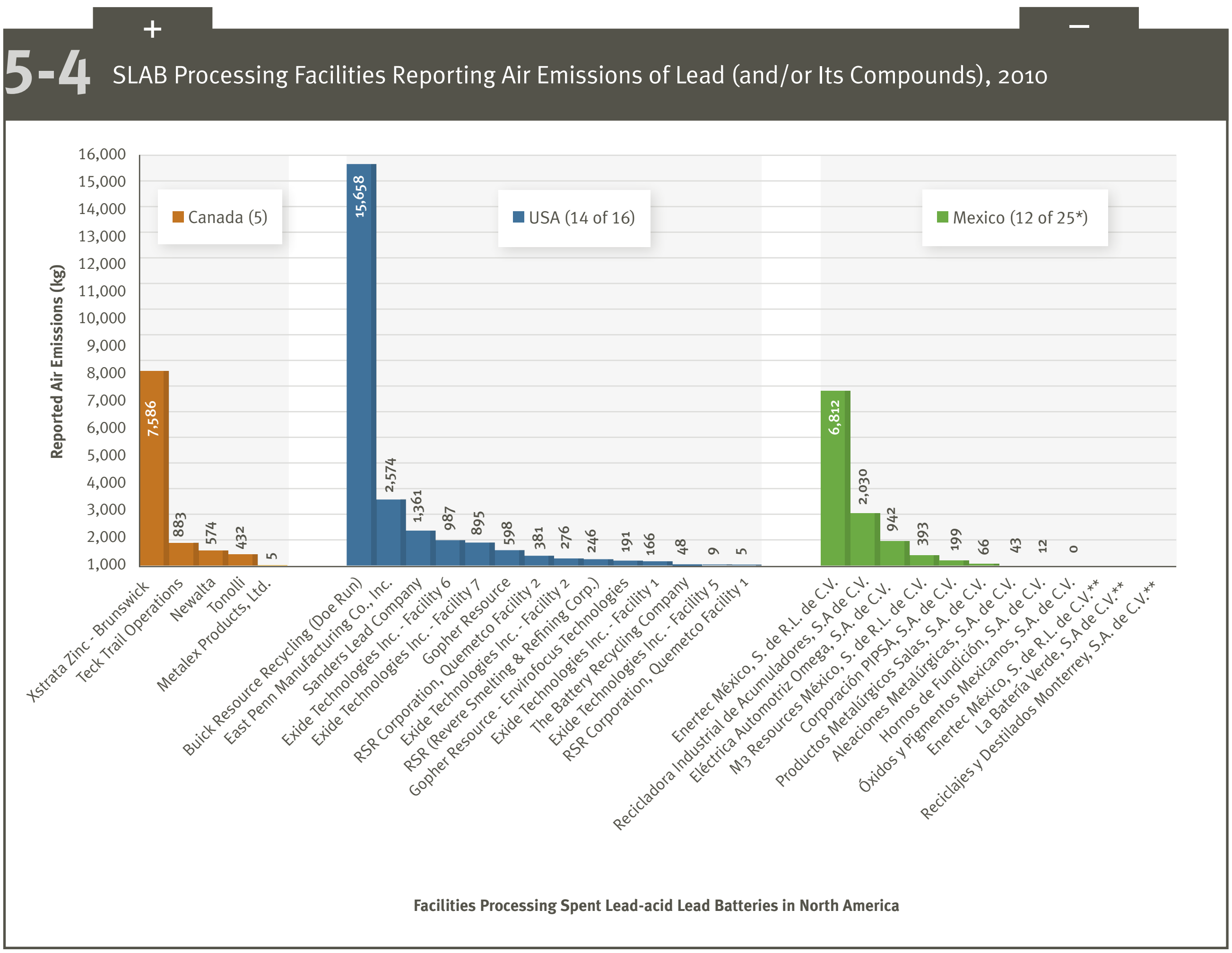
Source: US Environmental Protection Agency, “Summary of the Technology Review for the Secondary Lead Smelting Source Category,” EPA-HQ-OAR-2011-0344-0154, December 2011, p. 6.

Analyzing Pollution Release Information Across North America

One way to undertake a study of industry performance is to compare the lead emissions that battery recyclers across North America reported to their government's pollutant release and transfer registries.[133] Under these PRTR programs, certain facilities, such as secondary lead smelters, are required to report environmental releases and other waste management quantities of lead to the respective federal environmental authorities if a threshold for reporting is exceeded and other reporting requirements are met.[134] In turn, these registries publish this information as part of the public's established "right-to-know."

Our research reveals that there are gaps in the application of and compliance with the reporting requirements for lead emissions from secondary smelters under Mexico's PRTR program, *Registro de Emisiones y Transferencias de Contaminantes* (RETC)—see

FIGURE 5-4 SLAB Processing Facilities Reporting Air Emissions of Lead (and/or Its Compounds), 2010



* 13 facilities do not report to Mexico's RETC.
** Facility was not in operation or did not report in given year (2010).
Source: Compiled by the CEC from the CEC *Taking Stock Online* database, using information reported by facilities to RETC, NPRI, and TRI. As noted in Table 1-1, Xstrata Zinc - Brunswick and Teck Trail Operations in Canada are primary lead smelters that also process SLABs.

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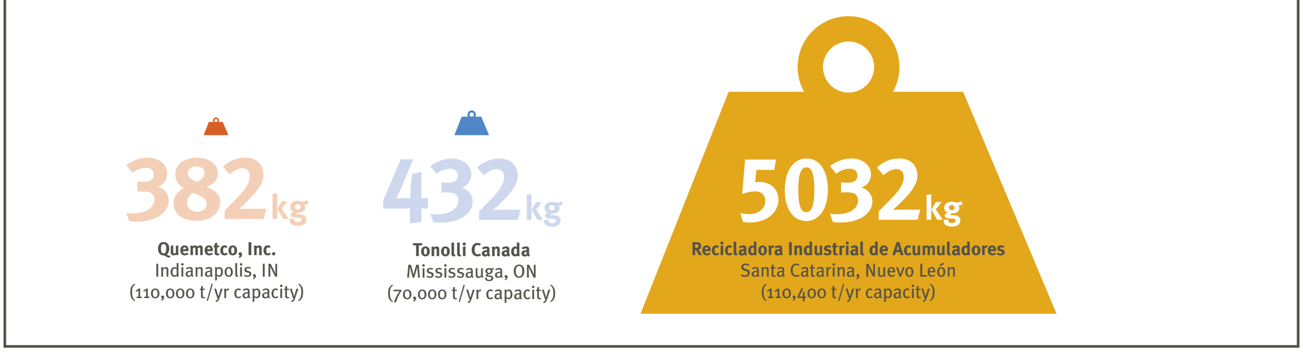
[133] In Canada, this program is called the National Pollutant Release Inventory (NPRI); in Mexico, *the Registro de Emisiones y Transferencia de Contaminantes* (RETC); and in the United States, the Toxics Release Inventory (TRI). An annual compilation of each of these registries has been prepared by the CEC and is available online at <http://www.cec.org/takingstock>.

[134] Table 1-1 lists all authorized North American facilities that smelt secondary lead from SLABs, including those that are classified as recyclers. In Mexico, the obligation to report to the RETC applies to any industrial facility under federal jurisdiction that manufactures, processes or otherwise uses (MPO) more than 5 kg of lead or that has more than 1 kg per year of emissions. In the United States, the reporting threshold is 100 pounds (45 kg) of lead MPO annually. In Canada, the reporting threshold is 50 kg MPO annually. In Mexico, the *Cédula de Operación Anual* (COA) is the reporting mechanism through which Semarnat receives information for input to the RETC related to releases, handling and transfers of substances subject to mandatory reporting in terms of the General Law of Ecological Equilibrium and Environmental Protection (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*—LGEEPA).

FIGURE **5-5** Lead Air Emissions from Recycling Facilities Reporting to RETC (Mexico), NPRI (Canada), and TRI (US), 2010



Note: PRTR data for 2010, tabulated by OK International. The RETC data were preliminary, later revised for final publication of the 2010 data set.

Table 1-1. Over 50 percent of the secondary lead smelters in Mexico have not reported their lead emissions to the RETC. Table 1-1 reveals serious annual data gaps among facilities obliged to report lead emissions. Moreover, according to Semarnat, some secondary lead smelters in Mexico may also be classified as recycling centers and thus are not subject to the federal licensing and associated RETC reporting requirements for air emissions, whereas other smelters employing the same foundry practices do not receive a similar classification and must obtain a license from and report their emissions to federal authorities.[135]

A different analysis, illustrated by Figure 5-5, has compared RETC data for facilities in Mexico with TRI and NPRI data from facilities with similar capacities in the United States and Canada, respectively, and shows that reported lead emissions from lead battery recycling plants in Mexico are about 20 times higher than from plants of similar permitted capacity in the United States.[136] Although an analysis may provide a general yardstick of industry performance, because actual capacity figures for these facilities are not available (and are usually much lower than permitted capacities), more detailed comparison of facilities with similar actual capacities is not possible. Despite this shortcoming, we believe that potential differences in operating capacity cannot account for observed differences in lead emissions. In addition, although that analysis provides useful information on annual emissions rates, it does not give an accurate picture of the ambient air pollution caused by the smelter, the dispersion of the lead particles, and the amount of pollution emitted relative to how much lead the facility produced.

Observing Pollution Control Features

During this study, the CEC Secretariat visited smelters in Canada, Mexico and the United States. Certain new smelters in Mexico, such as JCI's Enertec plant in García, Nuevo León, and *La Batería Verde* in Estado de México, demonstrate features common to modern plants in the United States—they are fully enclosed and maintain negative pressure to limit fugitive dust emissions, and have adopted pollution controls to reduce air emissions and strict controls to protect worker health and safety. In addition, JCI has announced that it will upgrade its facility in Ciénega de Flores, Nuevo León, purchased in 2005, with more efficient furnaces and to environmental control technologies,[137] although a specific time frame for this upgrade was not given.

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[135] The Secretariat has also learned that there is a proposal to include air emissions from industrial activities in the recycling of hazardous waste as an activity subject to federal authority. Source: e-mail from Óscar Trejo Cuevas, Subdirector of the *Licencia Ambiental Única*, Semarnat, to Marco Heredia, CEC program manager, 26 October 2012.

[136] Occupational Knowledge International and Fronteras Comunes, *Exporting Hazards*, 17. The 2010 RETC data used for this analysis was later revised for publication, which explains why our Table 1-1 and Figure 5-4 give a different amount for *Recicladora Industrial de Acumuladores*.

[137] "Johnson Controls Announces Planned Investment in Its Automotive Battery Recycling Center in Ciénega de Flores, Nuevo León, Mexico," *PR Newswire*, 30 August 2011, <http://www.prnewswire.com/news-releases/johnson-controls-announces-planned-investment-in-its-automotive-battery-recycling-center-in-cienega-de-flores-nuevo-leon-mexico-128692183.html>.

6


MAINTENANCE FREE BATTERY
MAINTENANCE FREE BATTERY
UPPER LEVEL
LOWER LEVEL

Key Findings and Recommendations

Key Findings

Levels of Environmental and Public Health Protection

The regulatory frameworks covering secondary lead smelters in the United States, Canada and Mexico do not provide equivalent levels of environmental and health protections. Currently, the United States has the most stringent overall framework, while in Mexico, with significant gaps in its existing regulatory framework, certain emission controls and requirements are the least stringent and need to be augmented.

Tracking the SLAB Trade in North America

- The United States, unlike Canada and Mexico, does not require a manifest to accompany international shipments of SLABs. It also does not require exporters of SLABs to obtain a certificate of recovery from the recycling facility.
- The United States operates a notice and consent system via bilateral agreements with Canada and Mexico that addresses the trade in hazardous waste, including SLABs.
- In 2012, the environmental agencies in Canada, Mexico and the United States began to share electronically export requests and consent documents for hazardous waste exports, including SLABs, through the Notice and Consent Electronic Data Exchange (NCEDE) project. This system is replacing a paper-based one in which governments exchanged notice and consent information by mail, fax and cable.
- At present, the US Environmental Protection Agency manually enters into a database thousands of pieces of information from annual reports submitted by exporters of SLABs.

Exports of US-generated SLABs

Global US Exports

- In terms of the global volume of SLABs exported by the United States, according to USEPA data Mexico is the leading destination (68 percent), followed by Canada (19 percent) and Korea (13 percent).
- Our review of US Census Bureau data indicates that exporters are sending SLABs to 47 countries where the USEPA has no record of having obtained permission from those countries to receive the SLABs.

US-Mexico Trade in SLABs

- According to USEPA data, in 2011 the United States exported 389,539,362 kg of SLABs to Mexico. According to data from US Census Bureau, in 2011 the United States exported 342,186,978 kg of SLABs to Mexico and imported 191,341 kg.
- The USEPA export figure is 47,352,382 kg higher than the US Census Bureau figure, indicating that exporters of SLABs may not be correctly classifying that quantity of SLABs under the harmonized tariff code system.
- According to our estimates, between 2004 and 2011 US exports to Mexico increased by 449–525 percent.

[US] exporters are sending SLABs to countries where USEPA has no record of having obtained permission from those countries to receive SLABs.

- Most of the increase in SLAB exports to Mexico is attributed to the business development and supply chain management of Johnson Controls Inc. (JCI), a US-based, globally diversified company. In 2004, JCI acquired *Ciénega*, a smelter in the municipality of Ciénega de Flores, Nuevo León, near Monterrey, Mexico, and began directing both US- and Mexican-generated SLABs to that facility for recycling. In 2011, JCI opened a secondary smelter, *García*, in the municipality of García in the greater Monterrey metropolitan area. According to USEPA data, in 2011 JCI's operations at *Ciénega* accounted for 43 percent of all SLAB exports to Mexico, with *García* accounting for 31 percent.
- The remaining 26 percent of the authorized exports of US-generated SLABs is being sent to seven facilities in three states in Mexico. These seven facilities imported 100,669,466 kg of SLABs in 2011.
- We estimate that in 2011 between 12 and 18 percent of all lead in US-generated SLABs was recycled in Mexico, and that between 30 and 60 percent of all SLABs recycled in Mexico came from the United States.

US-Canada Trade in SLABs

- According to Environment Canada data, in 2011 the United States was a net exporter of SLABs to Canada by 86,987,630 kg. Between 2004 and 2011, net exports to Canada increased 221 percent.
- A secondary lead smelter in Ontario, Tonolli Canada, and one in Quebec, Newalta, accounted for about 93 percent of these imports from the United States in 2011.
- Industry sources and regulatory authorities have informed the CEC Secretariat that they do not believe US Census Bureau data are a reliable indicator of the historical trade in SLABs to Canada prior to 2010. We concur in that assessment. Our review indicates that prior to 2010 some US exporters were improperly classifying SLAB exports under the harmonized tariff code 8548102500.
- We estimate that US net exports in 2011 to Canada represented about 4 percent of all lead in US-generated SLABs, and that the net export of SLABs from the United States accounted for about 31 percent of Canadian secondary lead production.

Data Reliability and Compliance in the United States

- The Secretariat's research has revealed data discrepancies that may indicate two compliance issues warranting further review by the appropriate US government agencies. The magnitude and relative importance of these issues were previously unknown to regulatory agencies.
  - First, as noted previously, our review of USEPA and US Census Bureau data indicated that 47,352,382 kg of SLABs were exported to Mexico in 2011 without having the proper harmonized tariff code applied.
  - Second, also as noted previously, our review of US Census Bureau data indicates that exporters are sending SLABs to countries where USEPA has no record of having obtained permission from those countries to receive the SLABs. To the extent this has occurred, it would be a violation of US law and potentially a violation of the importing countries' laws.

Data Reliability across North America

- In addition, we note that data on the import and export volumes compiled within both the US and Mexico by different agencies—in Mexico by Semarnat and Profepa and in the US by the USEPA and US Census Bureau—are not consistent. Moreover, national cross-border accounts in all three countries do not accord with shipping or receiving volumes from either sending or receiving countries. Agencies responsible for such monitoring within and across borders need to work together to improve the availability, accuracy, and comparability of data across North America.

Permitting Secondary Lead Smelters in North America

- In the United States, Canada and Mexico, secondary lead smelters operate under permits or licenses that contain conditions that are enforceable against the facility.
- In the United States, state governments issue pollution discharge permits under the authority of federal environmental

statutes. Although the federal government sets minimum standards, state requirements may in most instances exceed the federal requirements.

- In Canada, the provinces issue permits, based on provincial law, that reflect a collaborative process between the regulator and the regulated entity.
- In Mexico, the federal government issues operating permits for secondary lead smelting facilities based on federal environmental statutes. These permits specify operational conditions, processes and technologies, and address issues such as environmental impacts, licensing requirements for air emissions, and the management of hazardous waste.

Environmental Standards and Performance in Mexico for SLAB Recycling

- Notwithstanding Mexico's permitting process, important gaps remain within its overall regulatory framework, as well as with respect to the prevailing environmental and public health standards in the United States and Canada. Specifically, Mexico:
  - lacks regulations that establish lead emission limits from stacks and contain requirements to control fugitive emissions;
  - lacks regulations that require secondary lead smelters to have management plans to address stormwater discharges and releases of lead to the soil;
  - has not finalized regulations that would address outstanding hazardous waste management plans in the industry;
  - has not issued an official standard (*Norma Oficial Mexicana*—NOM) addressing the construction, operation and closure of secondary lead smelters;
  - has yet to complete a standard for the characterization and remediation of sites contaminated with lead (and other pollutants); and
  - does not have a blood lead level standard that includes a protocol for the medical removal of workers who exceed the specified levels.
- The United States strengthened its ambient air standard for lead in 2008. Thus today the ambient air standard in Mexico is 10 times less stringent than that in the United States.
- Moreover, Mexico's network of ambient air monitoring is incomplete. Air quality data for lead concentrations near all secondary lead smelters are unavailable, and no data are publicly available on stack emissions from secondary lead smelting facilities.
- The requirement that companies report pollution release data is not applied and enforced consistently across the secondary lead smelting industry. Over 50 percent of the secondary lead smelters in Mexico have not reported their lead emissions to the RETC program.
- Finally, although some companies in Mexico indicate that they strive to meet US standards, the Secretariat is unable to evaluate the performance of individual facilities and to assess the health risks to workers and the general population from lead emissions caused by secondary lead smelting facilities in Mexico. This situation stems from the absence of publicly available performance data on lead emissions and the lead concentration in the ambient air near secondary lead smelters, and on the overall blood lead levels of workers in the industry.

Recommendations

The CEC Secretariat recommends that the governments of Canada, Mexico and the United States adopt six broad goals to address the findings presented in this report. For each of these goals, we have offered specific steps that governments can take to help realize them. These recommendations are designed to improve the management of information across North America and to ensure that adequate measures are in place to protect workers and the general public from the lead emitted during the recycling of spent lead-acid batteries in Mexico.

1 Raise the Bar (North America)

The appropriate government entities in Canada and Mexico should commit to achieving levels of environmental and health protections in the secondary lead industry functionally equivalent to those in the United States. Raising the bar across North America to equivalent levels will avoid the development of pollution havens and provide greater levels of environmental and public health protection.

2 Improve Trade Compliance Efforts (North America)

Canada, Mexico and the United States should streamline and improve the flow of notice and consent information and the tracking of SLABs. Specifically:

- The United States should require the use of manifests for each international shipment of SLABs, and it should require exporters to obtain a certificate of recovery from the recycling facility.
- Canada, Mexico and the United States should cooperate to allow the regulated community to submit export requests electronically.
- Finally, Canada, Mexico and the United States should work together to share the import and export data maintained by their respective environmental and border agencies. This information sharing could be used to identify trends that may require a policy response or that may raise compliance issues.

The goals of these recommendations are to reduce administrative burdens, improve data quality, make it easier to provide data to environmental enforcement and border protection agencies for compliance purposes, facilitate the adoption of emerging tracking technologies, and help the governments provide timelier and more reliable and coherent information on what crosses their national borders.

3 Close Information and Performance Gaps (Mexico)

Mexico should establish a regulatory framework that covers the entire industry and provides public health and environmental protections functionally equivalent to those in the United States. The following points are applicable to this framework:

- It should be based on performance data from the completion or establishment of a comprehensive monitoring system to measure lead air emissions from every secondary lead smelter. More specifically:
  - Performance data, including average stack emissions and ambient air lead concentrations near smelters, should be collected by competent environmental authorities and compared across the entire sector.
  - Performance data should be provided to environment and health authorities at the federal, state and municipal levels, as well as to the public, on a periodic and timely basis.
  - Performance data should be compared against Mexico's existing ambient air standard of 1.5 micrograms per cubic meter ($\mu g/m^3$) to identify the most pressing gaps in meeting this standard.
- It should establish standards for stack and fugitive lead emissions functionally equivalent to those in the United States.
- It should adopt an ambient lead standard that is functionally equivalent to that of the United States.
- A medical removal limit should be included in the requirement to test the blood lead levels of workers in the battery recycling and manufacturing sectors.

- Secondary lead smelting facilities should be required to have storm water management plans, and standards and criteria should be issued for the development of hazardous waste management plans.
- Clear standards should be established for the construction, operation and closure of secondary lead smelters.
- A standard should be established for the characterization and remediation of sites contaminated with lead. In line with this, a policy mechanism should be established to ensure secure funding, sound management, and appropriate oversight of remediation of contaminated sites in Mexico.
- All facilities that undertake secondary lead smelting in Mexico should be required to report and publicize pollutant releases and transfers to the federal RETC program.
- Mexico should continue efforts to identify, halt and deter any SLAB recycling and lead recovery operations in the informal or clandestine sector.
- The Secretariat of Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*—Semarnat), the Office of the Federal Attorney for Environmental Protection (*Procuraduría Federal de Protección al Ambiente*—Profepa) and other federal agencies should have sufficient resources to ensure adherence to the law and protect public health and the environment.

4 Ensure Accurate and Comparable Information on Lead Emissions (North America)

- Performance data—including facility-specific stack emissions estimates, average ambient lead concentrations, and worker blood lead levels, as collected by competent environmental authorities in Canada, Mexico and the United States—should be maintained in a central North American repository and made available to the public.
- Emission data specific to the secondary lead smelting sector, as reported to each country's respective pollutant release and transfer registry (PRTR), should be catalogued and made available to the public via the CEC's North American PRTR initiative.
- CEC support of Mexico's PRTR initiative (*Registro de Emisiones y Transferencia de Contaminantes*—RETC) should continue, to ensure that comprehensive, comparable and quality data are available on the reported releases and transfer of lead by Mexico's secondary lead smelters.

5 Support Best Practices (North America)

The governments of Canada, Mexico and the United States should work together with the North American secondary lead smelting industry and nongovernmental organizations to develop strategies to support the adoption of best practices throughout the region. This effort should include the following:

- Support Mexico to enact legislation to establish a comprehensive battery stewardship program requiring the 1:1 exchange and recycling of batteries in only the highest-performing facilities. Such legislation would be expected to establish minimum deposit fees and control the return of used batteries to authorized recycling facilities throughout Mexico.
- Given the integrated nature of the SLAB recycling market in North America, ensure trilateral stakeholder input into any new stewardship or voluntary market-based mechanisms intended to drive continuous improvements in the industry throughout North America.

6 Foster Regional Cooperation and Technical Assistance (North America)

The North American governments, through the CEC or other appropriate venues, should cooperate to ensure:

- a plan of action to share information, technical assistance and best practices in order to assist Mexico in implementing the recommendations contained in this report;
- the highest level of comparable and publicly available information on the performance of the secondary lead smelting sector throughout North America; and
- enhanced cooperation and encouragement of cross-border support and intelligence-sharing on any illegal or unsanctioned traffic in SLABs across North American borders.

> Emissions data specific to the secondary lead smelting sector, as reported to each country's respective PRTR, should be catalogued and made available to the public via the CEC's North American PRTR initiative.

Appendix 1

Inspection and Oversight of the Transboundary Movement of Spent Lead-acid Batteries in Mexico

The Office of the Federal Attorney for Environmental Protection (*Procuraduría Federal de Protección al Ambiente*—Profepa) inspects the import, export and return of spent lead-acid batteries (SLABs) at the country's main ports of entry and customs offices. For this purpose, it reviews the documents evidencing the legal source of the waste, such as carrier authorizations and bonds or insurance guaranteeing the payment of environmental damages caused in the case of incidents associated with the handling of SLABs.

Profepa also verifies the environmentally sound management of SLABs, including *ad hoc* carriers, proper product identification and hazard signage, absence of leaks or seepage, that carriers have the necessary emergency equipment, and that batteries are properly stacked.

The flows of SLABs shown in the following tables occurred during 2011 and 2012 (all data collected by Profepa for those years, see Tables A-1 through A-4).

TABLE A-1. Spent Lead-acid Battery Importers and Exporters during 2011 and 2012

IMPORTS 2011

Company name	No. of movements	Approximate quantities recorded in SIREV (tons)	Quantities as % of total	Quantity authorized by Semarnat
Corporación Pipsa, S.A. de C.V.	1,020	19,422.61	5.01	69,600
Eléctrica Automotriz Omega, S.A. de C.V.	434	8,778.98	2.26	35,200
Enertec Exports, S. de R.L. de C.V.	251	72,318.20	18.65	408,213
Enertec México, S. de R.L. de C.V.	706	203,261.64	52.42	486,056
Hornos de Fundición, S.A. de C.V.	6	110.52	0.03	2,000
M3 Resources México, S. de R.L. de C.V.	1,931	33,476.79	8.63	40,000
Omega Solder México, S.A. de C.V.	66	1,287.44	0.33	3,600
Óxidos y Pigmentos Mexicanos, S.A. de C.V.	450	8,611.23	2.22	12,500
Recicladora Industrial de Acumuladores, S.A. de C.V.	562	40,489.86	10.44	79,929
Total	**5,426**	**387,757.28**	**100.00**	**1,137,098**

EXPORTS 2011

Company name	No. of movements	Approximate quantities recorded in SIREV (tons)	Quantities as % of total	Quantity authorized by Semarnat
Exide de México, S. de R.L. de C.V.	10	194.52	100.00	1,920
Total	**10**	**194.52**	**100**	**1,920**

TABLE A-2. Spent Lead-acid Battery Importers and Exporters during 2012

IMPORTS 2012

Company name	Movements	Approximate tons	Quantities as % of total	Quantity authorized by Semarnat
Corporación Pipsa, S.A. de C.V.	29	567	0.15	24,000
Eléctrica Automotriz Omega, S.A. de C.V.	30	621	0.17	10,000
Enertec Exports, S. de R.L. de C.V.	1,093	313,292	84.44	493,914
Enertec México, S. de R.L. de C.V.	59	1,054	0.28	*
M3 Resources México, S. de R.L. de C.V.	1,678	31,551	8.50	48,000
Omega Solder México, S.A. de C.V.	8	158	0.04	3,600
Óxidos y Pigmentos Mexicanos, S.A. de C.V.	175	3,354	0.90	15,900
Recicladora Industrial de Acumuladores, S.A. de C.V.	253	20,409	5.50	76,000
Total	**3,325**	**371,006**	**100**	**671,414**

*** Note**: Ruling issued by DGGIMAR without authorization for the company, because the waste is in the border region.

EXPORTS 2012

Company name	Movements	Approximate tons	Quantities as % of total	Quantity authorized by Semarnat
Residuos Industriales Multiquim, S.A. de C.V.	1	9.93	100	20
Total	**1**	**9.93**	**100**	**20**

TABLE A-3. Companies filing Return Notices for Spent Lead-acid Batteries during 2011

Company name	No. of movements	Quantities recorded in SIREV (tons)	Quantities as % of total
Accuride Internacional, S.A. de C.V.	2	2.821	0.86
Ademco de Juárez, S. de R.L. de C.V.	13	1.383	0.42
Ascotech, S.A. de C.V.	3	0.0805	0.02
Autopartes y Arneses de México, S.A. de C.V.	1	1.016	0.31
Black & Decker de Reynosa, S. de R.L de C.V. (Planta 3)	4	0.918	0.28
Black & Decker de Reynosa, S. de R.L. de C.V. (Planta 1)	12	62.779	19.24
Bose, S.A. de C.V.	2	0.2035	0.06
California Metals and Electronics México, S.A. de C.V.	1	4.057	1.24
Compañía Rinquim, S.A. de C.V.	16	3.975	1.22
Componentes Universales de Matamoros, S.A. de C.V.	1	0.089	0.03
Controles Reynosa, S.A. de C.V. (Planta 2)	5	0.993	0.30
Controles Reynosa, S.A. de C.V. (Planta 1)	7	1.616	0.50
Cordis de México, S.A. de C.V.	3	0.237	0.07

TABLE A-3.

Company name	No. of movements	Quantities recorded in SIREV (tons)	Quantities as % of total
Covalence Specialty Materials México, S. de R.L. de C.V.	1	0.021	0.01
Critikon de México, S. de R.L. de C.V.	4	0.154	0.05
Delphi Delco Electronics de México, S. de R.L de C.V. (Deltronicos Operations)	1	2.879	0.88
Eaton Industries, S. de R.L. de C.V.	7	2.34	0.72
EES, S.A. de C.V.	13	0.101	0.03
Electrónica BRK de México, S.A. de C.V.	1	2.555	0.78
Ensambladora de Matamoros, S. de R.L. de C.V.	4	6.3465	1.94
Ensatec, S.A. de C.V.	1	0.026	0.01
Fortune Plastic Metal de México, S.A. de C.V.	2	16.647	5.10
Fram Group Operations Mexicali, S.A. de C.V.	1	0.03	0.01
Globe Motors de México, S.A. de C.V.	2	0.021	0.01
Grupo Ambiental del Noroeste, S. de R.L. de C.V.	3	0.613	0.19
Honeywell Productos Automotrices, S.A. de C.V.	1	0.041	0.01
Honeywell Aerospace de México, S. de R.L. de C.V.	3	0.08	0.02
INTEL Tecnología de México, S.A. de C.V.	8	5.739	1.76
M3 Resources México, S. de R.L. de CV.	3	51.988	15.93
Mabamex, S.A. de C.V.	3	1.119	0.34
Motorola de Juárez, S. de R.L. de C.V.	3	1.388	0.43
Motorola Solutions de Juárez, S. de R.L. de C.V.	5	1.268	0.39
Pacific Treatment Environmental Services, S.A. de C.V.	63	5.303	1.62
Power Sonic, S.A. de C.V.	21	139.151	42.64
Puertas y Vidrios de Matamoros, S.A. de C.V.	1	1.525	0.47
Rectificadores Internacionales, S.A. de C.V.	1	0.016	0.00
Robert Bosch Sistemas Automotrices, S.A. de C.V.	1	0.177	0.05
Scientific Atlanta de México, S. de R.L. de C.V.	3	1.262	0.39
Servicios Ambientales Mexicanos, S.A. de C.V.	1	0.027	0.01
Sony Nuevo Laredo, S.A. de C.V.	1	1.051	0.32
System Sensor de México, S. de R.L. de C.V.	3	0.145	0.04
Tecnologías Internacionales de Manufactura, S.A. de C.V.	1	0.013	0.00
Termocontroles de Juárez, S.A. de C.V.	4	2.017	0.62
Termotec de Chihuahua, S.A. de C.V.	4	0.206	0.06
TRW Electrónica Ensambles, S.A. de C.V.	1	1.84	0.56
TYCO International de México, S. de R. L. de C.V.	1	0.1	0.03
Total	**242**	**326.358**	**100**

TABLE A-4. Companies Filing Return Notices for Spent Lead-acid Batteries during 2012

Company name	Transboundary movements	Approximate tons	Quantities as % of total
Accuride International, S.A. de C.V.	1	0.277	0.11
ADC de Juárez, S. de R.L. de C.V.	3	3.073	1.26
Ademco de Juárez, S. de R.L. de C.V.	19	1.834	0.75
Ascotech, S.A. de C.V.	2	0.054	0.02
Autopartes y Arneses de México, S.A. de C.V.	4	0.043	0.02
Bendix CVS de México, S.A. de C.V.	2	2.162	0.88
Black & Decker de Reynosa, S. de R.L. de C.V. (Planta 1)	5	14.530	5.95
Buenaventura Autopartes, S.A. de C.V.	1	0.855	0.35
Celestica de Reynosa, S.A. de C.V.	3	1.838	0.75
Controles Reynosa, S.A. de C.V. (Planta 2)	2	0.272	0.11
Controles Reynosa, S.A. de C.V. (Planta 1)	2	0.147	0.06
Cordis de México, S.A. de C.V.	4	0.479	0.20
Critikon de México, S. de R.L. de C.V.	2	0.158	0.06
Cummins Juárez, S.A. de C.V.	2	0.430	0.18
Dafmex, S. de R.L. de C.V.	2	0.209	0.09
Eaton Industries, S. de R.L. de C.V.	1	0.038	0.02
EES, S.A. de C.V.	3	0.036	0.01
Ensambladora de Matamoros, S. de R.L. de C.V.	1	4.000	1.64
Ensambladora de Matamoros, S. de R.L. de C.V.	2	3.000	1.23
Fram Group Operations Mexicali, S.A. de C.V.	1	0.059	0.02
Globe Motors de México, S.A. de C.V.	6	0.081	0.03
Grupo Ambiental del Noroeste, S. de R.L. de C.V.	2	0.850	0.35
Grupo Ambiental del Noroeste, S. de R.L. de C.V.	3	0.209	0.09
Harman de México, S.A. de C.V.	1	0.055	0.02
Intel Tecnología de México, S.A. de C.V.	11	0.282	0.12
Juver Industrial (Planta 2)	4	3.694	1.51
Juver Industrial, S.A. de C.V.	1	0.005	0.00
M3 Resources México, S. de R.L. de C.V.	2	31.927	13.07
Motorola Solutions de Juárez, S. de R.L. de C.V.	9	3.763	1.54
North Safety de Mexicali, S. de R.L. de C.V.	1	0.003	0.00
Pacific Treatment Environmental Services, S.A. de C.V.	43	10.052	4.11
Pacific Treatment Environmental Services, S.A. de C.V. / Comunicaciones de Calidad, S. de R.L. de C.V.	3	0.418	0.17
Pacific Treatment Environmental Services, S.A. de C.V. / Honeywell Productos Automotrices, S.A. de C.V.	2	0.009	0.00

TABLE A-4.

Company name	Transboundary movements	Approximate tons	Quantities as % of total
Pacific Treatment Environmental Services, S.A. de C.V. / Industrias Electrónicas Pacifico, S.A. de C.V	1	0.004	0.00
Pacific Treatment Environmental Services, S.A. de C.V. / Plamex, S.A. de C.V.	2	0.007	0.00
Pall México Manufacturing, S. de R.L. de C.V.	1	0.004	0.00
Power Sonic, S.A. de C.V.	18	35.361	14.47
Power Sonic, S.A. de C.V.	29	79.993	32.73
Puertas y Vidrios de Matamoros, S.A. de C.V.	1	1.525	0.62
Raychem Juárez, S.A. de C.V.	1	0.100	0.04
Robert Bosch Sistemas Automotrices, S.A de C.V.	3	0.139	0.06
Scientific Atlanta de México, S. de R.L. de C.V.	7	11.383	4.66
Sippican de México, S. de R.L. de C.V.	1	0.104	0.04
Sony Nuevo Laredo, S.A. de C.V.	5	15.544	6.36
System Sensor de México, S. de R.L. de C.V.	7	1.369	0.56
Tecnología Autoelectrónica de Durango, S. de R.L. de C.V.	1	4.894	2.00
TED de México, S.A. de C.V.	2	0.335	0.14
Termocontroles de Juárez, S.A. de C.V.	2	0.226	0.09
Termotec de Chihuahua, S.A. de C.V.	1	0.050	0.02
Toro Company de México, S. de R.L. de C.V.	1	4.480	1.83
Tyco International de México, S. de R.L. de C.V.	3	0.612	0.25
Valeo Sistemas Electrónicos, S. de R.L. de C.V.	3	1.139	0.47
Wistron México, S.A. de C.V.	1	2.260	0.92
Total	**240**	**244.368**	**100.00**

Annual Inspection Program

Given the hazards posed by the unsound management of SLABs, Profepa established an annual inspection program aimed at establishments authorized to recycle and import hazardous waste (Table A-5). It also asked some of its regional offices (delegations) to conduct inspection visits at establishments that, according to information from the Central Customs Competency and Modernization Administration (*Administración Central de Competencia y Modernización Aduanera*), have imported and exported SLABs (Table A-6).

TABLE A-5. Spent Battery Inspection Program for Industrial Establishments with Transboundary Movements in 2010–2011, 2012

INSPECTION SUMMARY (2010–2011)*

State	Two-year inspection goal (2010–2011)	% Completed
Baja California	15	100
Chihuahua	12	100
Jalisco	14	100
Nuevo León	9	100
Tamaulipas	9	100
Central Offices	6	100
Mexico City Metropolitan Area	2	100
Total	**67**	**100**

*IRREGULARITIES (2010–2011)	INSPECTIONS
Not in operation	2
Serious irregularities; no information submitted	31
Slight irregularities; partial information submitted	20
Company not at address	2
No irregularities	5
Company located in other state	1
Urgent measures	6
Total	**67**

INSPECTION SUMMARY (2010–2012)

State	Visits completed, 2010	Visits completed, 2011	Visits completed, 2012
Baja California	11	4	5
Chihuahua	11	1	1
Jalisco	10	4	4
Nuevo León	7	2	2
Tamaulipas	7	2	2
Mexico City Metropolitan Area		2	2
Central Offices	5	1	
Total Completed	**51**	**16**	**16**

TABLE A-6. Program to Verify Hazardous Waste Importation Authorizations

State	2010 Goal	Verifications completed 2010	2011 Goal	Verifications completed 2011	2012 Goal	Verifications completed 2012
Baja California	11	8	4	1	6	6
Chihuahua	11	11	1	1		
Jalisco	10		4		2	2
Nuevo León	7	4	2		24	24
Tamaulipas	7	7	2	2	5	5
Querétaro					1	1
Coahuila					1	1
Mexico City Metropolitan Area			2		1	1
Central Offices		5		1		
Total	**46**	**35**	**15**	**5**	**40**	**40**

IRREGULARITIES	INSPECTIONS
Slight irregularities; partial information submitted	25
No irregularities	3
Company not in operation	2
Urgent measures	9
Slight irregularities	1
Total	**40**

Joint Inspection with Customs

Between 30 January and 4 February 2012, a joint inspection was carried out with the General Customs Administration at the Tijuana, Baja California customs office, to inspect allegedly illegal shipments of SLABs. Profepa's Institutional Inspection Records System (*Sistema Institucional del Registro de Verificación*) had identified unreported transboundary movements. In this regard, there is a ruling establishing the classification and coding of merchandise whose import and export is subject to regulation by the Secretariat of the Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*—Semarnat).

The customs office inspected shipments that, according to the tariff sections listed in Table A-7, might be used for illegal transboundary movements. The inspection did not find any illegal shipments.

Unsound Management of SLABs

Profepa performs inspection and oversight actions to verify the handling of SLABs, which are deemed hazardous waste subject to management plans, following environmental, technological, economic and social efficiency criteria.

In October 2011, the Profepa Delegation in the State of Chihuahua stopped a trailer improperly carrying 1,800 lead-acid batteries. The vehicle is still in custody and the hazardous waste was forwarded for disposal.

In February 2012, the Profepa Delegation in the Aguascalientes stopped a truck carrying 148 SLABs without Semarnat authorization. Following an administrative proceeding, the batteries were sent for recycling.

That same month, the Profepa Delegation in Morelos inspected a collection center to verify compliance with the terms, conditions and effective term of the Semarnat authorization. The permit was not in effect and the authorized storage quantity was exceeded (1,360 SLABs, compared to the allowable quantity of 1,200). The facility was subject to partial temporary closure and ordered to suspend the receiving of batteries).

In February 2012, the Profepa Delegation in Chiapas inspected an establishment selling batteries and lubricants, where 300 SLABs were being stored without having an area set aside for hazardous waste and without proper safety measures. The facility was not authorized to store and transport waste. The establishment was preventively secured and the applicable penalties will be levied.

In March 2012, Profepa's Morelos office inspected another establishment collecting SLABs, finding 15 tons of SLABs stored without Semarnat authorization. The waste was placed under preventive attachment.

In April 2012 the Profepa Delegation in Tamaulipas inspected a recycling company in the Municipality of Reynosa, finding several irregularities, such as the failure to characterize the metal casings in contact with acids and occupational lead levels in excess of the maximum allowable limits. Urgent corrective measures were ordered.

In April, the Aguascalientes Delegation found a truck carrying a total of 427 SLABs of different sizes, without Semarnat authorization. Officials requested the support of the Office of the Attorney General of the Republic (*Procuraduría General de la República*—PGR) to secure the vehicle and its load; the company was ordered to forward the hazardous waste for disposal. Administrative proceedings were filed against the carrier.

Lastly, also in April 2012, the Profepa Delegation in the State of Chihuahua stopped a trailer carrying 2,700 kg of lead-acid batteries and 1,900 kg of contaminated brass scrap. The inspection report found inconsistencies with respect to the destination and documentation submitted by the carrier, although the waste appeared to be correctly contained and identified.

Profepa actions have prevented the unsound management of 4,462 SLABs, equivalent to 66,930 tons of hazardous waste, thereby preventing air pollution emissions and soil contamination.

TABLE A-7. Tariff Codes of Interest

Code Number	Chapter	Heading	Subheading	Section
39159099	Plastics and articles thereof	Waste, parings and scrap, of plastics	Of other plastics	Other
78020001	Lead and articles thereof	Lead waste and scrap	Lead waste and scrap	Lead waste and scrap
85489099	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	Waste and scrap of primary cells, primary batteries and electric storage batteries; spent primary cells, spent primary batteries and spent electric storage batteries; electrical parts of machinery or apparatus, not specified or included elsewhere in this chapter	Other	Other
85489003	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	Waste and scrap of primary cells, primary batteries and electric storage batteries; spent primary cells, spent primary batteries and spent electric storage batteries; electrical parts of machinery or apparatus, not specified or included elsewhere in this chapter	Other	Printed circuit assemblies comprising electrical and/or electronic components mounted on a printed circuit board, except as included in section
85071001	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	Electric accumulators, including separators thereof, whether or not rectangular (including square)	Lead-acid storage batteries, of a kind used for starting piston engines	Recognizable for aircraft
85071099	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	Electric accumulators, including separators thereof, whether or not rectangular (including square)	Lead-acid storage batteries, of a kind used for starting piston engines	Other
85072003	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	Electric accumulators, including separators thereof, whether or not rectangular (including square)	Other lead-acid storage batteries	Of a kind used as the primary source of electrical power for electrically powered vehicles

TABLE A-7.

Code Number	Chapter	Heading	Subheading	Section
85072004	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	Electric accumulators, including separators thereof, whether or not rectangular (including square)	Other lead-acid storage batteries	Lead-acid, with internal gas recycling system, sealed, with immobilized electro-lyte, for electronics, weighing less than 9 kg, with screw or clip terminals
85072099	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	Electric accumulators, including separators thereof, whether or not rectangular (including square)	Other lead-acid storage batteries	Other
85078099	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	Electric accumulators, including separators thereof, whether or not rectangular (including square)	Other batteries	Other accumulators
85079003	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	Electric accumulators, including separators thereof, whether or not rectangular (including square)	Parts	Parts
39159099	Plastics and articles thereof	Waste, parings and scrap, of plastics	Of other plastics	Other
39159001	Plastics and articles thereof	Waste, parings and scrap, of plastics	Of other plastics	Of products made of polymethyl methacrylate

Appendix 2

Sources of US SLAB Export Data Compared

Country	2011 Census Bureau data total (kg)	2011 EPA data total (kg)
AFGAN[ISTAN]	48	
ANG[UI]LLA	5,469	
ANGOLA	376	
[UNITED] ARAB EM[IRATES]	10,323	
AUSTRAL[IA]	16	
B[RITISH] VIRG[I]N [ISLANDS]	30,098	
BAHAMAS	16,117	
BELGIUM	9,729	
BOLIVIA	1,072	
BRAZIL	3,852	
C[OSTA] RICA	17,997	
CANADA	104,767,399	107,832,627.56
CAYMAN [ISLANDS]	12,494	
CHILE	33,413	
CHINA	13,643	
COLOMB[IA]	501,583	
CONGO-B[RAZZAVILLE]	2,200	
DOM[INICAN] REP[UBLIC]	20,515	
DOMINICA	229,553	
ECUADOR	2,280	
EGYPT	449	
F[RENCH] GUIAN[A]	146	
FRANCE	5,601	
GERMANY	119,431	
GRENADA	1,225	
GUAT[A]M[ALA]	218	
GUYANA	5,009	
HAITI	4,271	

Appendix 2

Country	2011 Census data total (kg)	2011 EPA data total (kg)
H[ON]G KONG	12,928	
HONDURA[S]	129,525	
INDIA	80	
JAMAICA	60,210	
JAPAN	1,758	
KOREA, REP[UBLIC OF]	1,239,319	72,317,813.39
LIBERIA	500	
LIBYA	69	
MEXICO	342,186,978	389,539,361.60
N[ETHERLANDS] ANTIL[LES]	2,064	
NETHERL[AN]DS	8,738	
PANAMA	45,878	
PERU	788,978	464,890.00
R[EPUBLIC OF THE] PHIL[IPPINES]	15,876	31,987.33
S[ANTA] LUCIA	3,238	
S[AINT] MAARTEN	1,949	
S[T] VIN[CENT & THE] GR[ENADINES]	2,612	
SALVAD[O]R	4,913	
SINGAP[O]R[E]	19,938	
SPAIN	9,433,555	1,271,645.00
ST K[ITTS &] N[EVIS]	39,762	
TRINID[AD & TOBAGO]	10,038	
TURK[S AND CAICOS] IS[LANDS]	1,814	
U[NITED] KING[DOM]	1,500	88,622.37
URUGUAY	9,371	
VENEZ[UELA]	27,088	
Total kg	**459,863,206.00**	**571,546,947.26**

Source: See notes 65 and 66 and accompanying text for information on the source of these data.

Appendix 3

Status and Membership of Mexico's Secondary Lead Recyclers in the *Programa Nacional de Auditoría Ambiental (Industria Limpia)*

Company	Status in *Programa Nacional de Auditoría Ambiental* (PNAA)
Enertec Exports, S. de R.L. de C.V. - Planta Ciénega de Flores	**Not in PNAA**
Enertec México, S. de R.L. de C.V. - Planta García, Nuevo León	**Not in PNAA**
Recicladora Industrial de Acumuladores, S.A. de C.V.	No longer in PNAA – certificate expired on 10 November 2011
Corporación PIPSA, S.A. de C.V.	No longer in PNAA – did not submit statement of work under action plan within deadline
M3 Resources México, S.A. de C.V.	**Not in PNAA**
Eléctrica Automotriz Omega, S.A. de C.V. Planta Doctor González	Valid Clean Industry certificate – expires 29 November 2013
La Batería Verde, S.A. de C.V.	**Not in PNAA**
Productos Metalúrgicos Salas, S.A. de C.V.	Participating in PNAA – about to begin field work
Óxidos y Pigmentos Mexicanos, S.A. de C.V.	Participating in PNAA – implementing action plan
Hornos de Fundición, S.A. de C.V.	**Not in PNAA**
Aleaciones Metalúrgicas, S.A. de C.V.	No longer in PNAA – did not complete activities defined in action plan following environmental audit
Reciclajes y Destilados Monterrey, S.A. de C.V.	**Not in PNAA**
Industrial Mondelo, S. de R.L. de C.V.	No longer in PNAA – did not complete activities defined in action plan following environmental audit
Metalúrgica Xicohténcatl, S. de R.L. de C.V.	**Not in PNAA**
South American Metals, S. de R.L. de C.V.	No longer in PNAA – did not complete requirements necessary to sign coordinating agreement
Martha Alicia Boites Jiménez	**Not in PNAA**
Versisa, S.A. de C.V.	**Not in PNAA**
Omega Solder México, S.A. de C.V.	Participating in PNAA – implementing action plan
Fundametz México, S.A. de C.V. (centro de acopio)	No longer in PNAA – did not complete activities defined in action plan following environmental audit
Sion Acumuladores, S.A. de C.V.	**Not in PNAA**
Funofec, S.A. de C.V.	**Not in PNAA**
Dian Procesos Metalúrgicos, S.A. de C.V.	**Not in PNAA**
Transformadora del Centro de Michoacán "Éric Bobadilla 2006"	**Not in PNAA**
Productos Metalúrgicos Poblanos, S.A. de C.V.	**Not in PNAA**
Industria de Acumuladores Jalisco	**Not in PNAA**

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