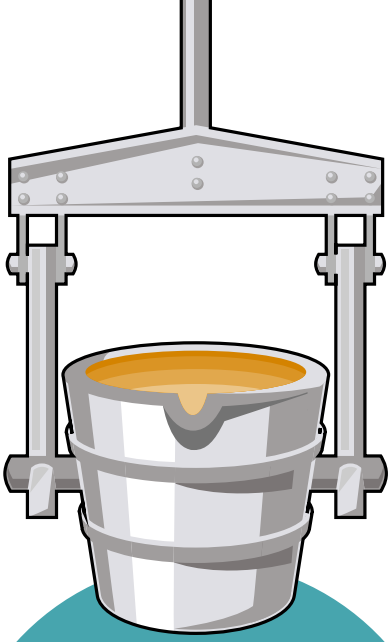
INTERNATIONAL ALUMINIUM

SPENT POT LINING: AN INTRODUCTION



Spent pot lining is an unavoidable by-product of aluminium smelting. Supporting its application in other industrial processes will contribute to circularity.

WHAT IS SPENT POT LINING?

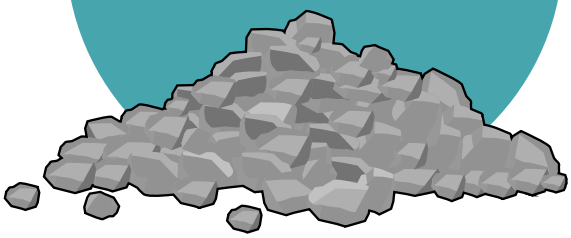
Spent pot lining is a **solid waste** generated during the production of primary aluminium.

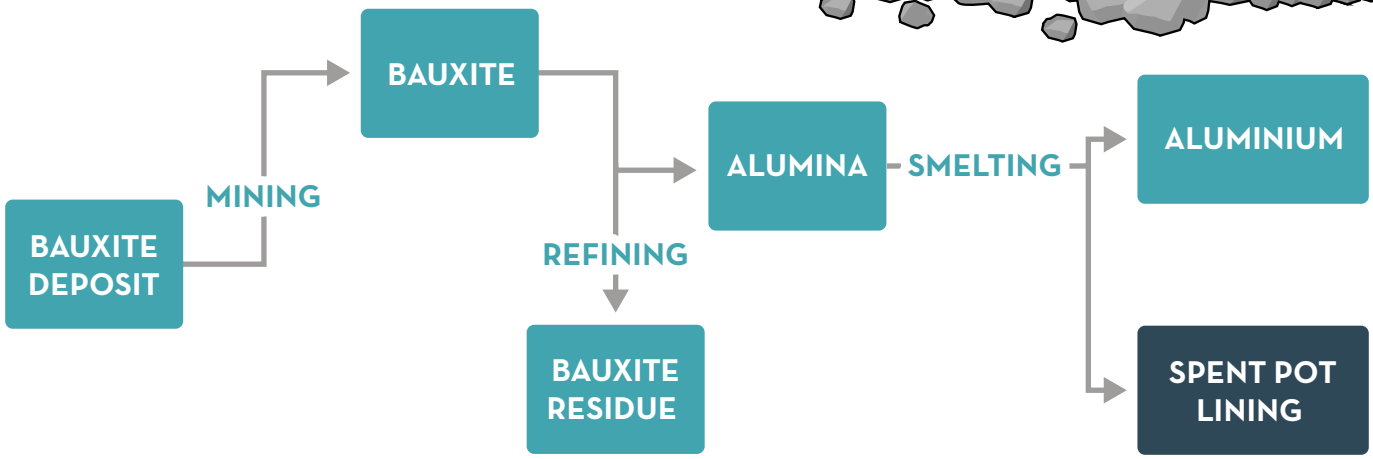
Primary aluminium is produced in steel pots which are lined. This lining is made up of two layers:

- an **insulating refractory lining**
- an **interior carbon lining**.

Over a period of typically between **4-7 years**, the pot lining wears and comes to the end of its life, when it is classified as spent pot lining.

Spent pot lining is the most significant waste from aluminium smelters.





HOW IS SPENT POT LINING USED?

40-50%

Almost half (40-50%) of spent pot lining generated is recycled and used in other industrial processes, such as:

- Cement production
- Steel production
- Mineral wool production

It can also be treated and deposited in specially designed and closely monitored landfills. The industry is actively seeking ways to maximise opportunities to recycle spent pot lining and reduce landfill.

Visit international-aluminium.org/resources/spent-pot-lining for more information.

Acknowledgements: Research leading to these results has received funding from the European Community's Horizon 2020 Programme (H2020/2014-2019) under Grant Agreement No. 776469 (REMOVAL). This publication reflects only the author's view, exempting the Community from any liability. Project website: https://www.removal-project.com/

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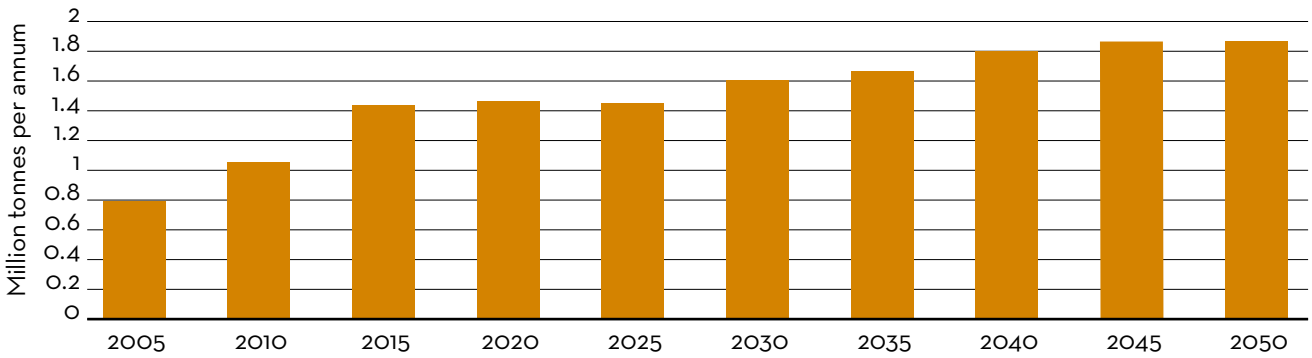
ESTIMATED TOTAL GLOBAL SPENT POT LINING GENERATION 2005–2050



1.85 million tonnes per year

Expected spent pot lining generation in 2050 – an increase from 1.45 million tonnes in 2020 and 0.8 million tonnes in 2005.

RECOMMENDATIONS FOR CONTAMINANTS AND TOXICITY HANDLING

As a by-product of an industrial process, there are safety requirements and recommendations for handling the material. IAI members are able to assist with information and safety data sheets on these topics:

- General workplace health and safety
- Personal protective equipment
- SPL health and safety training
- Safety data sheets
- Fitness for work
- Machinery operation and protection
- Physical hazards
- Hazardous waste
- Storage, handling and transport practices
- Water reactivity
- Flammable gas evolution
- Ventilated storage
- Cyanide
- Flouride salts
- Respirable crystalline silica dust
- Toxic gas release
- Other substances: nitrides, carbides, phosphides, sulphides

CHEMICAL COMPOSITION OF SPL FIRST CUT AND SECOND CUT (HYDRO ALUMINIUM, 2018)

Compound	Carbon lining 1st cut range wt %	Refractory lining 2nd cut range wt %
Al_2O_3	0-10	10-50
C	40-75	0-20
Na	8-17	6-14
F	10-20	4-10
CaO_2	1-6	1-8
SiO_2	0-6	10-50
Metallic Al	0-5	0
CN total	0.01-0.5	0-0.1
CN free	0-0.2	0-0.05

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SUMMARY OF SPL UTILISATION OPTIONS AND KEY FEATURES

Industrial use	First cut/ second cut/ both	Pre-treatment	Use/impact	Fluorides	Cyanides
Cement	Both	Crushing	Energy & raw material	Fluxing effect	Destroyed
Steel	First cut	Crushing	Energy	Fluxing effect	Destroyed
Mineral wool	First cut	Crushing and screening	Energy	Captured in mineral wool and in gas cleaning	Destroyed

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CASE STUDIES: COMPANIES FIND SUCCESS USING SPENT POT LINING

CEMENT PRODUCTION: Star Cement & Emirates Global Aluminium (EGA)

Since 2010, Emirates Global Aluminium (EGA) has been working with cement companies in the United Arab Emirates to explore the potential use of spent pot lining (SPL) in the cement manufacturing process.

EGA embarked on a study in 2019 to quantify the environmental benefits of adding SPL to the cement manufacturing process.

41 KILOTONS
In 2018, EGA supplied cement producers with 41,000 tonnes of its SPL inventory.

0.6% The study focused on using 0.6% SPL in feedstock and found that, as a result of this addition, fuel consumption and emissions were notably reduced.

3.5%
Coal consumption was estimated to reduce by 3.5%.

0.74%
CO_2 emissions were down 0.74%.

3.75%
NOX emissions were down 3.75%

STEELMAKING: Jindal Steel & Sohar Aluminium

Sohar Aluminium has partnered with steel plant Jindal Steel to explore the replacement of coarse carbon with SPL in the electric arc furnace (EAF) process.

Sohar Aluminium and Jindal Steel ran a trial phase in 2016, in which they successfully tested the potential for the addition of first cut SPL from Sohar's operations in Jindal Steel's steelmaking process. In 2017, Jindal Steel began officially taking its first cut SPL from Sohar

Sohar Aluminium and Jindal Steel's partnership has reduced the need for virgin raw materials and brought cost and environmental benefits for both companies.

MINERAL WOOL: UC Rusal & Rockwool

Rockwool, a major mineral wool producer, has used first-cut SPL since 1999 to replace more expensive coke that is otherwise used in the furnaces. UC Rusal has been collaborating and the feedstock of butts and SPL first cuts has enabled foundry coke reductions of up to 30%.

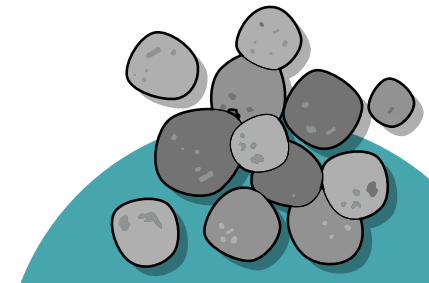
2–3 tonnes

A cupola furnace process is used by the wool producer, in which carbon materials act as fuel. Based on the difference in heating value, when using the cupola process, 2 to 3 tonnes of first cut SPL replaces 1.3 to 2 tonnes of coke.

100–250 mm

A certain porosity inside the bed of the furnace must be maintained for the industrial process to be successful. A nominal size of 100-250 mm for coke is targeted, and aluminium smelters can achieve this for the SPL to enable this utilisation application.

Refractory materials are not compatible with the cupola process, so if first cut SPL is used, it must be as clean as possible.



50–80mm
Before SPL is fed to the EAF furnace, it is crushed to a finer size of around 50 to 80 mm. This pre-treatment makes it easier to use at the steelmaker

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