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Calculation method of carbon dioxide emission intensity from iron and steel production —

Part 4:
Guidance for using ISO 14404 family

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee [or Project Committee] ISO/TC [or ISO/PC] ###, *[name of committee]*, Subcommittee SC ##, *[name of subcommittee]*.

This second/third/... edition cancels and replaces the first/second/... edition (ISO #####:####), which has been technically revised.

The main changes compared to the previous edition are as follows:

— xxx xxxxxxx xxx xxxx

A list of all parts in the ISO ##### series can be found on the ISO website.

Introduction

The steel industry recognizes the urgent need to take actions concerning climate change. Slowing and halting global warming requires reductions in GHG emissions on a global scale. To play a part in achieving these reductions, it is necessary for steel plants to identify the amount of CO_2 emitted during the production of steel products, in order to identify next opportunities for reduction of CO_2.

As the calculation methods for CO_2 emission and intensity in iron and steel industry, ISO 14404-1 (for steel plants with blast furnace) and ISO 14404-2 (steel plants with electric arc furnace) were published in 2013, and ISO 14404-3 (for steel plants with electric arc furnace and coal-based or gas-based direct reduction iron facility) was published in 2017.

ISO 14404 family specifies calculation methods for the carbon dioxide (CO_2) intensity of a steel plant from the amounts of the major inputs (purchased items) and outputs (sold items), such as natural resources, intermediate products, and energy. The concept is shown in Figure 1 —.

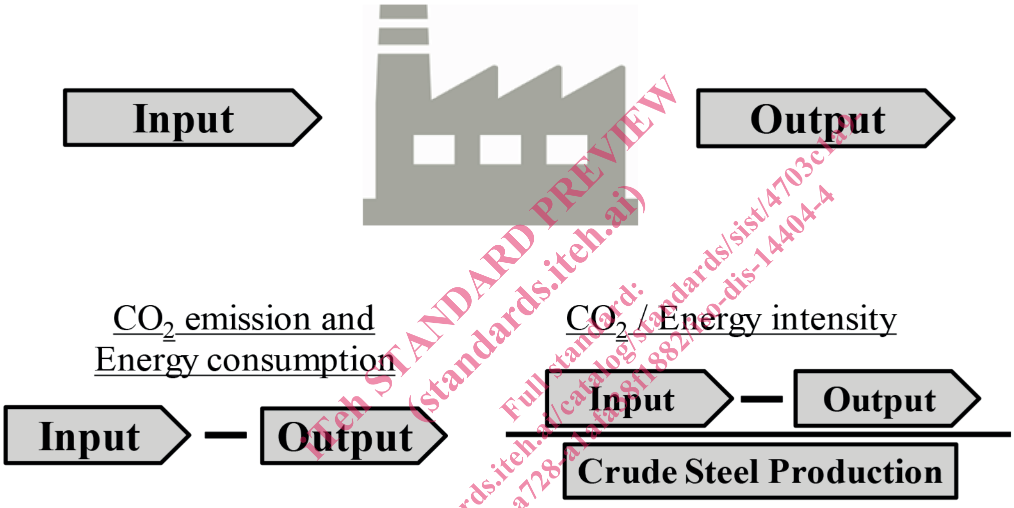

Figure 1 — Conceptual diagram of calculation method in ISO 14404 family

This calculation method only uses basic imports and exports that are commonly measured and recorded by the plants; thus, the method requires neither the measurement of the specific efficiency of individual equipment or processes nor dedicated measurements of the complex flow and recycling of materials and waste heat. In this way, the calculation method ensures its simplicity and universal applicability without requiring steel plants to install additional dedicated measuring devices or to collect additional dedicated data other than commonly used data in the management of plants.

In addition, ISO 14404 family provides the guidance to consider the activities in the boundary that are located outside of the site boundary by considering the upstream emissions of the intermediate products produced in such “outsourced steel production activities”. The conceptual diagram of boundary and site boundary is shown in Figure 2 —.

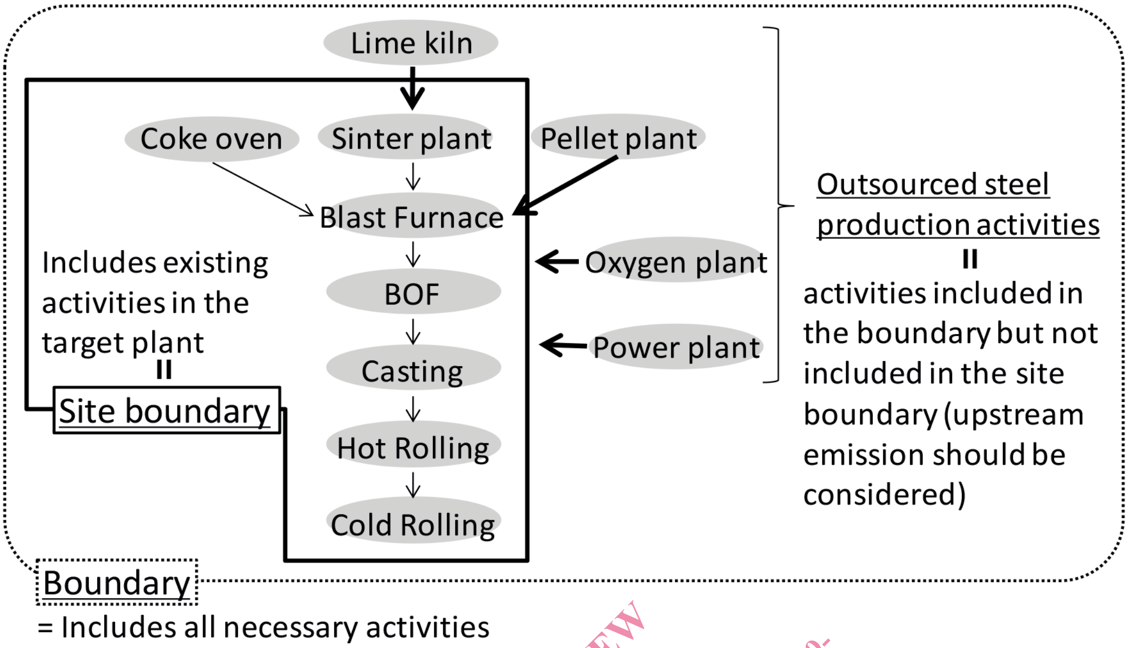

Figure 2 — Conceptual diagram of boundary and site boundary

Intermediate products with possibilities of considering upstream emissions include the following:

— Electricity / steam

— Substances produced in the basic activities existing in the target process route (eg purchased coke used in the BF - BOF route)

— Substances that substitute the iron source of the process route even if they do not exist in the target process route (eg purchased DRI used in the BF - BOF route)

ISO 14404 family is based on "CO_2 Emissions Data Collection User Guide" established by the World Steel Association (worldsteel), which consists more than 161 major steel companies in 60 countries and regions of the world. Actual data collection among worldsteel members has been conducted yearly based upon this guide since 2007. While ISO 14404 family and worldsteel "CO_2 Emissions Data Collection User Guide" share the same concept, they have different characteristics where the worldsteel's User Guide provides the method suitable for collecting data from steel plants across the world in a uniform way, and ISO 14404 family provide methods suitable for the evaluation of CO_2 intensity of steel plant for each process route (i.e. combination of iron source and steelmaking process).

Therefore, while worldsteel method applies common boundary and CO_2 emission factors to all steelworks regardless of their process routes, ISO 14404 family defines the boundary, CO_2 emission factors and intermediate products for which upstream emissions are considered for each of the process routes, such as BF-BOF (part 1), Scrap-EAF (part 2) and DRI-EAF (part 3).

ISO 14404 part 4 provides the guidance for calculating the CO_2 intensity at all types of steel plants, including steel plants with process routes not covered in ISO 14404-1, 2, 3 (steel plants with process routes other than BF - BOF, Scrap - EAF, DRI - EAF) as well as steel plants with multiple process routes, by defining the boundary, CO_2 emission factors and the intermediate products for which upstream emissions are considered for each of all types of steel plants. ISO 14404 part 4 also includes Universal Calculation Sheet, which covers all relevant emission sources from ISO 14404-1, 2, 3, to assist the calculation of CO_2 emissions.

Moreover, ISO 14404 part 4 provides additional guidance to the entire ISO 14404 family for the following topics, which have not been covered by ISO 14404-1, 2, 3.

a) Evaluation of exported slags

b) Evaluation of by-product gas

c) Evaluation of stock

d) Selection of calorific values and emission factors for electricity and fuel

Calculation method of carbon dioxide emission intensity from iron and steel production —

Part 4:
Guidance for using ISO 14404 family

1 Scope

ISO 14404 part 4 provides the guidance for calculating the CO_2 intensity at steel plants with all types of process routes, by defining the boundary, CO_2 emission factors and the intermediate products for which upstream emissions are considered for all types of process routes. In particular, ISO 14404 part 4 provides the guidance to apply ISO 14404 family to following types of steel plants. ISO 14404 part 4 also includes Universal Calculation Sheet, which covers all relevant emission sources from ISO 14404-1, 2, 3, to assist the calculation of CO_2 emissions.

i. Steel plants with different process routes from ISO 14404-1, 2, 3 (7.2.1)

ii. Steel plants with more than one process route (7.2.2)

iii. Steel plants purchasing pig iron from the outside (7.2.3)

iv. Steel plants and rerollers purchasing part or all of crude steel from outside (7.2.4)

Moreover, ISO 14404 part 4 provides additional guidance to the entire ISO 14404 family for the following topics.

a) Evaluation of exported slags

b) Evaluation of by-product gas

c) Evaluation of stock

d) Selection of calorific values and emission factors for electricity and fuel

Conversion to energy consumption and to consumption efficiency can be obtained using Annex A.

While the use of the calculation result is outside Scope of this standard, appropriate applications and inappropriate application are recommended in Annex B.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 Emissions

3.1.1
emission source
process emitting CO_2 during the production of steel products

Note 1 to entry: There are three categories of CO_2 emission sources: direct, upstream and credit. Examples of emission sources that are subject to this document are given in 3.1.2, 3.1.3 and 3.1.4.

3.1.2
direct CO_2 emission
CO_2 emissions from steel production activity inside the boundary

Note 1 to entry: Direct CO_2 emission is categorized as "direct GHG emissions" in ISO 14064-1.

3.1.3
upstream CO_2 emission
CO_2 emissions from imported material related to outsourced steel production activities outside the site boundary and from imported electricity and steam into the site boundary

Note 1 to entry: CO_2 emissions from imported material in this term are categorized as "other indirect GHG emissions" in ISO 14064-1.

Note 2 to entry: CO_2 emissions from imported electricity and steam in this term are categorized as "energy indirect GHG emissions" in ISO 14064-1.

3.1.4
credit CO_2 emission
CO_2 emission that corresponds to exported material and electricity or steam

Note 1 to entry: Credit CO_2 emission is categorized as "direct GHG emissions" in ISO 14064-1.

3.2 Gas fuel

3.2.1
natural gas
mixture of gaseous hydrocarbons, primarily methane, naturally occurring in the earth and used principally as a fuel

3.2.2
coke oven gas
COG
gas recovered from coke oven

3.2.3
blast furnace gas
BFG
gas recovered from blast furnace

3.2.4
BOF gas
LDG
gas recovered from basic oxygen furnace (Linze Donawitz converter)

Note 1 to entry: BOF: basic oxygen furnace

3.2.5
town gas
fuel gas manufactured for domestic and industrial use

3.2.6
COREX gas
gas recovered from COREX

3.2.7
Other gas
gas other than natural gas, coke oven gas, blast furnace gas, BOF gas and town gas

3.3 Liquid fuel

3.3.1
heavy oil
No. 4 to No.6 fuel oil defined by ASTM

Note 1 to entry: ASTM: American Society for Testing and Materials.

3.3.2
light oil
No. 2 to No.3 fuel oil defined by ASTM

3.3.3
kerosene
paraffin (oil)

3.3.4
LPG
liquefied petroleum gas

3.4 Solid fuel

3.4.1
coking coal
coal for making coke, including anthracite

3.4.2
BF injection coal
pulverized coal injection (PCI) coal, including anthracite

Note 1 to entry: BF: blast furnace

3.4.3
sinter coal
BOF coal
coal for sinter/BOF, including anthracite

3.4.4
EAF coal
coal used for an electric arc furnace (EAF), including anthracite

3.4.5
steam coal
boiler coal for producing electricity and steam, including anthracite

3.4.6
coke
solid carbonaceous material

3.4.7
charcoal
devolatilized or coked carbon neutral materials

EXAMPLE Trees, plants.

3.4.8
SR/DRI coal
coal used for smelting reduction (SR, including COREX)/ direct reduction iron (DRI), including anthracite

3.4.9
Other coal
coal other than steam coal, coking coal, BF injection coal, sinter coal, EAF coal, coke, charcoal and SR/ DRI coal

3.5 Auxiliary material

3.5.1
limestone
calcium carbonate
$CaCO_3$

3.5.2
burnt lime
CaO

3.5.3
crude dolomite
calcium magnesium carbonate
$CaMg(CO_3)_2$

3.5.4
burnt dolomite
$CaMgO_2$

3.5.5
electric arc furnace graphite electrodes
EAF graphite electrodes
net use of EAF graphite electrodes or attrition loss

3.5.6
nitrogen
N_2
inert gas separated from air at an oxygen plant, imported from outside the boundary or exported to outside the boundary

3.5.7
argon
Ar
inert gas separated from air at an oxygen plant, imported from outside the boundary or exported to outside the boundary

3.5.8
oxygen
O_2
gas separated from air at an oxygen plant, imported from outside the boundary or exported to outside the boundary