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

EXECUTIVE SUMMARY

Sulfide concentrates are produced in various particle sizes having different base metal and moisture contents and other chemical and physical characteristics that are used to evaluate and define the particular properties of the concentrate.

Concentrate prices and treatment charges are commonly settled by the base metal content. To evaluate a concentrate consignment, the base metal and moisture contents, as well as the total mass, must be determined.

Therefore, it is imperative have practical sampling and sample preparation methods based on scientific principles to collect and prepare representative samples for each lot. Such samples can then be tested using reliable standard methods for measuring base metal and determination of moisture content.

The scope of ISO/TC183 is standardization in the field of copper, lead, zinc and nickel ores and concentrates and smelter residues, including sampling, chemical analysis and physical testing.

The objectives are to supply International Standards that facilitate international trade in sulfide concentrates.

The validation of test methods is costly and time consuming, requiring specialized laboratory facilities and technical and scientific expertise in the field to carry out the work.

Copper is used in electrical applications (50%), general and industrial engineering applications (20%), building and construction (15%), transportation (11%) and other applications.

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.

Zinc is used in galvanized steel, protective coatings for steel, and die-casting. Zinc compounds are used for luminous dials, cosmetics, plastics, rubber products, soaps and inks.

The biggest use of nickel is as an alloying metal along with chromium and other metals in the production of stainless and heat-resisting steels. These are mostly used in industry and construction, but also for products in the home such as pots and pans and kitchen sinks.
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 programme 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 140 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 THE ISO/TC

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 prior to their smelting to produce the elemental metals, and it is these concentrates that 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 some penalty being applied for the presence of certain other elements.

Nickel occurs in nature principally as oxides, sulfides and silicates. Ores of nickel are mined in about 20 countries on all continents, and are smelted or refined in about 25 countries.

(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 used in electrical applications (50%), general and industrial engineering applications (20%), building and construction (15%), transportation (11%) and other applications.

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. Technical 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.

During the 1990s, alternative methods of copper production led to the lowering of demand for concentrate from sulfide mines. There are indications that this trend is likely to be reversed in future.

The top five copper-producing companies account for about 40% of world production and close to 50% of Western World production.

Copper has the advantage of high by-product value in that gold is a usual by-product. However, the reliance on by-products is not as strong as it is for other metals such as nickel. 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, leading to a lowering of demand for lead concentrate. Hence the concentrate market is currently in a state of over-supply. This could lead to a cutback on concentrate production in at least the short term.

Lead is used in storage batteries, paints, dyes, explosives, insecticides and rubber products. Because the first of these uses is the major one and because most lead-acid batteries are used in automobiles, lead demand is tied to automobile production. This will produce a continuing demand for lead, although the other lead uses are not in growth industries.

In October 2003, the international lead study group (ILSG) reported that the lead market was in surplus and was likely to remain so for the next few years, as refined lead production exceeds demand for the metal. The lead concentrate market seems also to be in surplus mainly due to increased mine production capacity in Australia. The level of mine production that exists in future will depend on the price of lead and its by-products such as silver, treatment charges and environmental issues.

China represents an interesting case in the lead market. Once a major importer, China became a major producer, but this corresponded with decreased demand. Hence China has a surplus of lead available for export.

Among the risks for the lead industry is the possibility of development of vehicles not requiring lead-acid batteries, increased production of lead as a by-product of zinc production and environmental/health concerns.

Barriers to entry into the lead market include low profit margins and environmental constraints.

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, protective coatings for steel, and die-casting. Zinc compounds are used for luminous dials, cosmetics, plastics, rubber products, soaps and inks.

Galvanizing accounts for nearly 50% of all zinc use. The increased demand for galvanized products is reflected in the growth in demand for zinc. However, increased mine capacity is likely to lead to a surplus of the metal. Meanwhile, the higher zinc prices encourage increased mine output.

The surplus of zinc will force the concentrate market into surplus also.

The barriers to entry into the industry are similar to those for lead.

e) Nickel

Nickel is widely used in over 300 000 products for consumer, industrial, military, transport/aerospace, marine and architectural applications. Nickel in coins is used in pure or alloy forms by many countries, or as bright and durable electrolytically applied coatings on steel (nickel plating). The biggest use, however, is as an alloying metal along with chromium and other metals in the production of stainless and heat-resisting steels. These are mostly used in industry and construction, but also for products in the home such as pots and pans and kitchen sinks. Stainless steels are produced in a wide range of compositions to meet special industry requirements for corrosion and heat resistance, and also to facilitate a clean and hygienic surface for food and other processing. In fact, about 65 per cent of nickel is used to manufacture stainless steels, and 20 per cent in other steel and non-ferrous (including "super") alloys, often for highly specialized industrial, aerospace
and military applications. About 9 per cent is used in plating and 6 per cent in other uses including coins and a variety of nickel chemicals.

Because sellers of concentrates are penalized for the level of certain elements being above specified values in their materials, TC 183 receives many requests to prepare methods for the determination of some of these elements. Although this work was initially deferred because of the need to concentrate on methods for the major elements, now that those projects have matured, the penalty element work receives much greater consideration. One of the problems is that different countries have differing ideas as to which penalty elements are of most concern and should be addressed first; it is not possible to take on too many of these projects at the same time. Furthermore, the concentrate type sometimes determines which are the most important elements. The need to determine each important element on each concentrate type could result in as many as 60 separate projects. Hence work to date has concentrated on the four most important elements, arsenic, mercury, fluorine and chlorine, by methods that can be used on all concentrate types. This is not an easy task, as the potential for other elements to interfere in these determinations is very great.

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:

Problems that occur in the weighing, sampling and analysis of sulfide concentrates include moisture loss in sampling systems, and oxidation during transport, drying and sample preparation.

The fact that the ores often have significant amounts of the precious metals, silver and gold, associated with them makes them even more valuable. The sheer value of these materials and the problems noted above make it desirable that International Standards be available for their sampling, weighing and analysis. When different laboratories using various techniques assay these products, differing results are obtained. The lack of standard methods of analysis is open to abuse by unscrupulous traders, who could have samples analysed by two different laboratories, the buyer accepting the lower values and the seller accepting the higher values.

Production of concentrates over the past five years is given in table 1.

<table>
<thead>
<tr>
<th>Year</th>
<th>Copper concentrates</th>
<th>Lead concentrates</th>
<th>Zinc concentrates</th>
<th>Nickel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>12,800</td>
<td>3,000</td>
<td>7,300</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>13,230</td>
<td>3,050</td>
<td>8,840</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>13,630</td>
<td>3,000</td>
<td>8,930</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>13,570</td>
<td>2,830</td>
<td>8,900</td>
<td>1,180</td>
</tr>
<tr>
<td>2003</td>
<td>13,630</td>
<td>3,100</td>
<td>9,560</td>
<td>1,200</td>
</tr>
<tr>
<td>2004</td>
<td>13,800*</td>
<td>3,050*</td>
<td>9,500*</td>
<td>1,280*</td>
</tr>
</tbody>
</table>

* Projected

The main producers of concentrates are given in table 2.
Table 2 — Producers of concentrates

<table>
<thead>
<tr>
<th>Country</th>
<th>Copper concentrates</th>
<th>Lead concentrates</th>
<th>Zinc concentrates</th>
<th>Nickel concentrates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of total</td>
<td>% of total</td>
<td>% of total</td>
<td>% of total</td>
</tr>
<tr>
<td>Australia</td>
<td>22</td>
<td>14</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>6</td>
<td>6</td>
<td>12,5</td>
<td>13</td>
</tr>
<tr>
<td>Chile</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>18</td>
<td>18,5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>8</td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td></td>
<td>4,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peru</td>
<td>10</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>19</td>
<td>17,5</td>
<td>10,5</td>
<td></td>
</tr>
</tbody>
</table>

Obviously, the customers for concentrates are those who produce the base metals copper, lead, zinc and nickel. The major producers and consumers of copper, lead, zinc and nickel are shown in tables 3 and 4 respectively.

Table 3 — Production of base metals

<table>
<thead>
<tr>
<th>Country</th>
<th>Production of copper % of total</th>
<th>Production of lead % of total</th>
<th>Production of zinc % of total</th>
<th>Production of nickel % of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>22</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td>9</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Chile</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>15</td>
<td>20</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>5</td>
<td>7,5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Republic of Korea</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td></td>
<td>4,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>22</td>
<td>23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4 — Consumption of base metals

<table>
<thead>
<tr>
<th>Country</th>
<th>Consumption of copper % of total</th>
<th>Consumption of lead % of total</th>
<th>Consumption of zinc % of total</th>
<th>Consumption of nickel % of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>11</td>
<td>8</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>6</td>
<td>6,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>9</td>
<td>4,5</td>
<td>7,5</td>
<td>30</td>
</tr>
<tr>
<td>North America</td>
<td>23</td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td></td>
<td>4,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>29</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Europe</td>
<td>27,5</td>
<td></td>
<td></td>
<td>35</td>
</tr>
</tbody>
</table>

The apparent refined copper balance for the first 4 months of 2004 showed a production deficit of 513,000 tonnes (t). This compares with a production deficit of 207,000 t in the same period of 2003. The reported drawdown of all stocks of refined copper for January to April 2004, 538,000 t, correlates well with the calculated production deficit. The refined market balance for April 2004 showed a deficit of 132,000 t. This compares to a deficit of 85,000 t after the inclusion of seasonal adjustments. World refined usage for the first 4 months of 2004 increased by 8.7% compared with that in January to April 2003. Refined copper usage in the January to April period increased in the Americas by 7.8% (United States +10.9%) and in Asia by 15.5% (China, +25.5%; Japan, +10.3%) compared with consumption of the equivalent period in 2003. The European Union’s apparent usage turned negative again in April, resulting in a 1.2% decline in the first 4 months of the year when compared with that of the first 4 month in 2003.

On the supply side, mine production decreased by 0.4% in the January to April 2004 period compared with that in January to April 2003. Production, however, is on an upward trend, with capacity utilisation, returning to 90% in April after falling to 80% and 83%, respectively, in January and February. By contrast capacity utilisation at refineries is still low at 81% and has hardly improved since the start of the year. In the year on year comparison, primary refined production rose by 0.9% in the first 4 month, while secondary refined (from scrap) production increased by 20.0%, reflecting the increased availability of scrap. In total, refined copper production increased by 2.9%.

At the end of June 2004, copper stocks held at each of the major metal exchanges (LME, COMEX, SHFE) totalled 241,724 t, a decline of 75,044 t over those of the previous month. Stock levels decreased at the warehouses of all these major metal exchanges. Exchange stock levels were down by 564,294 t compared to year-end 2003. The average LME cash price for June 2004 was US$ 2,686.7 per tonne, as compared with the May average of US$ 2,733.5 per tonne.

In 2003, the demand for refined lead metal exceeded supply by just less than 100,000 tonnes in the Western World. A rise in total world usage of refined lead metal of 1.1% was principally due to continued dynamic growth in China. Demand in the United States fell by 2.8% and in Europe by 1.3%. Global lead mine output decreased for the third year in succession. The fall in 2003 was 0.9%. Despite a significant 12.5% increase in China, global output of refined lead metal fell by 0.8% in 2003. This was primarily the result of the closure of a substantial volume of smelting and refining capacity in Europe, the United States and Australia. The proportion of refined lead metal
produced using recycled materials was a record 65%. London Metal Exchange stocks and stocks reported by producers in 2003 fell by 75,000 tonnes and 22,000 tonnes respectively.

A rise in world usage of refined lead metal of 1.1% in 2003 was principally due to continued dynamic growth in China. This was driven by the further rapid expansion of China’s vehicle fleet, increased exports of lead acid Starter, Lighting and Ignition (SLI) lead-acid batteries and significant investment in the telecommunications and IT sectors, which benefited demand for industrial batteries. In contrast, demand in the United States fell for the fourth year in succession. At 1.49 million tonnes, usage was 2.8% lower than in 2002 and 16% below the total achieved in 1999. This decline has been primarily a consequence of a rise in SLI battery imports, a trend towards longer life, better quality batteries and a slow pick up in the sales of industrial batteries after the IT boom at the end of the 1990s. European demand also remained disappointing, falling by 1.3% for reasons similar to those in the US.

Global lead mine output decreased for the third year in succession in 2003. The fall of 0.9% was due primarily to recent mine closures in Canada and Macedonia and reduced output from existing operations in Bulgaria, China, Poland and South Africa. Australia, China and the United States remained the largest producers of lead concentrates in 2003, between them accounting for over 60% of world output. Lead mine closures in Canada have resulted in a halving of the country’s output over the period 1999 to 2003. Chinese net imports of lead contained in lead concentrates from the West increased by 68% to a record 337,000 tonnes.

Total supply of refined zinc metal in the West exceeded demand by 118,000 tonnes in 2003. An increase of 2.5% in global usage of refined zinc metal in 2003 was principally due to further impressive growth in China driven by a strong rise in the demand for galvanised steel. Global zinc mine output rose by 4.1% with the largest three producing countries, China, Australia and Peru accounting for just under half of total output. Chinese net imports of zinc contained in zinc concentrates from the West exceeded 300,000 tonnes for the third successive year. A significant 5.9% fall in European refined zinc output, due to the closure of a number of large plants, was more than balanced by rises mainly in Asia. Chinese net exports of refined zinc metal to the West were 5% lower than in 2002. Inventories of refined zinc metal held in London Metal Exchange (LME) warehouses amounted to 740,000 tonnes at the year end, 89,000 tonnes higher than at the end of 2002. Reported producer stocks decreased by 13,000 tonnes.

An increase of 2.5% in global usage of refined zinc metal in 2003 was principally due to further impressive growth in China of 8.6%. Demand for zinc in the country continued to benefit from a strong rise in the demand for galvanised steel, clearly evident in the number of new galvanizing lines being built. Elsewhere in Asia small reductions in Japan and the Republic of Korea were more than balanced by rises in India, Taiwan (China), Thailand and Turkey. In the US, cutbacks in automotive output and a slowdown in investment in the non-residential construction sector reduced demand for galvanized steel. This influenced a reduction in usage of refined zinc of 6% compared to 2002. Demand in Europe rose by 2.9% in 2003 mainly due to increases in France, Germany and the Russian Federation.

Global zinc mine output rose by 4.1% in 2003. The largest three producing countries - China, Australia and Peru - accounted for just under half of total output. Latin American output continued to benefit from increases at the Antamina, Francisco Madero and Vazante mines located in Peru, Mexico and Brazil respectively, as well as investment in a number of other operations. Output in Namibia more than doubled as production at Anglo American’s 154,000 tonne per year Skorpion mine gathered momentum. A 12.5% rise in Europe was due primarily to the reopening of New Boliden’s Tara mine in Ireland at the end of 2002. Chinese net imports of zinc contained in zinc concentrates from the West totalled 327,000 tonnes, a similar level to that in both 2002 and 2001. Nickel production mainly increased in Oceania in the period 1997-2002. Strong world economic growth through the mid-nineties triggered an expansionary drive in nickel capacity by existing producers, resulting in a nickel production increase of 30% in the five years 1993-1998. In Europe, expansion in Finland and the United Kingdom accounted for most of the 48% or 60,000 t increase in production. In Oceania, Australia and New Caledonia accounted for all of the 39% or 35,000 t
increase in that area while Japan accounted for most of the 22% increase in production in Asia. New projects scheduled for completion, mainly in Australia, and further expansions by existing producers indicate further significant nickel production increases.

There has been volatility of the nickel price over the past decade. The economic collapse of the former East Bloc countries in the early nineties led to substantially lower nickel demand, which together with a massive destocking of nickel-bearing materials pushed exports to the West to an all time high. Nickel prices were driven lower than the cash costs of production, resulting in reduced nickel production in the West in 1993. A significant increase in exports from Russia in starting in the last half of 1996 and continuing throughout 1998 reversed the recovery of nickel prices occurring in 1994 and 1995.

3 BENEFITS EXPECTED FROM THE WORK OF THE ISO/TC

Sulfide concentrates are produced at various particle sizes having different base metal and moisture contents and other chemical and physical characteristics that are used to evaluate and define the particular properties of the concentrate.

Concentrate price is commonly settled by the base metal content. To evaluate a concentrate consignment, the base metal and moisture contents, as well as the total mass, must be determined.

Therefore, it is imperative have practical sampling and sample preparation methods based on scientific principles to collect and prepare representative samples from a lot. Such samples can then be tested using reliable standard methods for measuring base metal and determination of moisture content.

Sulfide concentrates are very hygroscopic, i.e. they absorb moisture from their surroundings. It is very important that the result of a determination, particularly for a major element, refers to the concentration of that element in the dry concentrate, and not the concentrate after absorption of moisture. It is on the basis of the concentration of metal in the dry concentrate that the value of a shipment is determined. It is therefore necessary to determine the amount of absorbed moisture in a concentrate sample at the time the major element is being determined. The dry-basis concentration can then be calculated. It has been shown that hygroscopic moisture contents of as little as 0.3% can cause dispute between buyers and sellers of concentrates.

As hygroscopic moisture determination is critical for all other analytical test methods, this became the first International Standard produced by TC 183 and it was published as ISO 9599:1991

Just as it is necessary to measure the moisture content of the test sample when carrying out chemical analysis, it is important to know the total moisture content of a shipment of concentrate. The material is traded on the basis of its dry mass and it is thus crucial that the bulk moisture be determined so that the dry mass can be calculated. Clearly, this measurement is fundamental to the industry. An International Standard ISO 10251:1997 was therefore developed.

International Standards prepared by ISO/TC 183 for sampling and chemical analysis ensure fair trade and competitive supply of sulfide concentrates.

The work of ISO/TC 183 also takes into consideration the environmental impact of the application of its International Standards and the safety and health of workers in the industry.

Benefits expected from the work of ISO/TC 183 include the following:

• Development of acceptable and validated standard methods in the most economical, scientific and practical way

• Elimination, or at least mitigation, of those barriers to sulfide concentrate trade caused by differences in standards, whilst assisting in furthering the aims of the World Trade Organization (WTO) Technical Barriers to Trade (TBT) agreement.
• Ability to respond quickly to the need for new or revised standards resulting from the development of new and improved metal production technologies and instrumentation to measure quality characteristics.

4 REPRESENTATION AND PARTICIPATION IN THE ISO/TC

4.1 Countries/ISO members bodies that are P and O members of the ISO committee

4.2 Analysis of the participation

ISO/TC183 has 36 members and the number of P-members is 14 (see annex A).

The most active participants in the work of TC 183 are experts from sulfide concentrate producers and consumers in P-member countries, who account for about 90% of production, 90% of exports and 70% of imports of concentrates traded internationally, as well as inspection agencies.

Thus, the major players in TC 183 are from concentrate exporting and importing countries. This means that the member organizations of TC 183 are appropriate for drafting International Standards to ensure fair international trading.

Realistically, however, only about half of the P members of TC 183 are active and attend meetings regularly.

5 OBJECTIVES OF THE ISO/TC AND STRATEGIES FOR THEIR ACHIEVEMENT

5.1 Defined objectives of the ISO/TC

The scope of ISO/TC183 is standardization in the field of copper, lead and zinc ores and concentrates and smelter residues, including sampling, chemical analysis and physical testing.

The objectives are to supply International Standards that facilitate international trade in sulfide concentrates by:

• Preparing, in a cost-effective manner, timely, safe and environmentally responsible International Standards of known and demonstrated precision and reliability, to meet the quality requirements and operating practices of the sulfide concentrate industry.

• Serving as a major instrument in achieving harmonization of the national sulfide concentrate standards of the various producers and consumer countries throughout the world.

• Assisting in the orderly international marketing of sulfide concentrates by having International Standards that are acceptable to, and used by, international trading partners.

• To draft International Standards based on industry best practices and sound scientific principles that meet industry requirements by:

• Developing new or revised International Standards that take into consideration new technology and instrumentation for measuring quality characteristics.

• Identifying and quickly responding to changing circumstances in sulfide concentrate technology and marketing requirements for new or revised standards, and anticipating possible future needs for standards of commercial relevance.

5.2 Identified strategies to achieve the ISO/TC’s defined objectives

The strategy is to establish appropriate working groups (WG) and, if necessary, study groups (SG) that are assigned responsibility for specific areas and standardization tasks covered by the scope of TC 183, including the effective organization of the available expertise and specialized laboratory facilities for standards development. Some key strategy issues are as follows:
a) **Timely and cost-effective drafting**
   - Effective use of electronic tools such as ISO templates, e-mail and web sites
   - Shortening of project timeframes by assigning clear targets
   - Effective communication and regular reporting of progress on work items by project leaders
   - **CONCURRENT PLENARY MEETINGS AND WG MEETINGS**
   - Forward planning of meetings and locations for four-year or six-year periods

b) **Timely drafting of International Standards that reflect market needs**
   - International Standards that reflect the evolution of the sulfide concentrate industry
   - Encouragement of increased participation of producers and consumers to provide the expertise needed to develop standards for this segment of international trade
   - Regular updating of standards to ensure their continued relevance

c) **Revision of published International Standards to comply with the current requirements**
   - Quality, environmental friendliness and safety in order to be usable in each country

d) **Investigation on implementation of International Standards**
   - Survey on implementation of International Standards by ISO/TC 183 member countries
   - Where the implementation of these standards is not high, clarifying why the International Standards are not used in those countries
   - Proposal developed of countermeasures based on investigations

e) **Promotion of participation in ISO/TC 183 from wide ranging areas**
   - To serve as an international forum to identify, prioritize, establish target dates, and obtain wide industry support to ensure sufficient level of active participation in the development of standards to meet the quality requirements and operating practices of the sulfide concentrate industry.
   - To promote and enhance collaboration among producers, users and experts in the field to develop by international joint effort acceptable and validated standards of commercial relevance.
   - To establish liaison with other technical committees involved with sampling of bulk minerals.
   - To establish liaison with ISO/TC 69 on statistical methods, because derivation of statistical data is an essential element of the International Standards prepared by TC 183

Another important area is that of transportable moisture limits (TML). To appreciate the need for a standard on TML, it is necessary to understand that concentrate cargoes are liable to moisture migration when on board ships. Such migration can cause the material to liquefy. The percent moisture content at which a flow state develops is called the flow moisture point, which is the parameter that is determined and from which a TML is derived. Usually, the moisture value is given to the ship’s captain, who decides whether he will accept the shipment.
At the time of establishing TC 183, members considered that a TML standard was needed, although specification of TML rested with the International Maritime Organization (IMO), which also uses a method for TML determination. Development of a standard thus required liaison with IMO and there was at that time no formal liaison in place between ISO and IMO. A type A liaison was soon established, affording TC 183 delegates the opportunity to attend IMO meetings.

In 1991, IMO published the flow table method in its *Code of safe practice for solid bulk cargoes*. The requirements of this procedure were added to the TC 183 draft procedure. The International Standard has been published as ISO 12742:2000.

TC 183 also recognizes the importance of weighing to the sulfide concentrates industry. Even where sampling and analysis can be carried out to a high degree of precision and accuracy, the value of a shipment will be incorrectly estimated if the weighing is not done properly. The usual method of draft survey is considered not sufficiently accurate for cargoes as valuable as concentrates. Draft surveys can be biased by as much as 0.3%.

Because the OIML is the body that produces international regulations for the control of measuring instruments, TC 183 has established a liaison with OIML. The two bodies have agreed on a number of issues, among them the need to ensure that weighing equipment is appropriately calibrated. TC 183 has developed a document on the precision of various methods being used. ISO 12745:1996 provides guidelines to test for bias in a range of mass-measurement techniques. It also allows for the estimation of precision for each technique.

Modern metallurgical plants require increasingly more precise chemical data, and the information is required on an increasing number of elements in the shortest possible timeframe. Apart from the requirements for efficient operation of the plant, more and more elements must be monitored for environmental purposes. One technique for achieving these objectives is that of X-ray fluorescence spectrometry (XRF). This technique is normally quick and simple, and therefore economical, in providing results; it is capable of high precision; it compares favourably with the best conventional techniques; it can handle wide concentration ranges; and it can be used to determine almost all of the elements of interest simultaneously.

As industry comes to rely more and more on XRF analysis, and as conventional methods are consequently scaled down, the time is opportune to develop International Standards for the analysis of sulfide concentrates by XRF.

TC 183 expects to prepare an International Standard for the analysis of sulfide concentrates by the use of XRF.

### 6 FACTORS AFFECTING COMPLETION AND IMPLEMENTATION OF THE ISO/TC WORK PROGRAMME

Although technical expertise and laboratory facilities are available, standardization work is usually given a low priority. Thus, it is often given little or no support and budgetary provision by the public and private sectors and relies heavily on spare time and voluntary effort of the experts involved.

The validation of test methods is costly and time-consuming, requiring specialized laboratory facilities and technical and scientific expertise in the field to carry out the work. This work is generally done at a slow pace, because most experts involved undertake it in addition to their regular work programme.

There is a lack of recognition that acceptable and validated test methods are often complex and expensive to develop. It is by international joint effort through an organization such as ISO that it is possible to develop these methods in the most economical, scientific and practical way.

There is also a lack of continuity of inputs by experts from member bodies into the work of TC 183, particularly in working groups, by individually appointed experts, due to job changes, retirement or the like. This could be crucial to the timely and successful completion of the specific tasks assigned to the various working groups.
An interesting observation that surfaces from time to time is that variations between printers around the world cause incompatibilities in the format of printed documents and different special characters are printed, e.g., Greek symbols. PDF format should be considered for circulation of CD, DIS and FDIS documents.

Regarding sampling in particular, in the process of discussions to develop or revise standards, there are sometimes substantial differences between current industry practice and correct scientific principles. In addition, commercial considerations can sometimes cloud the technical issues.

In chemical analysis, as technical people having the expertise to use some of the methods retire, they are not replaced by people who can contribute to revisions.

There is often unwillingness of people to accept project leadership.

There is general unfamiliarity of those preparing drafts with the ISO requirements regarding templates and drafting rules.

Non-availability of certified reference materials to evaluate test results effectively is quite common. In some countries, there is an inability (usually based on economic factors) to acquire specialized materials and equipment for certain tests.

Some countries have regulations that prevent the use of certain chemicals needed for some methods; replacement methods are not always available.

ISO has definite time frames for progress of work at various stages; these are not always consistent with the needs of inter-laboratory test programs required to validate chemical methods.

Failure of members to observe the time frames for return of votes and comments often affects timely progress.

7 STRUCTURE, CURRENT PROJECTS AND PUBLICATIONS OF THE ISO/TC

This section gives an overview of the ISO/TC’s structure, scopes of the ISO/TCs and any existing subcommittees and information on existing and planned standardization projects, publication of the ISO/TC and its subcommittees.

7.1 Structure of the ISO committee

7.2 Current projects of the ISO technical committee and its subcommittees

7.3 Publications of the ISO technical committee and its subcommittees

Reference information

Glossary of terms and abbreviations used in ISO/TC Business Plans

General information on the principles of ISO’s technical work