Annual Greenhouse Gas (GHG) Emissions Report

SLOVZINK

Greenhouse gas emissions resulting from the production of Zinc Oxide

2024

According to the Principles of GHG Protocol

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Summary

SlovZink, a.s., based in the Slovak republic, is a privately owned company that specializes in the manufacture of Zinc Oxide for use across a wide range of industries, both domestically and abroad.

We are committed to acting responsibly by upholding high standards and respecting the principles of our stakeholders, whether it's customers, suppliers or our community. Environmental responsibility and sustainability are central to our philosophy, which is reflected in the way we go about implementing solutions to reduce our CO2 footprint in manufacturing our products. Thus, we steadily work to minimize the consumption of primary raw materials and energy while maintaining our process efficiency,

Our approach is based on producing Zinc Oxide that is cost-effective, reliable, and aligned with our 'Sustainable Zinc Oxide supplier' commitment. We also recognize the importance of the life cycle assessment of the product, which in this case is performed in as a 'cradle-to-gate' evaluation due to the specific nature of the product. This assessment is performed on a yearly basis to better understand our environmental impact.

Regarding the findings, while the company considers the focus on direct and indirect (energy) impact to be of high importance, results consistently highlight that most of the carbon footprint, as high as 80%, is linked to the impact of raw material use.

As the materials sector evolves, there is a growing demand for product transparency from clients, manufacturers, and regulators. The results of the report help the stakeholders make informed choices whilst being reliable and replicable by using the methodology outlined in the internal directives to ensure their consistency. Finally, the principles of the data acquisition and evaluation are compliant with GHG Protocol Corporate Accounting and reporting standard.

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1. Introduction

1.1. The company

SlovZink, a.s. is a privately owned company, based in Košeca, Slovak republic whose expertise is in the manufacture of Zinc Oxide.

The company is managed by an EMS (Environmental Management system) compliant with ISO 14001:2015 and a quality management system compliant with ISO 9001:2015.

1. The products

The company produces its Zinc Oxide in two separate lines, both being the French process using various types of Zinc as raw material. To explain further, a portion of the Zinc Oxide is produced from recycling the waste of various galvanization processes, thus aiming to minimize the primary raw material consumption.

2. Greenhouse Gas Emissions

Greenhouse Gas (GHG) Emissions are a major contributing factor to climate change. Considering this, many local, national and international policies have been implemented to encourage companies and organisations to take responsibility for measuring, managing and reducing their emissions. These might arise directly from operations, or indirectly from purchased energy and lastly other supply chain activities, both upstream and downstream.

SlovZink, a.s. performs an annual assessment of its GHG emissions over a 12-month reporting period according to methodology outlined in the GHG Protocol Corporate Accounting and reporting standard:

/Greenhouse gasses – Part 1: Specification with guidance at the organisational level for quantification and reporting of GHG emissions and removals/.

This approach allows to differentiate between direct (Scope 1) and indirect (Scope 2 and Scope 3) emissions that are produced as a result of company's production processes. The data is then used to set objectives, track performance and develop strategies to further reduce the environmental impact.

There have been several assumptions made to equalize portions of data due to its unavailability in Scope 3. These are highlighted in the internal dataset and its corresponding section. Primary data is used wherever possible. This data is acquired from our existing management systems with respect to our internal directives.

3. Scope of Analysis

SlovZink, a.s. has conducted a 'cradle-to-gate' assessment of its annual GHG emissions, covering all emissions from processes under the direct control of the company, the use of all electricity and gas on the production site and emissions related to the raw materials produced by the upstream companies as well as the transport of said raw materials.

3.1. Organisational boundary

This study was prepared in accordance with *ISO 14064-1:2018 Greenhouse gasses Part 1: Specifications and guidelines at the organizational level for the quantification and reporting of greenhouse gas emissions and removals* as well as in accordance *with GHG Protocol Corporate Accounting and reporting standard*.

SlovZink, a.s. consolidates its greenhouse gas (GHG) emissions using the financial control approach. Under this approach, SlovZink, a.s. reports 100% of emissions from activities over which it has the ability to exert financial and operational influence for profit. Since the company operates a single facility, all Scope 1 and 2 emissions from the site are included in this report.

3.2. Emission categories

- Direct emissions (Scope 1): Emissions from sources owned or controlled by XYZ (e.g., on-site fuel combustion, process emissions, and plant equipment).
- Energy-related indirect emissions (Scope 2): Emissions from electricity purchased and consumed at the facility.
- Other indirect emissions (Scope 3): Value chain emissions such as raw material extraction and transportation, business travel, and waste disposal, where relevant and data is available.

3.3. Data and Methods

Primary data from monthly utility bills and internal operational records were used for Scope 1 and Scope 2 reporting.

Scope 3 calculations use a combination of supplier data and secondary data where necessary. In case of a presence of reasonable assumptions that warrant closer attention, a sensitivity and uncertainty analysis was performed. The analysis can be found in the section: *Appendix 1.* of this report.

Emissions factors were sourced from reliable, nationally and internationally recognized databases, updated to their latest versions for the reporting period. The calculation data, as well as the emission factors and formulas used to calculate the carbon footprint are shown in the section: *Appendix 2 (on request – redacted)*.

The base year for this GHG emissions study is 01.01.2024 – 31.12.2024.

3.4. Quality management

The data quality is ensured by the quality management systems implemented by SlovZink, a.s., which includes periodic checks of energy billing data, validation of material use, and annual review of GHG inventory methods and Emission factor sources.

3.5. Disclosure

This report represents the company's annual disclosure of greenhouse gas emissions. Total direct and indirect emissions will be published for stakeholder transparency in this report via the SlovZink, a.s. website.

4. Data reporting

Raw data was collected over the course of the period from 01.01.2024 – 31.12.2024. Conversion factors are then applied to the data so that GHG emissions (expressed as CO2 equivalents; CO2e) can be derived.

4.1. Raw materials

All deliveries are transported via road to the production site (transport emissions calculated under section 4.3).

Tables 1 and 2 show the raw materials purchased and delivered for use at site. The emission factors are sourced from the suppliers directly.

The supplier for SHG Zinc has provided their Scope 1 & 2, which is used in calculating the kg CO2e for the raw material purchased. Based on the supplier communication, an assumption was made regarding the nature of the Scope 3 emissions, which are to be considered negligible in proportion to the Scope 1 & 2 emissions due to the nature of the process used to manufacture the raw material in question.

In regard to TD (Top Dross Zinc), some of the suppliers do not possess the data necessary to determine the appropriate emission factor to be used in the calculation. Thus, the emission factor provided by the supplier of the vast majority is applied to all material sourced from smaller suppliers. The assumption that the emission factor is similar across the board is made based on the same or a very similar process used in the production of the raw material in question (waste from the galvanisation process).

Finally, it would be pertinent to mention, that the company is directly working on refining the process to increase the amount of Top Dross Zinc in order to significantly reduce its emissions in the foreseeable future.

Total tons CO2e in 2024:	24 136

Table 1: Total sum of the emissions from input materials expressed in tons CO2e

4.2. Energy and fuel

SlovZink, a.s., uses both natural gas and electricity at its production site. Part of the electricity is produced via photovoltaic panels implemented in year 2023 that enable the company to report the electricity generated in Scope 1 as zero as per the guidelines of GHG Protocol.

Since natural gas is used to generate heat in the production process, reporting of the emissions generated falls under Scope 1. The emission factors are sourced directly from the supplier that tracks the calorific values month by month to ensure high accuracy. These can be found on the website of the supplier and are also available in the appendix 2 *(on request – redacted)*.

The other type of fuel that drives combustion in one of the lines is Oven Coke and Charcoal. Both of these are reported under Scope 1. Finally, fuel such as CNG, Diesel and Gasoline, is reported under Scope 1.

As a part of improvements decided upon this year in regard to the purchased electricity, SlovZink, a.s., has committed to using electricity from renewable sources only from year 2025 on, so that it is able to achieve zero emissions in Scope 2.

The emissions from Energy and fuel can be found in the table below.

	Scope	Tons CO2e
Electricity – purchased:	Scope 2	994,34
Natural Gas:	Scope 1	1 781,13
CNG Station:	Scope 1	22,73
Diesel Fuel:	Scope 1	8,87
Gasoline:	Scope 1	5,70
Oven Coke:	Scope 1	2 307,424
Charcoal:	Scope 1	66,813
	TOTAL:	**5187**

Table 2: Emissions from Energy and Fuel

Total tons CO2e in 2024:	5 187

Table 3: Total sum of the emissions from input materials expressed in tons CO2e

4.3. Transportation

This section covers the emissions from the transportation of raw materials to SlovZink, a.s. production facility.

Only one of the company's suppliers (for SHG Zinc) is permanently based in a single location and provides the relevant information. All deliveries from this supplier is made by road. The direct emission factor applied for the relevant trucks is sourced from the report on CO2 emissions from heavy-duty vehicles published by European Automobile Manufacturers Association (ACEA).

The rest of the suppliers for the Top Dross Zinc operate a mixed delivery model, typically transporting goods from and between multiple sites and then onward to SlovZink, a.s. Due to the lack of transparency in exact routing and differing collection points, and because suppliers usually do not disclose the origin locations, it is not feasible to track actual delivery distances.

Using an assumption based secondary data application approach, the average distance from which the Top Dross Zinc raw material was sourced is 951,98 km. This assumption is made based on identification of the material coming from certain producers and applying a weighted arithmetic average distance between these locations.

A sensitivity analysis was performed by using the pedigree method to assess uncertainty. This analysis is documented as an appendix to this declaration.

This approach follows GHG Protocol Scope 3 Guidance and ISO 14064-1 principles to use the best available data and to disclose any assumptions and data quality variation.

Since the SHG Zinc is sourced from one supplier only, the amount of CO2e used in the transportation is:

	in year 2024
Client:	Továrenská 545/9, 01864 Košeca, Slovakia
Transport operation category:	Packed goods - Level 3 - FTL - ambient
Em. intensity value (g CO2e/tkm):	56,50
tons CO2e in 2024:	**438,53**

Table 4: Emissions from transportation of SHG Zinc

For Top-Dross Zinc, the number of Emissions can be expressed in two separate datasets, one for the known and the other for the unknown supplier routing:

	in year 2024
Supplier:	Known routing
Client:	Továrenská 545/9, 01864 Košeca, Slovakia
Transport operation category:	Packed goods - Level 3 - FTL - ambient
Em. intensity value (g CO2e/tkm):	56,50
tons CO2e in 2024:	**89,63**

Table 5: Emissions from transportation of TD Zinc, unknown routing

	in year 2024
Supplier:	Various - assumed distance
Client:	Továrenská 545/9, 01864 Košeca, Slovakia
Transport operation category:	Packed goods - Level 3 - FTL - ambient
Em. intensity value (g CO2e/tkm):	56,50
kg CO2e in 2024:	**191,35**

Table 6: Emissions from transportation of TD Zinc, known routing

Total tons CO2e in 2024:	**720**

Table 7: Total sum of the emissions from transport expressed in tons CO2e

4.4. Operation of premises

All emissions associated with the operation of premises, including facilities such as factories and office buildings, are comprehensively addressed in Section 4.2. This section already accounts for these emissions through the inclusion of gas and electricity consumption data.

4.5. Waste

Waste from the factory and neighboring offices is in the large part collected by the city of Košeca and the rest of the waste is disposed of in accordance with the law by various local contractors. In 2024, SlovZink, a.s. has recycled a large amount of metal from the factory due to the revisions made by the staff, which has resulted in the negative emissions reported in the table below.

	in year 2024
mixed municipal (kg):	2013,26
plastic (kg):	-1341,44*
glass (kg):	-73,79*
paper (kg):	-217,80*
Metal, scrap metal (iron) (kg):	-152201,35*
wood (palettes etc) (kg):	2355,37
Slag, ash and cinder(kg):	1639,20
Waste from sand and oil traps (kg)	19,50
Solvants (kg)	5,35
Packaging from mixed materials (kg):	864,00
Contaminated packaging (kg):	15,45
Absorbents & filtration materials (kg):	45,40
Laboratory chemicals (kg):	1,00
Wastewater sludge (kg):	1000,00
Plastic (2) & rubber (kg):	10,20
Mixed waste from mech. waste processing (kg):	1533,00
Lamps containing mercury (kg):	15,10

Table 8: The emissions from waste expressed in tons CO2e:

Total tons CO2e in 2024:	-144,31

Table 9: The emissions from waste expressed in tons CO2e

4.6. Water

All emissions associated with the operation of the water supply system, particularly those resulting from the use of its dedicated water pump, have been fully accounted for in section 4.2 of this report. This section incorporates the relevant environmental impacts, and data that have already been considered in the emissions calculations.

* These materials were recycled and are reported as burden credit, avoided

4.7. Fire extinguishers

SlovZink, a.s., uses standard carbon dioxide (CO_2) portable fire extinguishers. In accordance with the IPCC good practice guide, annual fugitive emissions from fire extinguishers are assumed to result from gradual leakage of the propellant.

The company owns twenty-five 5-kg fire extinguishers and one 25 kg extinguisher.

These amount to **2,38 kg.**

The emissions produced by extinguishers are insignificant compared to other sources, but they are nonetheless included to ensure the completeness of the GHG inventory.

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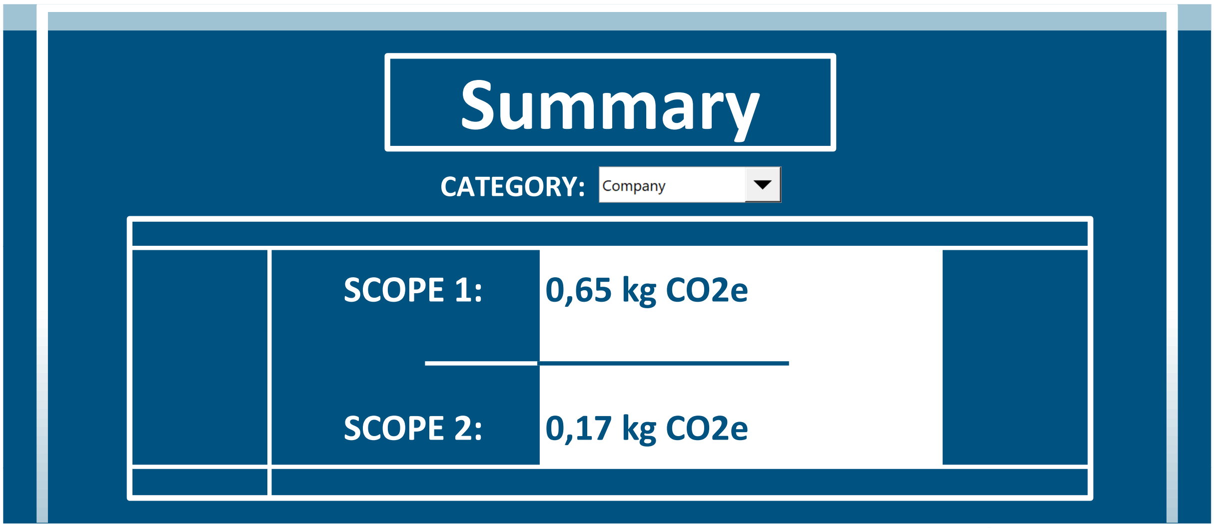
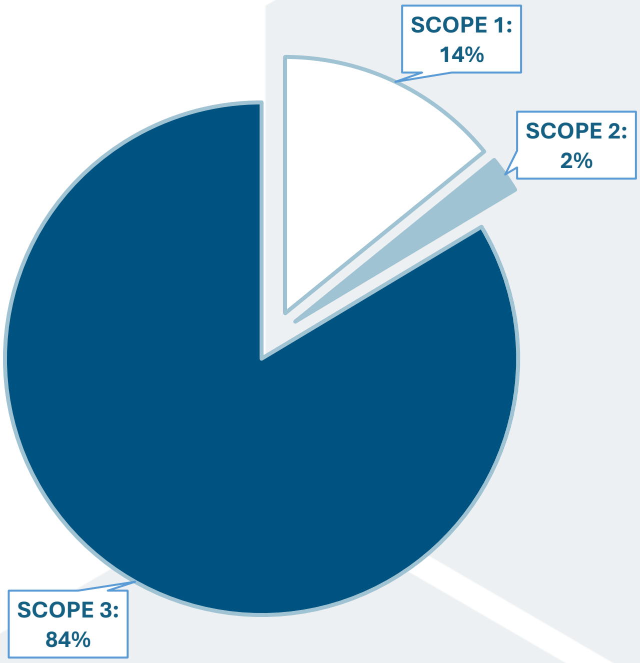
5. Final declaration

The final carbon footprint calculations for steel have been derived using all data discussed in section 4 of this manual. The final figures are stated below:



The following chart shows the share of emissions sorted by each scope:



For calculation of Scope 3 for individual customers please contact SlovZink, a.s., or ZENCOR Processing, a.s.

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APPENDIX 1: Sensitivity and Uncertainty Analysis of upstream transport of raw material type: Top Dross Zinc

Summary:

This study was performed to demonstrate the ability to verifiably establish the uncertainty and sensitivity of upstream transport of raw material type: Top Dross Zinc. All the formulas used in this analysis were also observed when performing similar analyses for the rest of the missing or uncertain data that could be reasonably estimated by industry standard data or data acquired from relevant sources. The case study for Top Dross Zinc is thus the only one that will contain the relevant method description. For the rest of the missing or uncertain data, only results are shown.

1. Background and scope

The appendix presents an uncertainty analysis for GHG emissions associated with the upstream (inbound) transportation of raw material, Top-Dross Zinc to the production site of SlovZink, a.s.

Unlike the supplier for SHG Zinc, which has a single, local, identifiable source location, Top Dross Zinc is procured from various suppliers using wide range of routing practices. Many of these suppliers do not disclose a detailed transport origin nor mileage used to deliver the material to the production site, thus making an accurate calculation not feasible.

Following this, SlovZink, a.s. has estimated transport emissions using a proxy distance per shipment established in the section 3. of this study and a published emission factor for the 5-LH type trucks.

To perform this analysis and quantify the range of reasonable values for GHG emissions, a pedigree matrix approach was selected.

2. Data and sources

The main source for the uncertainty method is ***GHG Protocol Quantitative Uncertainty Guidance from 2003 (as GHG Protocol QUG)*** .

The data relevant to this analysis can be found in the table below:

	Source
Quantity of TD Zinc	An input and yield company database
5-LH vehicle load	Average 5-LH FTL vehicle load delivered
Distance assumption	Arithmetic average of identified routes
Emission factor	An average EF published by European Automobile Manufacturers Association (ACEA) CO2 emissions from heavy-duty vehicles report

Appendix 1, Table 1

3. Deterministic (avg case) calculation

The data used in the Annual Greenhouse Gas (GHG) Emissions report under the Scope 3 - FTL – ambient, is a result of a deterministic, average case calculation.

The equation used for the estimation of the average case is the following:

$$Emissions\ in\ t\ CO2e = \frac{\mathrm{Mass\ (t)} \times \mathrm{Distance(km)} \times \mathrm{EF}(\frac{\mathrm{g}}{\mathrm{tkm}})}{10^6}$$

Appendix 1, Equation 1

4. Methodology: pedigree matrix & uncertainty factors

The pedigree matrix evaluates the quality of input data along five dimensions. These are:

- Completeness
- Temporal
- Geographical
- Technological

Each of the scores corresponds to an uncertainty factor. In addition to that, a basic uncertainty factor determined by the GHG Protocol QUG is applied to account for intrinsic variability in the type of the process. In this case, transport services, Ub = 2. This is added to each of the parameter calculation, since a conservative approach is warranted due to the nature of the missing data.

Next, the combined log standard deviation in ln space (σ) for each parameter (*Equation 1*) geometric standard deviation (*Equation 2*) and lastly total uncertainty using transport distance and emission factor as independent multiplicative parameters (*Equation 3*) are calculated as as follows:

$$\sigma = \sqrt{\sum_i (lnU_i)^2 + (lnU_b)^2}$$

Appendix 1, Equation 2

$$GSD = e^{\sigma}$$

Appendix 1, Equation 3

$$\sigma_{total} = \sqrt{\sigma_{distance}^2 + \sigma_{EF}^2}$$

Appendix 1, Equation 4

Finally, the bounds (*Equation 4 & 5*) are set to establish a 95% confidence (GHG Protocol QUG standard) interval

$$Lower\ Bound = Base \times e^{-1{,}96\sigma_{total}}$$

$$Upper\ Bound = Base \times e^{+1{,}96\sigma_{total}}$$

Appendix 1, Equation 5 & 7

5. Pedigree scores

The Numeric dimension (criteria) are set out in the GHG Protocol QUG as follows:

Numeric dimension criteria				
Dimension	Very good	Good	Fair	Poor
Precision	1,00	1,10	1,20	1,50
Completeness	1,00	1,05	1,10	1,20
Temporal	1,00	1,10	1,20	1,50
Geographical	1,00	1,02	1,05	1,10
Technological	1,00	1,20	1,50	2,00
TRANSPORT (Ub)	2,00			

Appendix 1, Table 2

The pedigree scores converted to numeric uncertainty factors are for the parameters of Distance and Emission factor are then:

RELEVANT ACTIVITY DATA			
Parameter	Dimension	Quality	Uncertainty factor U
Distance (activity data)	Precision	poor	1,50
	Completeness	poor	1,20
	Temporal	fair	1,20
	Geographical	fair	1,05
	Technological	good	1,20
TRANSPORT	N/A	N/A	2,00
Emission factor (ACEA EF)	Precision	good	1,10
	Completeness	good	1,05
	Temporal	good	1,10
	Geographical	very good	1,00
	Technological	very good	1,00
TRANSPORT	N/A	N/A	2,00

Appendix 1, Table 3

These factors are multiplicative in ln space when calculating for σ.

To explain, how the quality scores were assigned in the previous table – the relevant information pertaining to the Distance parameter and Emission factor was used. For example, we know, that the precision of the distance is of a poor quality, since we do not possess almost any information regarding the sourcing of the material.

6. Results

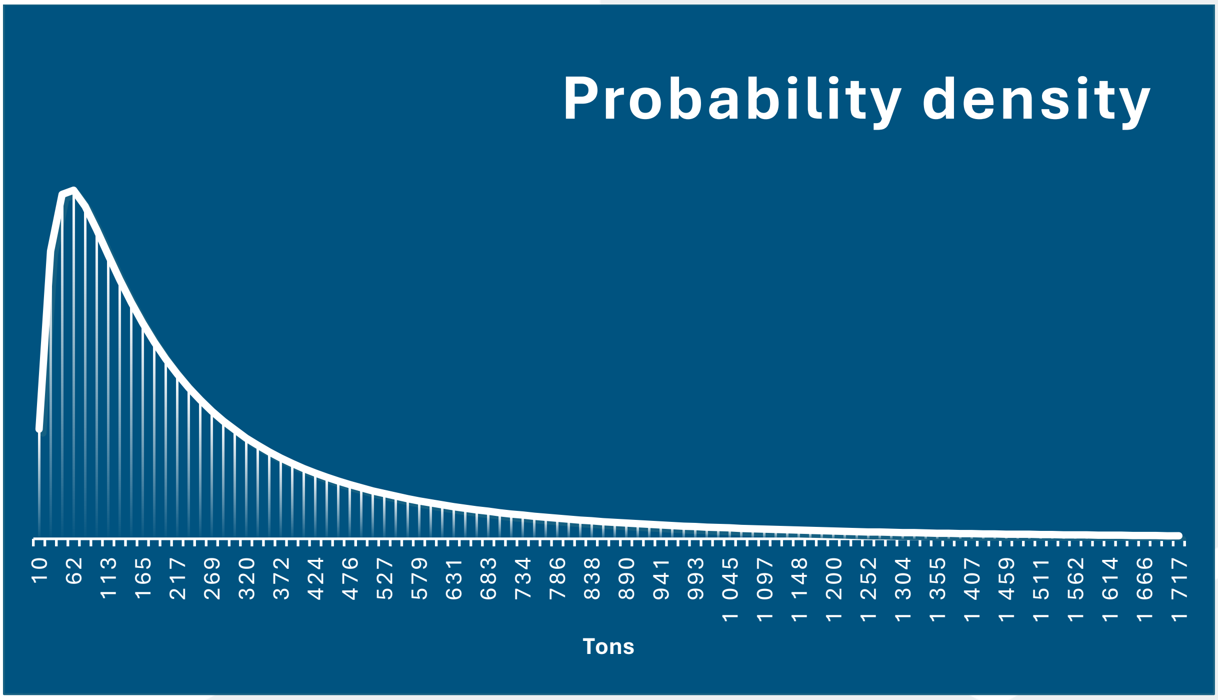
The results of *σ (ln)* and *GSD* from the calculation for parameters of Distance and Emission Factor are:

Parameter	σ (ln)	GSD
Distance (activity data)	0.864	2,37
Emission factor (ACEA EF)	0.708	2,03
Combined total	**1,117**	**3,06**

Appendix 1, Table 4

The lower and upper bounds are then **21,42** tons and **1708,89** tons.

The probability spread is represented by the following semi-log. graph:



Appendix 1, Graph 1

7. Sensitivity analysis

The sensitivity analysis is performed by establishing, which inputs contribute most to the uncertainty. A simple analysis was performed by establishing the percentages as follows:

SENSITIVITY ANALYSIS			
Parameter	σ (ln) Squared	SIGMA TOTAL	CONTRIBUTION
Distance (activity data)	0,747	1,248	60%
Emission factor (ACEA EF)	0,501		40%

Appendix 1, Table 5

8. Conclusion

The baseline scenario provides a rough estimate of emissions related to the transport of the Top Dross Zinc. The uncertainty range is very wide, mainly due to the lack of measured data on distances and routing and the high base uncertainty factor (Ub = 2.0) recommended for road freight by *GHG Protocol QUG.*

This highlights the lack of data on distance and routing from suppliers as the main source of uncertainty. As it stands, the data suggests that even with partial disclosure of information by suppliers, pedigree scores would improve, significantly reducing GSD and narrowing the uncertainty interval.

Following that, SlovZink, a.s. is planning to improve supplier transportation data in future using reporting cycles to reduce reliance on approximations by implementing a mandatory supplier assessment to improve reliability. These will include closer data on origin (ZIP CODE), vehicle type and load factor when this information is available.

Case 2: Unknown pallet types

Summary:

This calculation was performed to establish the uncertainty and sensitivity of raw material - packaging: unknown pallets. The difference here is usage of the Base Ub as one of the parameters as using it for each EF_weight and EF_type would inevitably result in overestimation.

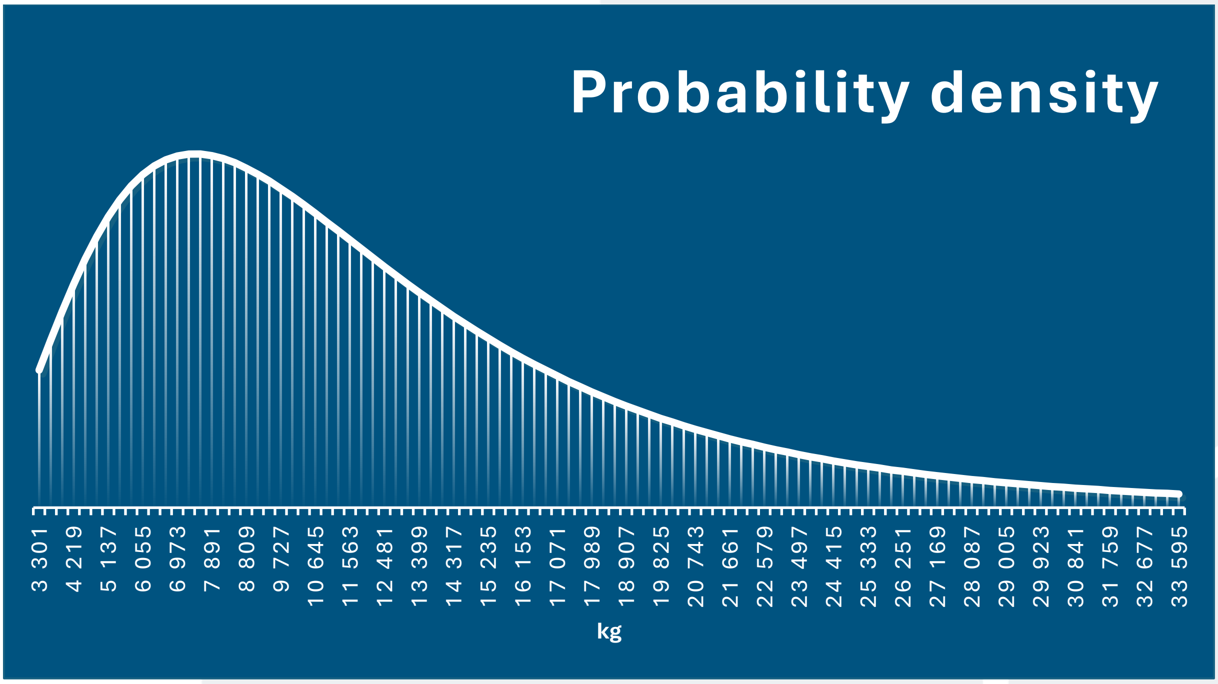
Results

Parameter	σ (ln)	GSD
Emission factor_type	0,417	1,52
Emission factor_weight	0,417	1,52
Raw material Ub	0,048	1,10
Combined total	**0,591**	**1,81**

Appendix 1, Table 6

The lower and upper bounds are then **3,31** tons and **1708,89** tons.

The probability spread is represented by the following semi-log. graph:



Appendix 1, Graph 2

Sensitivity:

SENSITIVITY ANALYSIS			
Parameter	Squared	SIGMA TOTAL	CONTRIBUTION
EF type	0,173	0,349	~ 50%
EF weight	0,173		~ 50%
EF UB	0,002		~ 1%

Appendix 1, Table 7

Case 3: Unknown waste weight

Summary:

This calculation was performed to determine the uncertainty and sensitivity of emissions from mixed municipal waste based on 110-liter bins. The main parameters considered were waste weight (kg/l), emission factor (EF), activity data (number and volume of bins) and finally, waste fate.

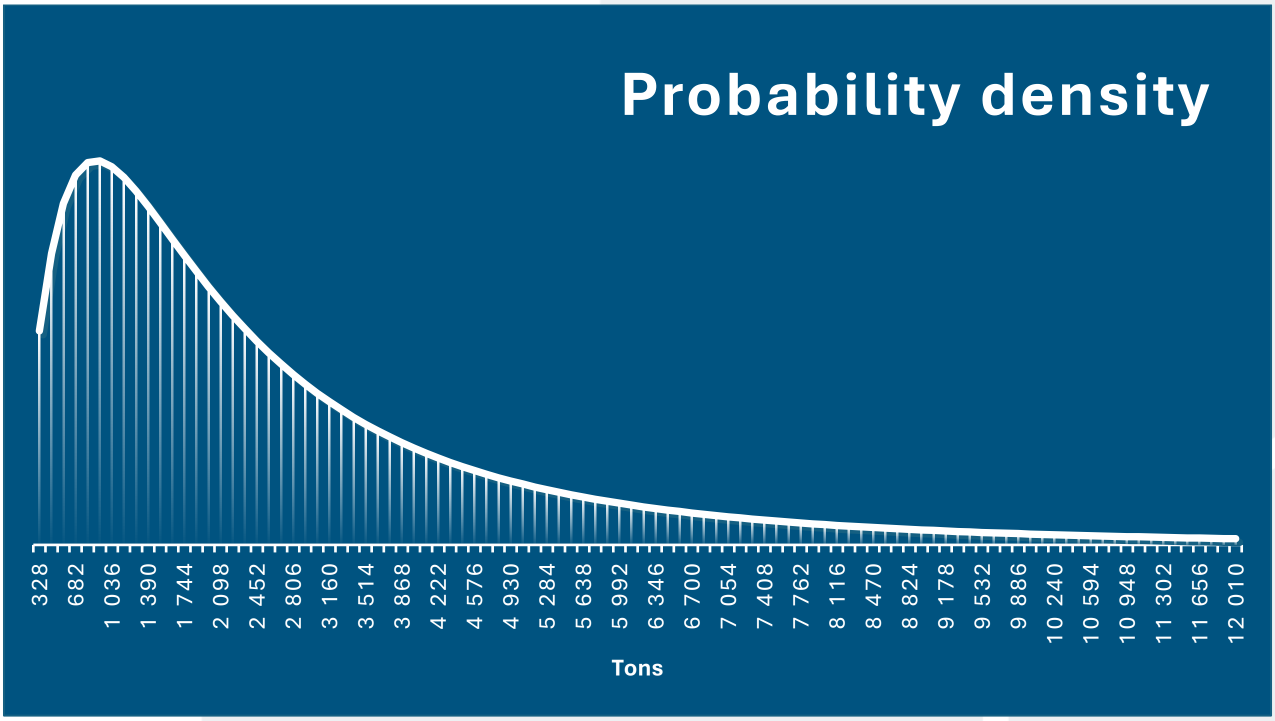
Results

Parameter	σ (ln)	GSD
Waste weight (kg/L)	0,516	1,68
Emission factor(EF)	0,291	1,34
Activity data (volume of bins	0,280	1,32
Waste fate / composition	0,631	1,88
Raw material Ub	0,049	1,05
Combined total	0,911	2,49

Appendix 1, Table 8

The lower and upper bounds are then **0,337** tons and **11,99** tons.

The probability spread is represented by the following semi-log. graph:



Appendix 1, Graph 3

Sensitivity:

SENSITIVITY ANALYSIS			
Parameter	Squared	SIGMA TOTAL	CONTRIBUTION
Waste weight (kg/L)	0,267	0,827	32%
Emission factor (EF)	0,085		10%
Activity data (volume of bins)	0,078		9%
Waste fate / composition	0,398		48%