EXECUTIVE SUMMARY

Business environment

The iron ore industry is an important segment of the world economy, supporting the key industry of iron and steel making. The market addressed by ISO/TC 102 includes natural iron ores as well as processed ores, such as concentrates and agglomerates (sinters and pellets). It also includes direct reduced iron (DRI) whose iron content is enhanced by preliminary reduction.

The industrial players include iron ore producers, steel works that use iron ores, inspection agencies, shipping companies and trading companies. Their fields of activity extend worldwide, including 43 countries that produce 2,050 million tonnes of iron ore annually, and 64 countries that trade 1,420 million tonnes of ore annually.

Looking back over the past 12 years (2003-2014), the environment surrounding the iron ore industry has significantly changed. The production of iron ores increased by about +76% (1,164→2,050 million tonnes) and the world trade (exports) of them also increased by about +138% (595→1,418 million tonnes). Iron and steel production was augmented in response to the growth of the Chinese economy, accompanied by increased production of iron ores by reinforcement of facility capacity, development of new mining areas and expansion of associated infrastructure to correspond to the iron ore demand which is mainly attributable to the marked increase in demand from China.

For a significant portion of commercial transactions the change to the load port quality measurements which determine cargo value have placed a greater responsibility for correct sampling and measurements at these locations than may have hitherto been the case. Additionally, a blended brand of iron ore is emerging to cover the shortage of iron ore supply. More and more importance is given to the international standards. Along with advancing technology development at various facilities, appropriate response to the new and revised standards is urgently needed.

Benefits

Iron ore is evaluated against two criteria: chemical composition, mainly iron content; and physical properties in the iron making and DR processes. International standards developed by TC102 specify methods for the determination of these chemical and physical properties as well as the sampling and sample preparation of these materials. They ensure that the fair trade provisions stated in the WTO/TBT agreement are adhered to and also serve as important basis for quality control in iron ore production and iron and steel making processes, contributing to the world economy by facilitating the stable supply of steel.
Objectives and priorities

The primary mission of TC102 is to provide international standards that are equitable and practical for the many countries involved in the international trade of iron ores and DRI. It is important that the standards reflect the needs of iron ore and DRI producers and users, as well as take safety and environmental issues into consideration. TC102 and its sub-committees aim to supply standards in a timely and efficient manner, while addressing changes in circumstances such as a shift in ore resource and technical innovations.
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 Electro-technical, 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 THE ISO/TC 102

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:

2.1.1 General description of the market

The iron ore industry is an important segment of the world economy, supporting the steel industry.
It includes natural iron ores in the form of lump and fine ores, as well as processed ores, such as
concentrates and agglomerates (sinters and pellets) for use in the iron and steel industries.
The market addressed by ISO/TC 102 also includes direct reduced iron (DRI), a high grade feed
stock for iron and steel making obtained from the reduction of natural or processed iron ores,
without reaching melting temperature. The dominant form of traded DRI is hot briquetted iron (HBI).

2.1.2 Description of the market structure and the major market players

The users of International Standards developed by TC 102 are the iron ore and DRI producers and
consumers, inspection agencies, transport companies and trading companies.

2.1.2.1 Structure of the market: Producers

a) Iron ore
Iron ore producers are centered in South America (Brazil, Venezuela, Chile and Peru), Australia,
CIS (Ukraine, Russia and Kazakhstan), North America (USA, Canada and Mexico), China, India,
South Africa, Mauritania and Sweden.

b) DRI
The main producers are located in the natural gas-producing countries mentioned in 2.2. DR
technology using coal in place of natural gas as a reducing agent has been established, and at
present India is the biggest DRI producer in the world. In addition, the use of steel mills as a DRI
source used to be only DR pellet. However, the proportion using Lump ore is getting higher.

2.1.2.2 Structure of the market: Customers

Most of the large-scale integrated steel works are located primarily in developed countries.
DRI is mainly used in electric arc furnaces (EAF), one of the steel-making processes that does not
use blast furnaces. Therefore, total investment costs for this type of steel mill are less than those
for integrated steel works, and the scale of production is smaller. There are currently around 150
DRI plants in operation world-wide. Most DRI output is consumed in-house in EAFs located near
the DR plants.

2.1.3 Major factors that may have an impact on the development of the markets

Essentially, iron ore production increases in accordance with steel production, which rises with
world economic growth. Thus, the consumption of iron ore and DRI is influenced by world
economic growth.

Iron ore producers are expected to supply iron ore of a less fluctuated quality to customers.
Economical minable reserves at existing iron ore mines will eventually be exhausted, irrespective
of their size. Thus, a significant factor is how to maintain the supply of iron ore of the required
quality. Tasks to prepare for the expected exhaustion of quality ore resources and the expected
increase in demand for iron ore are the development of new ore sources and the investment in infrastructure and port facilities.

Most DRI products are consumed in-house. The main reason why DRI is not exported on a large scale is the higher transportation costs due to re-oxidization problems. DR processes that use coal as the reducing agent will also be extensively used in natural gas non-producing countries. At present almost all DR processes that use coal exist in India, and this has led to India becoming the world’s biggest DRI producer. Consequently, production and international trade in DRI will be increased, and, in order to solve the transportation issues, it is necessary to further standardize HBI, which is projected to become the dominant form of traded DRI.

Moreover, new processes, such as DR using coal and smelting reduction, may be increasingly used in developed countries as a means to secure an iron source replacing blast furnaces, or as a way to secure good quality ferrous scrap, in view of construction costs and environmental protection.

The market outlook for iron ore and DRI is summarized as follows:

- Growth in the demand for iron ore and DRI supported by economic growth.
- Necessity of existing facilities extension, new resource development and infrastructure establishment in preparation for expected exhaustion of quality iron ore and growing demand for iron ore, mainly among the emergent countries in the future.
- Expansion of DR with non-coking coal and of new processes such as smelting reduction processes, as ways of securing iron resources that can be utilized in place of blast furnaces.
- Increased responsibility for environmental issues.
- Continued rationalization of operations by the iron ore industry and the iron and steel industry to maintain its competitive position.

The impact of market trends on TC 102 is expected to be as follows:

- Increased needs for rapid, low cost, and environmentally friendly sampling and analysis methods.
- Development or revision of standards to meet the changes not only in measuring techniques but also in resources, manufacturing technology and qualitative requirements.
- Increased need for International Standards for HBI, and increased participation of DRI producers and consumers in TC 102.

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:

2.2.1 Description of the total market (See Appendix)

Both iron ore and DRI are used in the iron and steel industry as the raw material for steel. The soaring production of iron ore and DRI corresponds to the rise in steel production (See Table 1).

Iron ore is mainly used for blast furnace feedstock. It is used in the blast furnace and the basic oxygen converter process at integrated steel works.

DRI is the product of the direct reduction (DR) process by which iron ores are reduced partially or almost completely to metallic iron to form high grade feed for iron and steel making. It is used mainly as a substitute for ferrous scrap in EAF, which requires high quality iron units.
Iron ore production has grown significantly in the last ten years, recording an increase of 63% (or 790 million tonnes) in the period from 2004 to 2014. This growth was largely due to the increase of demand for Chinese steel industry.

Table 1 Trends in Global Production of Iron ore, Crude steel and DRI

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<tbody>
<tr>
<td>Iron ore (pellets)</td>
<td>1163.6 (284.3)</td>
<td>1255.6 (305.7)</td>
<td>1401.0 (307.0)</td>
<td>1578.6 (350.9)</td>
<td>1707.2 (378.5)</td>
<td>1720.0 (367.5)</td>
<td>1591.3 (298.1)</td>
<td>1881.9 (406.0)</td>
<td>1955.3 (456.3)</td>
<td>1952.5 (452.3)</td>
<td>2010.5 (469.6)</td>
<td>2049.7 (461.2)</td>
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<td>Pig iron</td>
<td>670.1</td>
<td>724.1</td>
<td>793.5</td>
<td>875.0</td>
<td>946.3</td>
<td>927.4</td>
<td>908.4</td>
<td>1034.3</td>
<td>1089.3</td>
<td>1112.5</td>
<td>1160.7</td>
<td>1180.6</td>
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<tr>
<td>Crude steel</td>
<td>969.9</td>
<td>1071.4</td>
<td>1147.8</td>
<td>1250.1</td>
<td>1348.1</td>
<td>1343.3</td>
<td>1238.3</td>
<td>1432.8</td>
<td>1537.2</td>
<td>1559.5</td>
<td>1649.3</td>
<td>1661.4</td>
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<tr>
<td>DRI</td>
<td>49.5</td>
<td>54.6</td>
<td>56.9</td>
<td>59.7</td>
<td>67.1</td>
<td>68.0</td>
<td>64.3</td>
<td>70.3</td>
<td>73.2</td>
<td>73.1</td>
<td>74.9</td>
<td>74.6</td>
</tr>
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(Source: UNCTAD, Midrex Technologies Inc.)

In 2014, total iron ore production, which includes pellet production, from 43 countries totalled 2050 million tonnes. 1418 million tonnes, equivalent to 69% of total iron ore production, were exported from 35 countries. The amount of iron ore as a trading product increased by about 138%, from 595 million tonnes in 2003 to 1418 million tonnes in 2014. (See Table 2)

Acid and fluxed pellets are also manufactured from iron ore for blast furnace feedstock. The total production of pellets was 461 million tonnes in 2014, equivalent to about 23% of total iron ore production. The main producing areas of pellets are North America (17%), CIS (15%) and South America (14%).

Table 2 Trends in Global Trade in Iron ore

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<tbody>
<tr>
<td>Export (pellets)</td>
<td>594.8 (117.4)</td>
<td>648.4 (123.7)</td>
<td>719.2 (136.6)</td>
<td>768.7 (131.8)</td>
<td>833.6 (140.7)</td>
<td>890.8 (131.5)</td>
<td>962.1 (100.6)</td>
<td>1076.6 (149.8)</td>
<td>1133.2 (153.3)</td>
<td>1162.2 (146.9)</td>
<td>1291.6 (136.0)</td>
<td>1418.1 (137.0)</td>
</tr>
<tr>
<td>Import</td>
<td>580.7</td>
<td>657.2</td>
<td>724.5</td>
<td>774.7</td>
<td>839.0</td>
<td>896.0</td>
<td>943.6</td>
<td>1035.8</td>
<td>1118.3</td>
<td>1163.1</td>
<td>1247.7</td>
<td>1396.6</td>
</tr>
</tbody>
</table>

(Source: UNCTAD)

In 2014, the main iron ore producing countries were Australia (723.7 million tonnes), Brazil (399.4), China (193.2), India (129.8), Russia (113.2), Ukraine (85.7), South Africa (66.9), USA (54.3), Iran (48.5), Canada (44.2), Sweden (28.1), Sierra Leone (21.4), Kazakhstan (21.3), Mexico (17.2), Mauritania (13.0) and Chile (13.0). Total amounts of production from these top fifteen countries accounted for 96% of world iron ore production.

In 2014, the main iron ore exporting countries were Australia (716.8 million tonnes), Brazil (344.4), South Africa (65.5), Ukraine (40.8), Canada (40.3), Sweden (23.6), Russia (23.0), Iran (22.0), Sierra Leone (21.4), Kazakhstan (15.2), Chile (14.1), Mauritania (12.6), USA (12.4), Peru (10.9), India (9.8) and Malaysia (9.8). Total amounts of exports from these top fifteen countries stood at 97% of world iron ore trade.

The total export of pellets was 137 million tonnes in 2014, equivalent to around 10% of total iron ore export and around 30% of total pellet production. The pellet exporting countries were Brazil (50.9 million tonnes), Sweden (17.5), Ukraine (16.5), Canada (14.0), Russia (10.0),
USA (9,7), Oman (6,4), Kazakhstan (5,5), Australia (2,6), Bahrain (1,4), India (1,3), Chile (1,0) and Venezuela (0,2). These 13 countries accounted for almost 100% of world pellet trade.

On the other hand, 42 countries import iron ore. In 2014, the top fifteen importing countries or economies were China (932,5 million tonnes), Japan (136,4), R. O. Korea (73,3), Germany (43,0), Taiwan (23,0), France (17,1), United Kingdom (14,5), Italy (9,5), Canada (9,2), Turkey (8,5), Saudi Arabia (8,2), Netherlands (7,3), Poland (7,4), Belgium-Luxembourg (6,7) and Argentina (6,4). Altogether, these fifteen countries or economies imported 1303 million tonnes, equivalent to 93 % of world iron ore trade. The main regions importing iron ore were Asia (88%) and Europe (10%).

The DRI industry is a relatively young segment, supporting the steel industry. World production has been expanding at increasing rates, from about 7 million tonnes in 1980 to 17,7 million tonnes in 1990, 43,8 million tonnes in 2000, 70,3 million tonnes in 2010 and 74,6 million tonnes in 2014. Production capacity was around 108,4 million tonnes in 2014.

In 2014, around 150 plants in 21 countries produced DRI. The top thirteen DRI-producing countries, whose production is more than 1,5 million tonnes/year, were India (17,31 million tonnes), Iran (14,55), Saudi Arabia (6,46), Mexico (5,98), Russia (5,35), Trinidad and Tobago (3,24), Egypt (2,88), Qatar (2,64), UAE (2,41), Venezuela (1,68), Argentina (1,67), South Africa (1,55) and Canada (1,55). This represented about 90% of world DRI production.

Many DRI-producing countries are located in petroleum-rich areas having ample supplies of natural gas for direct reduction. As a result, DRI production is centered in the Middle East (39%), Asia (25%), Latin America (17%), Africa (7%) and Russia (7%). As most DRI is for internal use, only 12,9 million tonnes, representing 17 % of total DRI production, was shipped in the form of HBI (5,2 million tonnes) and DRI (7,7 million tonnes) on the world market.
3. BENEFITS EXPECTED FROM THE WORK OF THE ISO/TC 102

Iron ore and DRI products come in various particle sizes with different iron and moisture content and other chemical and physical characteristics that are used to evaluate and define the particular properties of the iron ore and DRI under assessment.

Iron ore price is commonly decided by its iron units. To invoice an iron ore consignment, its iron and moisture content, as well as its total mass, must be determined. Therefore, for fair and equitable trade on a global basis, it is necessary to have practical sampling methods based on scientific principles and proper sample preparation so that representative samples can be collected and prepared from a lot that can then be tested using reliable standard methods for measuring total iron and determination of moisture content.

In other words, validated ISO/TC 102 International Standards of known and demonstrated precision for sampling, chemical analysis and physical testing are required to ensure fair and equitable trade in global markets. In this respect, TC 102/SC 1 is responsible for sampling methods, TC 102/SC 2 for methods of chemical analysis and TC 102/SC 3 for methods of physical testing of iron ores, DRI and HBI.

Iron ore changes its physical characteristics during the reduction process when subjected to high temperatures in the blast furnace. If the physical characteristics of iron ore during low and high temperature reduction are not satisfactory for blast furnace operation, difficulties arise. Physical testing of blast furnace feedstock to estimate the physical characteristics of iron ore is needed to ensure stable blast furnace operation.

In the field of DR, it is important to have physical testing methods to evaluate the quality of iron ore for DR processes, and for their product, DRI. In DR processes, physical testing methods are required to determine various physical characteristics of iron ores to help evaluate and select DR feedstock to ensure efficient DR process operation, and to maintain the production and quality of the product.

On the other hand, for the product "DRI", HBI in particular has become the dominant form traded internationally, and, as such, also requires a set of well established International Standards for global trade. Some of these have already been published.

TC 102 itself is also the custodian of the standard for the terminology used in the fields of iron ore and DRI/HBI. Standardization of the terminology and definitions is essential for effective communication and for avoiding misunderstandings within and between the various TC 102/SCs, WGs and SGs, as well as producers and consumers. Furthermore, TC 102 work takes into consideration the environmental impact of the application of its standards and the safety and health of operators.

Benefits expected from the work of ISO/TC 102 are summarized as follows:

- Development of acceptable and validated standard methods in the most economical, scientific and practical way
- Elimination, or at least mitigation, of those barriers to iron ore and DRI trade caused by differences in standards, whilst assisting in furthering the aims of the WTO/TBT agreement.
- Capability to respond quickly to the need for new or revised standards resulting from the development of processed iron ore and iron- and steel-making technologies as well as of the instrumentation to measure quality characteristics
- Contribution to stable blast furnace and DR operations through establishment of processes to precisely evaluate the quality of raw materials.
4. REPRESENTATION AND PARTICIPATION IN THE ISO/TC 102

4.1 Membership

http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=51012

TC102 has 39 members, of which 19 are P-members.

4.2 Analysis of the participation

The most active participants in the work of TC 102 are experts from iron ore producers and consumers in P-member countries, which account for about 87% of production, 89% of exports and 84% of imports of iron ore traded internationally, as well as inspection agencies. The major DRI-producing countries are also P-members of TC 102.

Thus, the major players in TC 102 are from iron ore exporting and importing countries. This means that the member organizations of TC 102 are the appropriate parties for drafting International Standards to ensure fair international trade. However, only about two-thirds of P-members regularly attend and actively participate in the programme of meetings of TC 102, its sub-committees, working groups and study groups, and the role of convener is invariably taken by the same four or five countries.

5. OBJECTIVES OF THE ISO/TC 102 AND STRATEGIES FOR THEIR ACHIEVEMENT

5.1 Defined objectives of the ISO/TC102

Based on the considerations above, ISO/TC 102 proposes the following objectives and strategic directions for its future work:

5.1.1 Provide equitable International Standards that facilitate international trade in iron ore and DRI by:

- Preparing in a cost-effective manner, timely, safe and environmentally responsible standards of known and demonstrated precision and reliability that meet the quality requirements and operating practices of the iron ore and iron and steel industries.
- Serving as a major instrument in achieving harmonization of the national iron ore and DRI standards of the various producer and consumer countries throughout the world.
- Assisting in the orderly international marketing of iron ore and DRI by having standards acceptable to and used by international trading partners.

5.1.2 Draft International Standards based on industry (iron ore industry, iron and steel 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 iron ore and DRI 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 sub-committees and their respective working groups (WG) and study groups (SG) that are assigned responsibility for specific areas and standardization tasks covered
by the scope of TC 102 including the effective organization of the available expertise and specialized laboratory facilities for standards development.

5.2.1 System organization for efficient drafting of standards

a) Reinforcement of project management functions (deliberate fulfilment in accordance with the convener’s manual)
   ➢ Screening, refinement and prioritization of standardization needs and objectives; confirmation of fundamentals at meetings (market needs, feasibility, particulars of necessary work, roles of each member participates, target date)
   ➢ Progress follow-up and go/stop judgment on standardization needs and objectives at meetings
   ➢ WD enhancement (elaborate review in WG, particularly for work requiring international co-operative test)

b) Work streamlining
   ➢ Effective use of electronic tools such as ISO templates and ISO TC servers
   ➢ Concurrent plenary meetings and SC meetings
   ➢ Joint SC meetings to co-ordinate common activities
   ➢ Forward planning of meetings and locations for two-year periods
   ➢ Clear network of organized bodies (Secretariat-member bodies-mirror committees, experts)
   ➢ Draft review by editing committee (for formatting and comparability with other standards)

5.2.2 Developing International Standards relevant to the market

a) Concentration on market needs by developing standards that reflect the evolution of the iron ore and DRI industries
   ➢ Encouragement of increased participation of DRI 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

b) Revision of published ISO standards to comply with current requirements
   ➢ Quality, environmental friendliness and safety for use in each country

c) Investigation of the implementation of ISO standards developed by ISO/TC 102
   ➢ Survey on implementation of ISO standards by ISO/TC 102
   ➢ Clarifying why the ISO standards are not used in each member country in case the level of implementation of ISO standards developed by ISO/TC 102 members is not high
   ➢ Development of countermeasure proposals based on the implementation investigations

5.2.3 Promotion of participation in ISO/TC 102 from a wide range of areas

a) To serve as an international forum to identify, prioritize, establish target dates, and obtain wide industry support to ensure a sufficient level of active participation in the development of standards to meet the quality requirements and operating practices of the iron ore and DRI industry.

b) To establish liaison with other TCs involved with sampling of bulk minerals, particle sizing and chemical analysis

5.2.4 Utilization of Advisory group

a) Establishment of basic TC 102 policy
b) Deliberation of important TC 102 issues and advice to each SC
6. FACTORS AFFECTING COMPLETION AND IMPLEMENTATION OF THE ISO/TC 102 WORK PROGRAMME

Experts from member countries engaged in standardization work that is given a low priority on ISO standards undertake the work in addition to their regular work programs in their spare time.

Distilling the points after the current meeting is required to facilitate all the participants towards the given subjects using limited time effectively. Completion, sharing and management of W/S are also indispensable to achieve the goal of each WG/SG by the next meeting to be held 2 years later.

Details are described by the convener’s manual approved and registered as TCR15. Active and reliable promotion is requested in accordance with the manual.

Lack of sharing information related to promoting works between the experts without timely completion of W/S influences application of work programs. Therefore, creation and execution of work plans following the convener’s manual are quite essential.
7. STRUCTURE, CURRENT PROJECTS AND PUBLICATIONS OF THE ISO/TC 102

Information on ISO online

The link below is to the TC’s page on ISO’s website:

http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=51012

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

Reference information

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

General information on the principles of ISO’s technical work
Fig. 3 Export of Iron Ore

- Peru
- Mauritania
- United States
- Indonesia
- Chile
- Iran
- India
- Kazakhstan
- Sweden
- Russian Federation
- Canada
- Ukraine
- South Africa
- Brazil
- Australia
- Total World

Fig. 4 Import of Iron Ore

- Poland
- Netherland
- Belgium/Luxembourg
- Canada
- Argentina
- Turkey
- United Kingdom
- Italy
- France
- Russian Federation
- China, Taiwan P
- Germany
- Korea R
- Japan
- China
- Total World
Note:

- **Oceania**: Australia, (New Zealand)
- **EU**: Germany, (Sweden)
- **CIS**: Russia, (Ukraine)
- **Africa**: Egypt, Libya, South Africa and Nigeria
- **Middle East**: Iran, Qatar, Saudi Arabia and (Iraq)
- **Asia**: China, India, Indonesia, Malaysia, Myanmar and (Viet Nam)
- **North America**: Canada, Mexico and USA
- **South America**: Argentina, Brazil, Peru, Trinidad and Tobago, and Venezuela

( ): No actual production record for the last five years

Data resource: MIDREX TECHNOLOGIES INC.