THE WORLD LEAD FACTBOOK 2019

INTERNATIONAL LEAD AND ZINC STUDY GROUP (ILZSG)
The **ILZSG** was set up by the United Nations in 1959 as an intergovernmental organization, and is one of the longest established International Commodity Organizations.

The main role of the **ILZSG** is to ensure transparency in the markets for lead and zinc worldwide. This is achieved by producing a continuous flow of information to the market place on supply and demand developments in lead and zinc through the monthly publication of high quality statistics, in-depth market research and specifically targeted economic studies. The Group also organizes international sessions and special conferences bringing together industry and governments to discuss matters of concern in the lead and zinc sectors.

The **ILZSG** provides opportunities for regular intergovernmental consultations on international trade in lead and zinc, and considers possible solutions to any problems or difficulties which are unlikely to be resolved in the ordinary development of world trade. The Group also publishes continuous information on the supply and demand position of lead and zinc and its probable development and prepares special studies on a range of subjects related to the world lead and zinc market.

The work of the Group is largely carried out by four committees: Standing, Statistical and Forecasting, Mine and Smelter Projects, Economic and Environment. Each committee is chaired by a representative from one of the ILZSG's national delegations, who directs the program of work. The committee chairpersons report back to the whole Study Group during formal sessions which are held at its headquarter in Lisbon, Portugal, or by government invitation in a member country.
MEMBER GOVERNMENTS
ILZSG OFFICERS & SECRETARIAT

STUDY GROUP
Chairperson: Mr. Li Yusheng (China)
Vice-Chairperson: Mr. Salim Bhabhrawala (United States)

STANDING COMMITTEE
Chairperson: Mr. Henrique Santos (Portugal)
Vice-Chairperson: Mr. Mitsunori Fukuda (Japan)
Vice-Chairperson: Mr. Michael Szurlies (Germany)
Finance Member: Mr. Henrique Santos (Portugal)

STATISTICAL AND FORECASTING COMMITTEE
Chairperson: Mr. Erasmus Shivolo (Namibia)
Vice Chairperson: Mr. Piotr Krawczyk (Poland)
Vice Chairperson: Ms. Patricia Akodjenou (France)

MINE AND SMELTER PROJECTS COMMITTEE
Chairperson: Mr. Giancarlo Urbani (Italy)
Vice Chairperson: Ms. Eibhlin Doyle (Ireland)

ECONOMIC AND ENVIRONMENT COMMITTEE
Chairperson: Mr. Salim Bhabhrawala (United States)
Vice Chairperson: Mr. Peter Akerhammar (Sweden)
Vice Chairperson: Mr. Anton Shukerov (Bulgaria)

SECRETARIAT
Mr. Paul White, Secretary-General
Mr. Jianbin Meng, Director of Economics and Environment
Mr. João Jorge, Director of Market Research and Statistics
Mr. Juan Luis Mamani Rodriguez, Manager of Statistics Analysis
Ms. Inês Lopes, Administrative Officer

CONTACT
Rua Almirante Barroso,
38 - 5th, 1000-013
Lisbon, Portugal
phone:    (351) 21 359 2423
fax:       (351) 21 359 2429
sales@ilzsg.org
SELECTED CURRENT PUBLICATIONS

1. Lead and Zinc Statistics - Monthly Bulletin + Interactive Database
2. Lead and Zinc Mine and Smelter Database
3. Lead and Zinc New Mine and Smelter Projects 2019
5. World Directory: Primary and Secondary Lead Plants 2019
7. Joint Study on Mining, Smelting and Refining Waste 2019
8. Main First Uses of Lead and Zinc in Europe 2017
9. The By-Products of Lead, Zinc, Copper and Nickel 2015
10. Lead-Acid Industrial Batteries 2015
11. Risk Factors in Developing Mineral and Metal Projects 2014
12. Environment and Health Controls on Lead 2014
13. The Chinese Primary and Secondary Lead Metal Sector 2014
14. Taxation, Royalties and Other Fiscal Measures Applied to the Non-Ferrous Metals Industry 2014

For further details please refer to www.ilzsg.org
# Table of Contents

**About ILZSG**
- 1. Production Concentration Rate
- 2. Primary & Secondary Production
- 3. Production Breakdown
- 4. Chapter 4 Lead Usage
- 5. Chapter 5 Lead Market & Trade

**Chapter 1 Lead Basics**
- 6. Lead Usage 2005-2018
- 7. Lead First Use Countries
- 8. Lead Usage Change 2008-2018
- 9. Lead Wire, Sheet, Pipe, Sheathing
- 10. Top Lead Use Countries 2018
- 11. Per Capita Lead Usage
- 12. Lead Usage History and Trend
- 13. Lead Usage by Sector
- 14. Lead Usage for LABs
- 15. Geo Location of LAB Producers
- 16. LAB Market Value
- 17. Lead Concentrate Import
- 18. Lead Concentrate Export
- 19. Concentrate Import Structure
- 20. Lead Concentrate Export Structure
- 21. Chapter 3 Lead Metal Production
- 22. Concentrate I & E Countries
- 23. Leading Concentrate Exporters
- 24. Lead Shot & Ammunition
- 25. Refined Lead Concentrate Import
- 26. Refined Lead Concentrate Export
- 27. Concentrate I & E Countries
- 28. Refined Lead Concentrate Import Structure
- 29. Refined Lead Concentrate Export Structure
- 30. Leading Concentrate Exporters
- 31. Refined Lead Stock & Price
- 32. Chapter 6: EHS of Lead
- 33. Leading Refined Lead Exporters
- 34. Lead Compound, Alloys & Solder
- 35. Chapter 7: Lead Stock & Price
- 36. Refined Lead Stock & Price
- 37. Lead Wire, Sheet, Pipe, Sheathing
- 38. Lead Shot & Ammunition
- 39. Geo Location of LAB Producers
- 40. LAB Market Value
- 41. Refined Lead Concentrate Import
- 42. Refined Lead Concentrate Export
- 43. Concentrate I & E Countries
- 44. Refined Lead Concentrate Import Structure
- 45. Refined Lead Concentrate Export Structure
- 46. Leading Concentrate Exporters
- 47. Leading Refined Lead Exporters
- 48. Chapter 8: Lead Market & Trade
- 49. Lead Wire, Sheet, Pipe, Sheathing
- 50. Lead Shot & Ammunition
- 51. Geo Location of LAB Producers
- 52. LAB Market Value
- 53. Refined Lead Concentrate Import
- 54. Refined Lead Concentrate Export
- 55. Concentrate I & E Countries
- 56. Refined Lead Concentrate Import Structure
- 57. Refined Lead Concentrate Export Structure
- 58. Leading Concentrate Exporters
- 59. Leading Refined Lead Exporters
- 60. Chapter 9: Lead Stock & Price
- 61. Lead Wire, Sheet, Pipe, Sheathing
- 62. Lead Shot & Ammunition
- 63. Geo Location of LAB Producers
- 64. LAB Market Value
- 65. Refined Lead Concentrate Import
- 66. Refined Lead Concentrate Export
- 67. Concentrate I & E Countries
- 68. Refined Lead Concentrate Import Structure
- 69. Refined Lead Concentrate Export Structure
- 70. Leading Concentrate Exporters
- 71. Leading Refined Lead Exporters
- 72. Chapter 10: EHS of Lead
- 73. Lead Wire, Sheet, Pipe, Sheathing
- 74. Lead Shot & Ammunition
- 75. Geo Location of LAB Producers
- 76. LAB Market Value
- 77. Refined Lead Concentrate Import
- 78. Refined Lead Concentrate Export
- 79. Concentrate I & E Countries
- 80. Refined Lead Concentrate Import Structure
- 81. Refined Lead Concentrate Export Structure
- 82. Leading Concentrate Exporters
- 83. Leading Refined Lead Exporters
- 84. Chapter 11: Lead Stock & Price
- 85. Lead Wire, Sheet, Pipe, Sheathing
- 86. Lead Shot & Ammunition
- 87. Geo Location of LAB Producers
- 88. LAB Market Value
- 89. Refined Lead Concentrate Import
- 90. Refined Lead Concentrate Export
- 91. Concentrate I & E Countries
CHAPTER ONE: LEAD BASICS

Symbol: Pb
Electrons per Atom: 82
Molecular Weight 207.2 g/mol
Melting Point: 327.4°C
Boiling Point: 1740.0°C
Number of Neutrons: 125
Crystal Structure: Cubic
Density: 11.34 g/cm³
Color: Light-gray to slightly bluish-gray
- Soft, highly malleable, ductile
- Relatively poor conductor of electricity
- Resistant to corrosion but tarnishes upon exposure to air
- Attenuation of X-rays, gamma rays and sound waves
CHAPTER TWO: LEAD RESOURCES

Galena is the main ore of lead along with cerussite (PbCO3) and lead sulfate (PbSO4). In addition, a small amount of lead also exists in various uranium and thorium mines. Lead ores are abundant worldwide and there were 42 countries mining lead across Europe, Africa, the Americas, Asia and Oceania in 2018. Lead ores are mined at a rate close to 5 million tonnes (calculation based on lead contained in concentrate) a year. Lead ore is mainly mined as a byproduct of zinc and silver.
Lead Reserves

The proven lead ore resource is over 2 billion tonnes, and the reserve volume is about 89 million tonnes. The world’s lead resources are mainly distributed in: Siberia, Russia; the central and western regions of China; Queensland, New South Wales in Australia; the southeastern area of Missouri and the Mississippi River valley area in the US; Zacatecas and San Luis Potosi in Mexico; Cerro de Pasco and Morococha in Peru.
There are over 40 countries mining lead ore since 1990s across 5 continents
42 countries in 2018 mined lead ore.
ILZSG data shows,

- In the Americas, output has been stable at between 1-1.2 million tonnes,
- In Asia, production has experienced fast growth and reached 2.65 million tonnes in 2018,
- In Europe, output has shrunk by 44% to around 0.45 million tonnes in the 30 years since 1988,
- In Africa, output decreased to 0.1 million tonnes,
- In Oceania, output has been stable at a level between 0.45-0.75 million tonnes.
World lead mine production peaked in 2013
World lead mine production surpassed 4 million tons in 2010
By the end of 2018, cumulative primary refined lead production had reached 207.3 million tonnes.
CHAPTER THREE: Refined Lead Metal Production

World Refined Lead Metal Production 2007-2018

Source: ILZSG

Refined Metal Production
Secondary Metal Production
Primary Metal Production
Production in Europe and the Americas has been stable, whereas output in Asia has increased significantly.
There are 70+ countries across the world that have lead smelting and/or refining capacities in 2018
Refined Lead Metal Producing Countries With Output Above 100,000 Tonnes in 2018

Source: ILZSG
Refined Lead Metal Production is a highly concentrated Industry with those producing countries with an output above 100,000 tonnes in 2018 contributing 88% of world production.

China’s refined lead production contributed 42% of world total production in 2018.
ILZSG data shows:

- The proportion of total output accounted for by secondary production was between 55% and 63% of the total refined lead production during the observed period.
- The secondary production proportion surpassed the 60% threshold in 2017.
In 2018, secondary refined lead production accounted for 89% of the total refined metal production in the Americas,

- The proportion of secondary refined lead production in Europe was 79%,
- The proportion of secondary refined lead production in Asia was 51%,
- There is a huge potential for growth in secondary refined lead output in Asia.
CHAPTER FOUR: LEAD USAGE

Accumulated Lead Metal Usage Since 1960

Source: ILZSG

374.2 Million tonnes
Usage volume in Europe and the Americas has been stable for the observed period,
Usage growth has been mainly in Asia,
World refined lead usage reached 11.73 million tonnes in 2018.
Countries and Regions with First Use of Refined Lead Metal in 2018

- There are 75+ countries and regions across the world using refined lead as material to produce downstream products,
- Indirect lead usage is at every corner of the world since lead is mainly used to produce LABs

Source: ILZSG
World Refined Lead Metal Usage Growth between 2008 and 2018

World Refined Lead Metal Usage Growth

Growth Composition in Asia

Source: ILZSG
China used nearly 5 million tonnes of refined lead in 2018, accounting for 42.5% of the global usage.
### World Refined Lead Metal Usage per Capita 2018

<table>
<thead>
<tr>
<th>Region</th>
<th>kg/per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>5.17</td>
</tr>
<tr>
<td>EU 28</td>
<td>3.56</td>
</tr>
<tr>
<td>P.R. China</td>
<td>3.52</td>
</tr>
<tr>
<td>Europe</td>
<td>2.63</td>
</tr>
<tr>
<td>The Americas</td>
<td>2.33</td>
</tr>
<tr>
<td>Asia</td>
<td>1.70</td>
</tr>
<tr>
<td>World Average</td>
<td>1.54</td>
</tr>
<tr>
<td>Oceania</td>
<td>0.44</td>
</tr>
<tr>
<td>Africa</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Source: ILZSG
World Refined Lead Metal Usage

- Lead is one of the earliest metals to be discovered and used in human history.

- Its usage has evolved from ancient times in piping by the Romans and coin forging by the Chinese to roofing and decorating and in batteries, shot and ammunition, rolled and extruded products, cable sheathing, lead compounds and other alloys.

- Nowadays, the battery industry is the single largest lead using industry worldwide thanks to the continuing growth of automobile industry and the potential growth of renewable energy sector that will require a cost-effective and efficient means of storage.

- It is estimated that the battery industry accounted for 86% of refined lead metal usage in China, 84% in Europe and 87% in the United States in 2018.

- Lead usage in other sectors has been declining over the past 30 years, mainly for environmentally related reasons.
World Refined Lead Metal Usage by Sector 2018

- Lead Acid Batteries: 86%
- Rolled & Extruded Products: 5%
- Lead Compounds including Lead Oxides & Lead Salts: 7%
- Shot & Ammunition: 1%
- Miscellaneous Sectors including Alloys & Solder: 1%

Source: ILZSG
% of Lead Usage Accounted for by LAB Production in the Main Lead-using Regions and Countries 2018

- Europe: 84%
- Japan: 97%
- USA: 87%
- China: 86%
- South Korea: 71%

Source: ILZSG
Geographical Location of LAB Producers 2018

- Asia: 73%
- Europe: 10%
- the Americas: 10%
- Africa: 6%
- Oceania: 1%

Source: ILZSG
World LABs Market Value 2017

(US$ Total: 45 Billion)

Source: Grand View Research
SLI Lead-Acid Batteries

Standard SLI batteries are installed in all vehicles with an internal combustion engine. On average, LABs for automobiles contain 9-14kg lead per unit. With the ongoing development of alternative batteries options and the adoption of EVs, it is possible that the traditional SLI LAB market will shrink with a reduction in sales in both the OEM and replacement according to SLI batteries forecast by Grand View Research.
Start/Stop Lead-Acid Batteries

Advanced Absorbent Glass Mat LABs and Enhanced Flooded LABs have been developed to offer improved deep-cycle resistance and charge recovery in order to facilitate start/stop functionality for fuel saving. AGM and EFB require about 20% more lead compared to traditional SLI batteries. It is expected that the adoption of Start/Stop LABs in both the OEM and replacement market will increase.
Industrial Lead-Acid Batteries

Currently, nearly 80% of industrial batteries are Lead-Acid Batteries. Depending on the scale of the energy storage capacity, the lead content varies. It is estimated that nearly 60% of storage unit weight is refined lead Metal. Industrial LABs are used in the fields of UPS, telecommunication, renewable energy storage, etc.

Global Market Breakdown of Industrial LABs 2017

(US$ Total: 9.9 Billion)

- Telecom: 51%
- UPS: 36%
- Others: 9%
- New Energy: 4%

Source: Grand View Research
Motive Lead-Acid Batteries

Motive Lead-Acid Batteries are used in forklift trucks, airport ground support equipment, golf carts and backup energy for transportation, etc.

World Market Breakdown of Motive LABs 2017

(US$ Total: 15 Billion)

- Forklift: 51%
- E-bikes: 44%
- Other: 5%

Source: Grand View Research
Lead Wire, Lead Sheet, Lead Pipe and Cable Sheathing

Lead wire is used for a variety of applications such as lead anodes, lead weights, tying fishing flies, small casting used by lead bullet and model racing car manufacturing. Lead wire provides excellent resistance against heat, cold and chemicals.

Lead sheet is mainly used in the construction sector as a roofing material. According to the European Lead Sheet Association, over 100,000 tonnes of lead sheet are used globally each year. Other uses of lead sheet include radiation protection and X-ray shielding protection (lead sheet is an ideal quality product applicable to radiology for equipment such as linear accelerators, gamma knifes, post-loading equipment, PET-CT rooms, CT rooms, DR rooms, DSA rooms, and X-ray machines in modern high-grade hospitals).
Lead Wire, Lead Sheet, Lead Pipe and Cable Sheathing

Lead pipe is now mainly used for carrying acids and corrosive chemicals.

Lead has been used to sheathe cables for more than 130 years, but it was substituted substantially by other materials due to the technological advancement in cable industry. It is estimated that less than 10 percent of land and underwater cables are currently sheathed with metal. Lead accounts for a small portion of this market.
Lead Shot and Ammunition

Lead is still widely used for making shot and bullets. However, its usage in shot is under threat for environmental reasons. It is therefore likely that lead will be substituted by other materials such as steel in shot, and its usage volume in this sector will decrease.

Administered by UNEP, the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) & Convention on Migratory Species (CMS) have engaged in phasing out the use of lead shot for hunting in wetlands.

Based on Article 69(1) of the REACH Regulation, the EU prepared restriction dossier on lead in shot used in wetlands. Member States are required to set up supervision mechanisms to monitor compliance with the proposed restriction.

On the day before President Trump's inauguration, the outgoing Obama administration passed a directive banning the use of lead ammunition and fishing sinkers on federal land.
Lead Compounds, Alloys and Solder

Lead compounds include lead monoxide (PbO), lead tetroxide known as red or orange lead (PB3O4), tribasic lead sulphate, lead dichloride, dibasic lead phthalate, dibasic lead sulphate, neutral lead stearate, dibasic lead stearate, dibasic lead sulphite etc..

Lead-acid batteries are the main end-use sector for lead compounds. Other applications include plastic stabilizers, pigments and frits, glass crystal, and antiknock agents in gasolines. Apart from batteries, usage in these sectors has decreased due to environmental legislation and subsequent substitution.

Lead alloys are used as type metal, window and fishing weights, etc. Lead solder was widely used in the electronics sector. However, its use in consumer products such as electronic devices has been banned in many jurisdictions; the trend of being substituted by lead-free alternatives such as tin, silver and copper is irreversible.
Asian and European countries are major lead concentrate importers.

Asia and Europe together accounted for over 90% of the world concentrate import trade volume in 2018.
Countries in the Americas, Europe and Oceania (Australia) are the major lead concentrate exporters.

Australia’s export volume decreased substantially in 2016 due to mine closures but saw a recovery in 2018.
ILZSG data shows that

- China was the largest importer of lead concentrates over the period 2008-2018.
- South Korea’s import volume grew substantially over this time.
- Germany was the main lead concentrate importer in Europe.
- Canada was the largest importer in the Americas.
- Kazakhstan has recently emerged as a significant importer.
Main Lead Ore & Concentrate Importers & Exporters 2018

Source: ILZSG
Leading Lead Ore & Concentrate Exporters 2018

Peru is now the largest lead concentrate exporting country in the world.
Over 2 million tonnes of refined lead metal is currently traded annually.
Main Refined Lead Metal Importers & Exporters 2018

Source: ILZSG
The United States was by far the largest refined lead importer in the world in 2018.
The Top 7 importing countries accounted for 60% of total world refined lead import.

Source: ILZSG
Leading Refined Lead Metal Exporters with Volume above 100 thousand tonnes 2018

The Republic of Korea was the largest refined lead metal exporter in 2018
Lead Stocks and Prices May 2014- May 2019

- SHFE China
- Producers + Consumers + LME
- LME Cash Settlement Price

US $ per tonne
monthly average
Pure lead is rare in nature. Currently lead is usually found in ore together with zinc, silver and copper and is extracted together with these metals.

Over the past 50 years there has been a significant reduction in the use of lead in gasoline, paint and water transportation systems. In addition, the adoption of advanced and strict emission and exposure control measures have resulted in a substantial decrease in the level of lead concentration in air, soil and water.

The negative image of lead was enhanced among the general public largely due to the wide use of leaded gasoline which generated lead particles in the air. With the ban of leaded gasoline in most countries in the world, lead levels in the air decreased substantially and are no longer a major source of lead exposure. Other atmospheric sources of lead in the air include forest fires, volcano eruptions, and combustion of coal and wood. The most recent study by International Lead Association suggests that approximately 50% of atmospheric lead in the environment originates from natural sources. Emission legislations regarding the lead mining, smelting and lead-acid batteries industry promoted the development of pollutant control technology and equipment; many production facilities have been upgraded to meet the revised emission levels.

Lead can accumulate in water and soil via a variety of channels. Lead pipes are still in use as a mean of water transportation in a number of countries and corrosion of these pipes can result in the transmission of lead into human body. The uses of lead in paints, ceramics, leaded glasses, etc. are also a source of lead emissions into the water and soil.