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STRATEGIC BUSINESS PLAN 2025
ISO/TC 183 COPPER LEAD ZINC AND NICKEL CONCENTRATES AND ORES

Executive summary

Sulfide ores containing base and precious metals are processed by mining companies into sulfide mineral concentrates, which in turn are processed by smelters into copper, lead, zinc, and nickel metals, along with precious metals and other byproducts. Ores and concentrates require accurate sampling and analysis to measure their elemental and physical properties.

Practical sampling and sample preparation methods, underpinned by scientific principles, are essential to collect representative samples for each lot of ore or concentrate. Such samples can then be tested using standardized methods for reliably determining base metal content, physical properties, and moisture levels. Additionally, appropriate and approved sampling and testing for Transportable Moisture Limit (TML) are essential to ensure safety of life at sea by preventing cargo liquefaction during maritime transport.

Sales contracts determine the economic value of traded concentrates, typically referencing benchmark metal prices, smelter treatment and refining charges, and metal contents, along with any penalties for deleterious elements.

ISO/TC 183's scope is the standardization of sampling, chemical analysis, and physical testing methods specifically for copper, lead, zinc, and nickel ores, concentrates, and smelter residues.

The primary objectives of ISO/TC 183 are to develop and maintain standards that support mining, smelting, and trading companies in reliably and accurately determining the value of base metal sulfide ores and concentrates. These standards support the global production of approximately 22 million tonnes of copper (~USD 180–200 billion), 4.5 million tonnes of lead (~USD 9–10 billion), 12.5 million tonnes of zinc (~USD 35–40 billion), and 3.16 million tonnes of nickel (~USD 75–80 billion) annually [1–4]

References:
[1] International Copper Study Group. (2023). Copper Market Report. Retrieved from https://icsg.org
[2] International Lead and Zinc Study Group. (2023). Lead and Zinc Statistics. Retrieved from https://ilzsg.org
[3] International Nickel Study Group. (2023). Nickel Market Report. Retrieved from https://insg.org
[4] U.S. Geological Survey. (2023). Mineral Commodity Summaries. Retrieved from https://usgs.gov (International Copper Study Group, 2023; International Lead and Zinc Study Group, 2023; International Nickel Study Group, 2023; U.S. Geological Survey, 2023).

1 Introduction

1.1 ISO technical committees and business planning

The extension of formal business planning to ISO Technical Committees (ISO/TCs) is an important measure which forms part of a major review of business. The aim is to align the ISO work program with expressed business environment needs and trends and to allow ISO/TCs to prioritize among different projects, to identify the benefits expected from the availability of International Standards, and to ensure adequate resources for projects throughout their development.

1.2 International standardization and the role of ISO

The foremost aim of international standardization is to facilitate the exchange of goods and services through the elimination of technical barriers to trade.

Three bodies are responsible for the planning, development and adoption of International Standards: ISO (International Organization for Standardization) is responsible for all sectors excluding Electrotechnical, which is the responsibility of IEC (International Electrotechnical Committee), and most of the Telecommunications Technologies, which are largely the responsibility of ITU (International Telecommunication Union).

ISO is a legal association, the members of which are the National Standards Bodies (NSBs) of some 164 countries (organizations representing social and economic interests at the international level), supported by a Central Secretariat based in Geneva, Switzerland.

The principal deliverable of ISO is the International Standard.

An International Standard embodies the essential principles of global openness and transparency, consensus and technical coherence. These are safeguarded through its development in an ISO Technical Committee (ISO/TC), representative of all interested parties, supported by a public comment phase (the ISO Technical Enquiry). ISO and its Technical Committees are also able to offer the ISO Technical Specification (ISO/TS), the ISO Public Available Specification (ISO/PAS) and the ISO Technical Report (ISO/TR) as solutions to market needs. These ISO products represent lower levels of consensus and have therefore not the same status as an International Standard.

ISO offers also the International Workshop Agreement (IWA) as a deliverable which aims to bridge the gap between the activities of consortia and the formal process of standardization represented by ISO and its national members. An important distinction is that the IWA is developed by ISO workshops and fora, comprising only participants with direct interest, and so it is not accorded the status of an International Standard.

2 Business Environment of ISO/TC 183

2.1 Description of the Business Environment

The following political, economic, technical, regulatory, legal and social dynamics describe the business environment of the industry sector, products, materials, disciplines or practices related to the scope of this ISO/TC, and they may significantly influence how the relevant standards development processes are conducted and the content of the resulting standards:

(a) General

The most important occurrence of copper, lead and zinc is as their sulfide ores. After mining and extraction, these ores are concentrated into products suitable for smelting which produces the elemental metals. Concentrates are normally traded internationally. Those who sell the concentrates are paid according to the levels of the base metals and the precious metals that they contain, together with potentially some penalty being applied for the presence of certain other deleterious elements. Nickel occurs in nature principally as oxides, sulfides and silicates.

(b) Copper

Copper's chemical, physical and aesthetic properties make it a material of choice in a wide range of domestic, industrial, and high technology applications. Copper is ductile, corrosion resistant, malleable, and an excellent conductor of heat and electricity. Alloyed with other metals, such as zinc (to form brass), aluminum or tin (to form bronzes), or nickel for example, it can acquire new characteristics for use in highly specialized applications. For instance, copper is used for conducting electricity and heat; communications; transporting water and gas; roofing, gutters and downspouts; protecting plants and crops, and as a feed supplement; and making statues and other forms of art.

Copper is the least vertically integrated of the major base metals. About half of all concentrates are sold to non-integrated custom smelters and to integrated smelters having spare capacity. Non-integrated miners pay a treatment and refining charge to smelters. Treatment and refining charges vary with supply and demand in the concentrate market but can differ with movements in the metal market. Consequently, the technical and refining share of the metal price will vary considerably.

Copper has the advantage of high by-product value in that gold is a usual by-product. Copper prices are affected by the price of other metals, stock levels, changes in production costs and technology advances.

Barriers to entry into the market are high capital costs for large deposits, the availability of alternative methods of producing copper and environmental concerns.

(c) Lead

The principal consumption of lead is for lead-acid batteries, which are used in vehicles, and in emergency systems (e.g. hospitals) as well as in industrial batteries found in computers and forklift trucks. Lead is also used in remote access power systems and load levelling systems as well as in compounds in the glass and plastics industries and for radiation shielding.

About 70% of refined lead on the market comes from secondary sources, such as metal produced by recycling lead-acid batteries at secondary smelters and the recycling of scrap lead at primary smelters. As long as these sources remain plentiful and cheap, the trend can be expected to continue.

The barriers to entry into the market are similar to those for copper.

(d) Zinc

Zinc's effectiveness in protecting steel against corrosion by galvanizing is well recognised, while the ability to die cast complicated components makes zinc indispensable in a multitude of industry and household products. It also has important markets in the brass and construction industries and in chemicals and constitutes an essential nutritional element.

Zinc is used in galvanized steel (60 %), die-casting (15 %), brass and castings (14 %), compounds (8 %) and others (3 %).

The barriers to entry to entry into the market are similar to those for copper and lead.

(e) Nickel

About 68% of world production is used in stainless steel. A further 10% is used for nickel-based and copper-based alloys, 9% for plating, 7% for alloy steels, 3% in foundries, and 4% in other applications such as in rechargeable batteries,[15] including those in electric vehicles (EVs).[16] Nickel is widely used in coins, though nickel-plated objects sometimes provoke nickel allergy. As a compound, nickel has a number of niche chemical manufacturing uses, such as a catalyst for hydrogenation, cathodes for rechargeable batteries, pigments and metal surface treatments.[17] Nickel is an essential nutrient for some microorganisms and plants that have enzymes with nickel as an active site.[18]

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Treadgold, Tim. "Gold Is Hot But Nickel Is Hotter As Demand Grows For Batteries In Electric Vehicles". Forbes. Retrieved October 14, 2020.
"Nickel Compounds" (PDF). Nickel Institute. Archived from the original on August 31, 2018.
Mulrooney, Scott B.; Hausinger, Robert P. (June 2003). "Nickel uptake and utilization by microorganisms". FEMS Microbiology Reviews. 27 (2–3): 239–261. doi:10.1016/S0168-6445(03)00042-1. PMID 12829270.

2.2 Quantitative Indicators of the Business Environment

The following list of quantitative indicators describes the business environment in order to provide adequate information to support actions of the ISO/TC:

The valuation of sulfide ores and concentrates (copper, lead, zinc, nickel) strongly depends on the accuracy and precision of weighing, sampling, and analytical methods. Variability in weighing methods, differences in sampling techniques, and inherent material heterogeneity significantly contribute to differences in commercial valuations when not adequately managed. Moisture loss and oxidation occurring during sampling, transport, drying, and sample preparation further affect analytical results and thus valuation accuracy and accompanying level of error.

Additionally, variability arises from analytical methods and laboratory practices. Different laboratories may utilize various analytical techniques - each possibly subject to method-specific biases and calibration discrepancies. Such methodological differences, without standardization, commonly lead to varying assay results for the same ore or concentrate lot, creating potential disagreements between trading partners. ISO standards mitigate these risks by providing clear, harmonized methodologies for weighing, sampling, sample preparation, and analysis, supported by the principles of Pierre Gy's Theory of Sampling. ISO standards establish procedures that enable trade ensuring that buyers, sellers, and laboratories operate using agreed-upon methods.

The adoption and application of these ISO standards improve fairness, transparency, and trust in ore and concentrate valuations. By adhering to harmonized procedures, all parties can obtain comparable, reliable, and authoritative results within recognized uncertainty limits, reducing disputes and facilitating smoother, more equitable transactions.

Quantitative Indicators of the Business Environment for Copper (Cu), Lead (Pb), Zinc (Zn), and Nickel (Ni) Ores and Concentrates

Copper (Cu)

Global mine production of copper was approximately 22 million metric tons in 2022, with Chile (5.2 million metric tons), Peru (2.2 million metric tons), the Democratic Republic of Congo (2.2 million metric tons), China (1.9 million metric tons), and the United States (1.3 million metric tons) as the top producers (International Copper Study Group, 2023). China is the largest importer, having imported 25.3 million tonnes of copper ore and concentrates in 2022 (National Bureau of Statistics of China, 2023). The major exporters, including Chile, Peru, and Mexico, exported copper ore and concentrates valued at approximately $28.8 billion to China in the same year (U.S. Geological Survey, 2023).

Lead (Pb)

The global production of mined lead was about 4.5 million metric tons in 2022. China contributed approximately 2.0 million metric tons, making up about 44% of the global output. Other significant producers include Australia, the U.S., Mexico, India, and Peru (International Lead and Zinc Study Group, 2023). The global lead concentrate trade is concentrated mainly in Asia and Europe, accounting for over 95% of the import volume. The United States was the largest exporter of lead concentrates in 2022, nearly exporting all its mine output (U.S. Geological Survey, 2023).

Zinc (Zn)

Global zinc mine production in 2022 was about 12.5 million metric tons. Key producers included China (4.0 to 4.2 million metric tons), Peru, Australia, India, the United States, Mexico, and Bolivia (U.S. Geological Survey, 2023). China is the largest importer of zinc concentrates, annually importing about 1.9 to 2.0 million tonnes of contained zinc. The estimated market value of global zinc concentrate output in 2022 exceeded $35 to $40 billion (International Lead and Zinc Study Group, 2023).

Nickel (Ni)

World nickel production reached approximately 3.16 million metric tons in 2022. Indonesia was the largest producer with about 1.6 million metric tons. Other significant producers included the

Philippines, Russia, New Caledonia, Australia, and Canada (International Nickel Study Group, 2023; U.S. Geological Survey, 2023). The Philippines exported approximately 29.3 million tonnes of nickel laterite ore in 2022, mainly to China. The global nickel production was valued between $75 and $80 billion, based on the average nickel prices in 2022 (International Nickel Study Group, 2023).

References

- International Copper Study Group. (2023). *Copper Market Report.*
- National Bureau of Statistics of China. (2023). *Annual Statistical Report.*
- U.S. Geological Survey. (2023). *Mineral Commodity Summaries.*
- International Lead and Zinc Study Group. (2023). *Lead and Zinc Statistics.*
- International Nickel Study Group. (2023). *Nickel Market Report.*

3 Benefits expected from the work of ISO/TC 183

The primary benefit of ISO/TC 183's work is the establishment of internationally harmonized standards for weighing, sampling, sample preparation, and physical and analytical testing applicable to copper, lead, zinc, and nickel ores and concentrates. These standards significantly reduce variability and uncertainty in measurement results, leading to greater consistency, transparency, and mutual trust between trading parties.

By adopting these standardized methodologies, trading partners can minimize commercial disputes arising from discrepancies in concentrate valuation, resulting in tangible cost savings and more efficient trade processes. Additionally, standardized procedures for determining Transportable Moisture Limit (TML) play a critical role in maritime safety, preventing cargo liquefaction incidents and thereby protecting human life, environmental integrity, and valuable assets.

The consistent use of ISO standards can also provide tangible Environmental, Social, and Governance (ESG) benefits. Transparent and standardized sampling and analytical practices enhance corporate governance and accountability, supporting responsible sourcing and traceability initiatives. Improved precision and consistency in measurement and valuation processes also enable better resource management, reduce waste, and contribute to more sustainable industry practices, aligning operations with evolving regulatory and stakeholder ESG expectations.

Overall, the activities of ISO/TC 183 deliver significant economic, operational, safety, and sustainability advantages to the global minerals and metals industry and its stakeholders.

4 Representation and participation in ISO/TC 183

4.1 Membership

ISO/TC 183 Copper, lead, zinc and nickel ores and concentrates

4.2 Analysis of the participation

ISO/TC 183 has 9 P (Participating) members:

Australia, Brazil, Chile, China, Germany, Iran, Islamic Republic of, Japan, Netherlands and Poland

And 26 O (Observing) members:

Algeria, Austria, Bulgaria, Czech Republic, Egypt, Finland, France, India, Indonesia, Ireland, Italy, Kazakhstan, Korea, Democratic People's Republic of Korea, Republic of Mongolia, Papua New Guinea, Philippines, Portugal, Romania, Russian Federation, Serbia, Spain, Tunisia, Türkiye, United Kingdom and Uzbekistan.

The core of the most active P members, Australia, Brazil, China, Japan and The Netherlands, covers a majority of trade within the industry, with involvement dictated by a need to have a level of control and input into the standard practices employed in the industry, thereby mitigating technical and commercial risks. Other P and O members have contributed significantly in the past and may do so again in the future. The current level of participation facilitates standard development and revision, and although more expert participation would be welcome, this is not seen as essential to ensure the future viability of the committee.

Broader participation is limited by the availability of technical experts and the level of employer sponsorship available to cover technical expert time and expenses associated with committee activities.

Major mining countries such as the United States and Canada, as well as key mineral resource suppliers from Southern Africa, are not participating. The mineral resource reserves and production volumes are not reflected in the participating countries, resulting in regional imbalances. Possible reasons include the presence of independent national standards such as ASTM in North America, which diminishes the importance of ISO standards. Additionally, the lack of institutional infrastructure, skilled personnel, and geopolitical issues in Southern Africa are considered contributing factors.

5 Objectives of ISO/TC 183 and strategies for their achievement

5.1 Defined objectives of the ISO/TC

The primary objectives of ISO/TC 183's is the establishment of internationally harmonized standards for weighing, sampling, sample preparation, and physical and analytical testing applicable to copper, lead, zinc, and nickel ores and concentrates. These standards are aimed at significantly reducing variability and uncertainty in measurement results, leading to greater consistency, transparency, and mutual trust between trading parties.

The published standards and standards under development can be found at:

ISO/TC 183 Copper, lead, zinc and nickel ores and concentrates

5.2 Identified strategies to achieve ISO/TC 183's defined objectives

The priority of the committee is to update existing and to develop new test standard methods of sampling and analysis.

New standards can be developed from existing National Standards with approval of the committee.

The committee's work is performed by WGs with participants from Member Bodies. This structure allows for the development of standards from proposal to publication.

Biennial meetings of ISO/TC 183 are held to receive reports from the WGs and hold WG meetings. WG meetings are held between biennial meetings as necessary to meet project delivery requirements. The biennial meetings also provide an opportunity for NMBs to present proposals from their industry sectors for new work.

The type of work produced by the committee is ideally suited to the WG model where NMBs nominate experts to participate in the work. SGs, AHGs and CAGs are initiated as required.

In the past, the development of standards related to the analysis methods and sampling techniques of trading components, focusing primarily on base metals, has been prioritized to establish smooth international transactions. Currently, the development of standards for the analysis methods of penalty elements using ICP-OES and AAS is being primarily advanced.

The validity of the standards is verified by conducting round-robin tests, referencing already established international standards such as DIN, GB, and JIS.

By utilizing online meeting systems and cloud-based document management systems for working group meetings, flexibility in working methods is ensured, allowing participation from various regions and overcoming geographical constraints.

Collaboration is conducted with other Technical Committees, such as TC102, TC155, TC 69/SC6, and TC 334.

6 Factors affecting completion and implementation of ISO/TC 183 work program

Once a WG is established the biggest factors impacting the development of a standard are:

- Limited time and resources available to WG conveners and NMB experts as most have competing demands in their employment,
- Lack of suitable Certified Reference Materials for method validation and performance specification programs,
- Changes in technology that impact the scope of work,
- Securing enough O and P countries and laboratories to meet minimum participation requirements.

A lack of alignment with the latest technologies is also a concern. If international best practices and the latest research findings are not reflected in the standards, it may lead to inconsistencies with other countries' standards and pose barriers to international trade.

7 Structure, current projects and publications of ISO/TC 183

Projects are prioritized based on the needs of the industry and resources available from the National Bodies.

The vast majority of business in this industry sector fall outside of the European Union and as such, the need to engage with European Regional Standardization processes is low.

The time allocated to each project by convenors over the life of a project varies depending on the scope of the project and the difficulty in completing the work required to fulfill the scope. Some of the more difficult projects have taken 20 years or more to complete, consuming many hundreds of hours of convenor time. The reasons for these exceptionally long project times are referred to in Section 6. At the other end of the spectrum are projects that are completed within the scheduled time scale of 3 years with several hundred hours of convenor time required.

The main stakeholders in projects developed by the committee are mining and smelting companies. These are well represented on the committee and also on National Member Bodies, facilitating extensive stakeholder engagement.

Information on ISO online

The link below is to the TC's page on ISO's website:
ISO/TC 183 Copper, lead, zinc and nickel ores and concentrates

Click on the tabs and links on this page to find the following information:
- About (Secretariat, Committee Manager, Chair, Date of creation, Scope, etc.)
- Contact details
- Structure (Subcommittees and working groups)
- Liaisons
- Meetings
- Tools
- Work program (published standards and standards under development)

Reference information

Glossary of terms and abbreviations used in ISO

General information on the principles of ISO's technical work