Guidelines for Accounting and Reporting Greenhouse Gas Emissions China Mining Enterprises (Trial)

Instructions

I. Purposes and Significance of the Guidelines

In order to fully implement the goals of “establishing and improving a system for calculating the Greenhouse Gas (GHG) emissions and gradually creating a carbon emission trading market” as stipulated by the Planning Outline of the 12th Five-Year Plan of National Economy and Social Development in People's Republic of China, in conformity with the requirement of the Planning Outline for Greenhouse Gas Emission During the 12th Five-Year([2011]41) by the State Council, with the aim "to establish accounting system of greenhouse gas at national, local and enterprise level and to allow key enterprises to directly submit statistics about energy supply and greenhouse gas emission,” the National Development and Reform Commission (NDRC) presided over the redaction of Guidelines for Accounting and Reporting Greenhouse Gas Emissions China Mining Enterprises (Trial) (the Guidelines).The applicable targets of this document are mining enterprises except mining of coal, oil and gas. The Guidelines provide methods and standards for the accounting and reporting their greenhouse gas emissions, to help enterprises come out with a more comprehensive and precise account of greenhouse gas emissions and facilitate the establishment of a better greenhouse gas emissions control plan and policies about carbon emission permits trading. The Guidelines also provide technical support for competent authorities when they organize work on reporting of greenhouse gas emissions by key enterprises, help them improve their knowledge on practical issues of greenhouse gas emissions and thereby formulate appropriate policies.

II. Preparation Process

The Guidelines are drafted by National Center for Climate Change Strategy and International Cooperation (NCSC), as commissioned by the NDRC. The authors of this document analyzed research results and practical experiences about greenhouse gas

emissions of enterprises at home and abroad, and referred to the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* published by the Inter-governmental Panel on Climate Change and *Provincial Guidelines on the Compilation of Greenhouse Gas Inventories* (Trial) published by NDRC. After field research and intensive studies, the NCSC developed the *Guidelines for Accounting and Reporting Greenhouse Gas Emissions China Mining Enterprises* (Trial). Efforts have been made to ensure that the Guidelines are scientific, comprehensive, standardized and practicable. Great support has been provided by China Mining Association and China Non-Metallic Materials Industry Association during the formulation of this document.

III. Main Contents

The *Guidelines for Accounting and Reporting Greenhouse Gas Emissions China Mining Enterprises* (Trial) incorporate a main text and two appendixes. The main body contains seven sections, which elaborate the application scope of the Guidelines, cited documents and references, terminology and definitions, accounting boundary, accounting methodology, quality assurance and documentation, and report contents and format. This document covers mainly emissions of carbon dioxide from burning of fossil fuels, decomposition of nitrates, amount of carbon dioxide absorbed during the carbonization process, and net purchase use of electricity and heat.

IV. Issues that need Clarification

An enterprise subject to the Guidelines should consider its corporate legal person as the accounting boundary and report the greenhouse gas emissions from all equipment under its control. Enterprises need to provide activity levels and emission factors for review and verification. Enterprises should conduct actual measurement of their activity level and emission factor data if possible. For the convenience of

users, with reference to *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, *Good Examples of List of Greenhouse Gases and Uncertainty Management for IPCC Nations*, *Provincial Guidelines on the Compilation of Greenhouse Gas Inventories (Trial)* and other documents, the Guidelines provide parameters of some common fossil fuels and emission factor recommended values of other emission sources for those enterprises unable to conduct actual measurement.

Considering the fact that GHG emission accounting and reporting are a completely new and complicated endeavor, some inadequacies may be found in practical application of the Guidelines, and it is hoped that those application units may provide their feedbacks in a timely manner, all aimed at making further revisions in the future.

The National Development and Reform Commission issued the Guidelines and is responsible for their explanation and revision.

Contents

1. Application Scope

The Guidelines apply to the accounting and reporting of greenhouse gas emissions from mining enterprises in China. Enterprises that conduct mining, mineral separation or processing of ferrous metal, non-ferrous metal, non-metal ores and other minerals can calculate their greenhouse gas emissions in accordance with this document and prepare their emission report. For enterprises that do not participate in the above-mentioned business but emit greenhouse gases, they should prepare their emission report in accordance with the accounting methods and report guidelines for their industry.

2. References

Reference documents include mainly:

General Rules about Accounting and Report of greenhouse gas emissions by Industrial Corporations

Provincial Guidelines on the Compilation of Greenhouse Gas Inventories (Trial)

Research on List of Greenhouse Gases in China in 2005

2006 IPCC Guidelines for National Greenhouse Gas Inventories

GB17167 General Principle for Equipping and Managing of the Measuring Instrument of Energy

GB/T 213 Measurement Methods for Calorific Value of Coal

GB/T 384 Measurement Methods for Calorific Value of Petroleum Products

GB/T 22723 Measurement of Calorific Value of Natural Gas

GB/T 476 Measurement Methods for Carbon and Hydrogen in Coal

SH/T 0656 Measurement of Carbon, Hydrogen and Nitrogen in Petroleum Products and Lubricants

GB/T 13610 Analysis on Composition of Natural Gas (GC)

GB/T 8984 Measurement of carbon monoxide, carbon dioxide and hydrocarbon in Gases (GC)

GB/T 3286.1 Chemical Methods of Analysis on Lime Stone and Dolomite: Measurement of Calcium Oxide and Magnesium Oxide

GB/T 3286.9 Chemical Methods of Analysis on Lime Stone and Dolomite: Measurement of Carbon Dioxide

3. Terminology and Definitions

The following terminology and definitions apply in the Guidelines:

3.1 Greenhouse gases (GHGs)

Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere and clouds. The greenhouse gases herein refer to six types of greenhouse gases controlled under the Kyoto Protocol, namely, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs),and sulfur hexafluoride (SF_6).

3.2Reporting entity

A reporting entity refers to an enterprise or independent accounting unit regarded as a legal person, which has performed as a GHG emission actor and therefore should calculate and report its GHG emissions.

3.3 Mining enterprises

Mining enterprises refers to enterprises whose major business is mining, mineral separation and processing of ferrous metals, non-ferrous metals, non-metal ores or other minerals.

3.4 Emissions from fossil fuel burning

Emissions from fossil fuel burning refer to the greenhouse gas emissions generated by the burning of fossil fuels for the purpose of generating energy.[1]

3.5 Emissions from the decomposition of nitrates

Emissions from the decomposition of nitrates refer to carbon dioxide emissions generated by the process of roasting or calcination of carbonate ores (limestone, dolomite, magnesite, etc.).

3.6 Carbon dioxide absorbed in the carbonation process

Carbonation refers to the process of channeling CO_2 produced by the burning of fuels and calcination of nitrates into a carbonation tower, so as to produce pure nitrate products or purify ores. The amount of carbon dioxide absorbed in the process of carbonation should be subtracted from the total emissions of the enterprise.

3.7Emissions from net purchased electricity and heat

Emissions from net purchased electricity and heat refer to equivalent CO_2 emissions from net purchased electricity and heat (steam, hot water).

3.8 Activity level

Activity level refers to the activity undertaken by a reporting entity during a reporting period that leads to greenhouse gas emissions or reduction, such as the amount of burned fossil fuels, calcinated ores, the amount of out-purchased electricity and out-purchased steam.

[1]The purpose of burning fossil fuels is to provide heat or mechanical work for certain processes.

3.9 Emission factor

An emission factor refers to the factor used to quantify GHG emissions per unit of activity level. An emission factor is usually obtained through sampling measurement and statistical analysis and reflects the discharge rate or reduction rate at a certain activity level in the given condition.

3.10Carbon oxygenation efficiency

Carbon oxygenation efficiency refers to the percentage of oxygenated carbon in fuels containing carbon in the process of burning.

4. Accounting Boundary

4.1 Enterprise boundary

An enterprise with a legal person status or a unit that can be deemed a legal person is the boundary for accounting and reporting GHG emissions and for accounting and reporting the greenhouse gas emissions from all the equipment under their operational control.[2] The range of operational control includes direct production systems, auxiliary production systems and affiliated production systems. Direct production system includes mining, mineral separation, processing and other production processes. Auxiliary production system includes the ventilating system, transport system and drainage system for the direct production system, as well as power, electricity supply, water supply, heating, cooling, machine maintenance, assay, instrument, ware house, etc. Affiliated production system includes production command and management system and other departments and units at service for the production department (such as staff canteens and bathrooms).

4.2 Emission sources and types of gases

[2]If the reporting entities have the power to decide to put forward and carry out policies concerning certain equipment or business, then it has operation control over this equipment or business.

The reporting entities should determine the emission sources and gas types that need to be accounted and reported, including:

4.2.1 CO_2 emissions from burning of fossil fuels refer to carbon dioxide emissions during the process in which fossil fuels burn in stationary or mobile equipment. The main equipment and devices used in mining enterprises include industrial boiler, furnace, calcinator, chain-and-grid conveyer, sintering machine, stove, diesel rock drill, forklift, bulldozer, dump truck, etc.

4.2.2 CO_2 emissions from decomposition of nitrates refer to carbon dioxide emissions in the process of roasting or calcination of carbonate ores (limestone, dolomite, magnesite, etc.). The decomposition of nitrates occur in such processes as sintering of iron ores, using carbonates as solvent, roasting calcareous phosphate rock, calcinating camsellite or boron ores with carbonate, calcinating lime stone to make quick lime, burning dolomite to make light-burnt dolomite, and calcinating magnesite in order to produce light-burned magnesium, dead-burned magnesium and magnesium oxide. If these processes occur within the boundary of the enterprise, it must account and report the amount of carbon dioxide emissions in accordance with the *Guidelines on Accounting and Reporting of Greenhouse Gas Emission in Chinese Steel Companies*.

4.2.3 CO_2 absorbed in the carbonization process refers to the production process of light calcium carbonates, light magnesium carbonate, barium carbonate, strontium carbonate, lithium carbonate and other carbonates includes calcination, slaking, carbonization, sedimentation (filtration), and desiccation. The amount of absorbed carbon dioxide in the process of carbonization should be removed from the total emissions of the enterprise.

4.2.4 Potential CO_2 emissions in purchased electricity and heat refer the amount of emissions occurs within the power station that produces electricity and

heat, but the enterprise that actually consumes electricity and heat should account them into the total emissions in its report.

The production process and greenhouse gas emission source are shown in Figure 1.

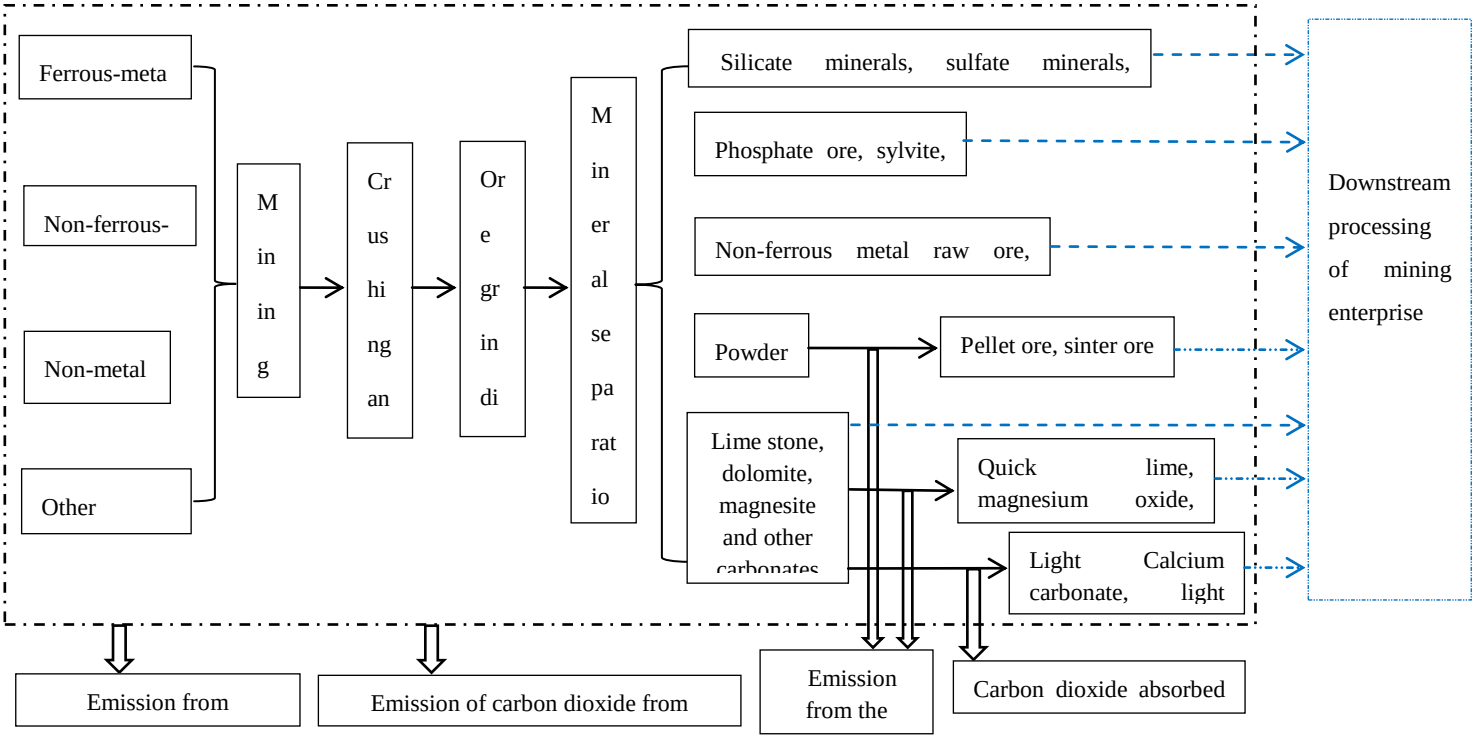

Figure 1.The production process and source of greenhouse gas emissions

Note: The figure does not show the auxiliary production system and the affiliated production system. But equipment in these two systems should also be included in the accounting.

If there are other emission sources and greenhouse gases that are not covered in the Guidelines, the reporting entity should account and report its emissions with reference to the relevant guidelines for those industries published by the competent national authorities.

5. Accounting Methodology

After the determination of accounting boundary, the following measures should be taken to calculate the emissions of greenhouse gases:

(1) Identify and determine emission sources and gas types at different production processes;

(2) Choose the appropriate calculation equation to determine the amount of greenhouse gas emissions;

(3) Acquire activity level data and emission factor;

(4) Put collected data into the calculation equation to get the results; and

(5) Describe and summarize the process and results of calculation in required format.

The total amount of GHG emissions equals CO_2 from burning of fossil fuels, CO_2 from decomposition of nitrates, potential CO_2 emissions from purchased electricity and heat, minus CO_2 absorbed in the process of carbonization.

$$E_{GHG} = E_{CO_2\_burning} + E_{CO_2\_nitrates} - E_{CO_2\_carbonization} + E_{CO_2\_electricity} + E_{CO_2\_heating} \quad (1)$$

where,

E_{GHG} represents the total amount of GHG emissions, unit: ton CO_2;

$E_{CO_2\_burning}$ represents CO_2 from fossil fuels burning, unit: ton CO_2;

$E_{CO_2\_nitrates}$ represents emissions from the decomposition of nitrates, unit:ton CO_2;

$E_{CO_{2\_carbonization}}$ represents carbon dioxide absorbed in the carbonation process, unit: ton CO_2;

$E_{CO_{2\_electricity}}$ represents emissions of carbon dioxide from purchased electricity, unit: ton CO_2;

$E_{CO_{2\_heating}}$ represents emissions of carbon dioxide from purchased heat, unit: ton CO_2;

5.1 Emissions from fossil fuel burning

5.1.1 Equation

CO_2 emissions from burning of fossil fuels can be calculated based on the amount of fossil fuels of different types, carbon content of per unit fossil fuels, and carbon oxygenation efficiency. The equation is:

$$E_{CO_{2\_burning}} = \sum_i (AD_i \times CC_i \times OF_i \times \frac{44}{12}) \quad \text{.....（2）}$$

where,

$E_{CO_{2\_burning}}$ represents CO_2 emissions from fossil fuels burning, unit: ton;

I represents the type of fossil fuels;

AD_i represents the amount of fossil fuel *type i* used in burning, unit: ton (solid or liquid), Nm^3 (gas);

CC_i represents the carbon content of fossil fuel *type i*, unit: ton (solid or liquid), Nm3 (gas);

OF_i represents oxygenation efficiency of fossil fuel *type i*, range of value from 0 to 1;

$\frac{44}{12}$represents the conversion coefficient between CO_2 and C.

5.1.2 Obtaining activity level data

The amount of consumed fossil fuels of different types should be determined with reference to original expense calendar and statistical ledger. It refers to the fossil fuels that are sent to all kinds of burning equipment, including fossil fuels recycled by the enterprise. The accounting process should meet the requirements of *GB 17167 General Rules about Allocation and Management of Energy Calculators*.

5.1.3 Obtaining emission factors

5.1.3.1 Carbon content of fossil fuels

Enterprises can commission qualified professional organizations to test carbon content of fossil fuels on a regular basis. The process of carbon content measurement should be carried out in conformity with *GB/T 476 Measurement Methods for Carbon and Hydrogen in Coal*, *SH/T 0656 Measurement of Carbon, Hydrogen and Nitrogen in Petroleum Products and Lubricants*, *GB/T 13610 Analysis on Composition of Natural Gas (GC)*,*GB/T 8984 Measurement Of Carbon Monoxide, Carbon Dioxide And Hydrocarbon In Gases (GC)* and other relevant standards. Coal should be tested upon entering the factory or at least once a month, and its carbon content should be determined by the incoming amount or by the weighted average of monthly supply. Oil should be tested upon entering the factory or at least once a season, and arithmetic average value should be adopted as its carbon content. Natural gas should be tested upon entering factory or at least once in half a year, and the carbon content should be calculated according to the volume, concentration and chemical formula of every component, see Equation (3):

$$CC_g = \sum_n \left(\frac{12 \times CN_n \times V_n}{22.4} \times 10\right) \qquad \text{……（3）}$$

where,

CC_g represents carbon content of tested gas *g*, unit: ton carbon/ 10,000 Nm3;

n represents different components of tested gas*i*;

CN_n represents number of carbon atoms in the chemical formula of *n*;

V_n represents volume concentration of gas *n*, range from 0 to 1, e.g. the volume concentration of CH4 is 95%, noted as 0.95.

Molar mass of carbon is 12, unit: kg/kmol; and

Molar volume of ideal gas is 22.4, unit: Nm3/kmol.

If the enterprise cannot conduct actual measurement of carbon content, it can test the net calorific value (NCV) of fossil fuels and calculate carbon content according to Equation (4):

$$CC_i = NCV_i \times EF_i \quad (4)$$

where,

CC_i represents carbon content of fossil fuel *i*, unit: ton (solid or liquid), Nm3 (gas);

NCV_i represents NCV of fossil fuel *i*, unit: GJ/ton (solid or liquid), GJ/Nm3 (gas);

EF_i represents carbon content per unit heating value of fossil fuel *i*, unit: ton/GJ. Carbon content per unit calorific value of common fuels can be found in Table 2.1 of Appendix II.

The process of carbon content measurement should be carried out in conformity with *GB/T 213 Measurement Methods For Carbon And Hydrogen In Coal, SH/T 384 Measurement Of Carbon, Hydrogen And Nitrogen In Petroleum Products*

And Lubricants, GB/T 22723 Analysis On Composition Of Natural Gas (GC), GB/T 8984 Measurement Of Carbon Monoxide, Carbon Dioxide And Hydrocarbon In Gases (GC) and other relevant standards. Coal should be tested upon entering the factory or at least once a month, and its carbon content should be determined by the incoming amount or by the weighted average of monthly supply. Oil should be tested upon entering the factory or at least once a season, and arithmetic average value should be adopted as its carbon content. Natural gas should be tested upon entering factory or at least once in half of a year, and the carbon content should be calculated according to the volume, concentration and chemical formula of every component.

If the enterprise cannot even measure NCV, it can, with the permission of authorities, use the recommended value in Table 2.1 of Appendix II.

5.1.3.2Carbon oxygenation efficiency

The default value of carbon oxygenation efficiency of liquid fuels is 0.98; the default value of carbon oxygenation efficiency of gas fuels is 0.99; the default value of carbon oxygenation efficiency of solid fuels can be found in Table 2.1 of Appendix II.

5.2 Emissions from the decomposition of nitrates

5.2.1 Equation

CO_2 Emissions from the decomposition of nitrates can be calculated from the amount of calcinated or roasted ores, decomposition rate of ores and the mass fraction and emission factor of carbonate content in the ore. The equation is:

$$E_{CO_{2\_nitrates}} = AD_{ore} \times \eta_{ore} \times \sum_i (PUR_i \times EF_i) \quad \text{……（5）}$$

where,

$E_{CO_{2\_nitrates}}$ represents emissions from the decomposition of nitrates, unit: ton CO_2;

AD_{ore} represents the amount of calcinated or roasted ores, unit: ton;

η_{ore} represents the decomposition rate of ores, range from 0 to 1;

i represents the type of carbonate;

PUR_i represents the mass fraction of carbonate *i*, range from 0 to 1;

EF_i represents emission factor of $CO_2$of *i*, unit: ton CO_2/ton nitrates.

5.2.2 Obtaining activity level data

The quantity of roasted or calcinated nitrate ores should be determined by enterprise ledger or statistical report. The decomposition rate of ores should be determined by the equipment and monitoring data. If there is no monitoring data, recommended value (100%) can be used.

5.2.3 Obtaining emission factor data

Enterprises can appoint qualified professional organizations to carry out regular tests on the chemical components and mass fraction of nitrate ores, and calculate emission factor from chemical constituents, chemical formula and the number of CO_3^{2-}. The measurement of the chemical constituents of nitrates should abide by *GB/T 3286.1 Chemical Methods of Analysis on Lime Stone and Dolomite: Measurement of Calcium Oxide and Magnesium Oxide* and *GB/T 3286.9 Chemical Methods of Analysis on Lime Stone and Dolomite: Measurement of Carbon Dioxide*.

If actual measurement cannot be carried out, data about the purchased goods given by providers can be used. The emission factor of some common nitrates can be obtained from the recommended value in Table 2.2 of Appendix II.

5.3 Absorption of greenhouse gases in carbonization

5.3.1 Equation

CO_2 absorbed in the carbonation process can be calculated from the mass of carbonized products and the mass fraction and emission factor of nitrate components.

$$E_{CO_{2\_carbonization}} = AD_{carbonization} \times \sum_j (PUR_j \times EF_j) \ldots (6)$$

where,

$E_{CO_{2\_carbonization}}$ represents carbon dioxide absorbed in the carbonation process, unit: ton;

$AD_{carbonization}$ represents the mass of carbonized products (nitrates mixture), unit: ton;

j represents the nitrate components in carbonized products;

PUR_j represents the mass fraction of nitrate *j* in carbonate products, ranging from 0 to 1;

EF_j represents emission factor of CO_2 of nitrate *j*, unit: ton CO_2/ton nitrates.

5.3.2 Obtaining activity level data

The mass of carbonized products (carbonates mixture) should be determined by enterprise ledger or statistical report.

5.3.3 Obtaining emission factor data

Enterprises can commission qualified professional organizations to carry out regular tests on the chemical components and mass fraction of nitrate ores, and

calculate emission factor from chemical constituents, chemical formula and the number of CO_3^{2-}. The measurement of the chemical constituents of nitrates should abide by *GB/T 3286.1 Chemical Methods of Analysis on Lime Stone and Dolomite: Measurement of Calcium Oxide and Magnesium Oxide* and *GB/T 3286.9 Chemical Methods of Analysis on Lime Stone and Dolomite: Measurement of Carbon Dioxide*.

If actual measurement cannot be carried out, data about the purchased goods given by providers can be used. The emission factor of some common nitrates can be obtained from the default value in Table 2.2 of Appendix II.

5.4 Emissions generated by net purchased electricity and heat

5.4.1 Equation

The potential emissions from purchased electricity and purchased heat can be calculated respectively according to Equations (7) and (8);

$$E_{CO_{2\_elec}} = AD_{elec} \times EF_{elec} \quad \text{……（7）}$$

$$E_{CO_{2\_heat}} = AD_{heat} \times EF_{heat} \quad \text{……（8）}$$

where,

$E_{CO_{2\_elec}}$ represents emissions of carbon dioxide from purchased electricity, unit: ton CO_2;

$E_{CO_{2\_heat}}$ represents emissions of carbon dioxide from purchased heat, unit: ton CO_2;

AD_{elec} represents the amount of net purchased electricity, unit: MWh;

AD_{heat} represents the amount of net purchased heat, unit: GJ;

EF_{elec} represents emission factor of CO_2 in electricity supply, unit: ton CO_2/MWh; and

EF_{heat} represents emission factor of CO_2 in heat supply, unit: ton CO_2/MWh.

5.4.2 Obtaining activity level data

The amount of net purchased electricity should be determined by readings from electric meters used by electricity provider, energy consumption ledger or statistical report. It equals the amount of purchased electricity minus the amount of electricity provided to external users by the enterprise.

The amount of net purchased heat should be determined by energy consumption ledger or statistical report. It equals the amount of purchased heat minus the amount of heat provided to external users by the enterprise.

Hot water in the unit of mass can be converted into caloric unit according to Equation (9);

$$AD_{hot\ water} = Ma_w \times (T_w - 20) \times 4.1868 \times 10^{-3} \quad \text{.....（9）}$$

where,

$AD_{hot\ water}$ represents the heat of hot water, unit: GJ;

Ma_w represents mass of hot water, unit: ton;

T_w represents the temperature of hot water, unit: ℃;

4.1868 is the specific heat of water NPT, unit: kJ/(kge℃).

Steam in the unit of mass can be converted into caloric unit according to Equation (10);

$$AD_{st} = Ma_{st} \times (En_{st} - 83.74) \times 10^{-3} \quad \text{.....（10）}$$

where,

AD_{st} represents the heat of steam, unit: GJ;

Ma_{st} represents the mass of steam, unit: ton;

En_{st} represents the enthalpy of steam at given temperature and pressure, unit: kJ/kg. The enthalpy of saturated steam and superheated steam can be found in Table 2.3 and 2.4 of Appendix II.

5.4.3 Obtaining emission factor data

The emission factor of CO_2 in electricity supply should be the average emission factor of CO_2 of the power grid in the vicinity of the enterprise, and should be determined by the updated data published by relevant authorities.

The emission factor of CO_2 in heat supply should be 0.11 ton CO_2/GJ for the time being, to be updated on the basis of official data published by authorities in the future.

6. Quality Assurance and Documentation

The reporting entities should establish quality assurance and documents filing system of GHG emission report, including:

6.1 To establish regulations about quantification and report of GHG emissions, including organization form, responsible institutions, working process, etc;

6.2 To formulate the list of major GHG sources, form proper quantification methods for GHG emissions and file the documents;

6.3 Make practicable monitoring plan for every parameter involved in calculation. The plan should cover: to-be-measured parameters, sampling point or

position of metering equipment, sampling method and procedure, monitoring method and procedure, monitoring frequency and time, data collection or delivery process, responsible department, QA and QC procedure, etc. Enterprises should designate relevant departments and personnel to be responsible for sampling, monitoring, analysis, recording, collection and filing of data. If a default value of emission factor is used, the source of the recommended value should be provided and updates should be monitored regularly.

6.4 Make plans to carry out checks and calibration on metering equipment regularly in accordance with requirements. If the equipment is found to be outdated, the enterprise should take necessary measures to address the issue;

6.5 Make contingency measures for missing data and changes in production activity and report methods. If the activity data and data of emission factor is missing, the enterprise should adopt proper methods to estimate the data in place of the missing ones.

6.6 Establish norms about documents filing. Preserve and maintain GHG annual report and data records. Ensure that the data can be used for third-party inspection and be reported to the competent authorities;

6.7 Establish internal review and verification procedure for data. Ensure the completeness and accuracy of data through cross-verification of data from different sources, statistics about the fluctuations during the accounting period and comparison with data in the previous years.

7. Content and Format of Report

Reporting entities should report the following contents in the format specified in Appendix I:

7.1 Basic information of the reporting entity

Basic information of the reporting entities should contain the name of the reporting entities, report year, nature of business, sector, organization or subsidiary, location (including registered location and production location), founding time, evolution, legal representatives, and name of person in charge and contact details.

Detailed explanation about legal entity boundary, production process, and process and results of emission source identification (tables and illustrations should be provided when necessary).

7.2 Greenhouse gas emissions

Reporting entities should report the total GHG emissions during the whole reporting period in the form of CO_2e, the emissions of carbon dioxide per mass unit from burning of fossil fuels, the decomposition of nitrates, potential emissions from the electricity and heat used by enterprises, and the amount of carbon dioxide absorbed during the carbonization process, as well as other GHGs not covered in the document but required by other documents published by the authority.

7.3 Activity level and its sources

Reporting entities should, in accordance with the division of accounting boundary and emission sources, report the activity level data of every emission source separately, and explain in detail about the monitoring and execution condition, including data source, monitoring location, monitoring methods, recording frequency, etc.

7.4 Emission factors and sources

Reporting entities should report the corresponding carbon content or other parameters needed in calculation of emission factor at every activity level. If actual measurement is conducted, the monitoring plan and execution condition should be reported. Otherwise, sources of data, reference, relevant postulation and reasons should be provided.

7.5 Other issues

Reporting entities can explain other issues or provide suggestions to help improve the Guidelines in its report.

Appendix I: Report Format Template

Greenhouse Gas Emissions Report for China Mining Enterprises

Reporting Entity (Seal):

Reporting Year:

Date: Day/Month/Year

Based on *Guidelines for Accounting and Reporting Greenhouse Gas Emissions for China Mining Enterprises* (Trial) issued by National Development and Reform Commission, this reporting entity has accounted the total GHG emissions amount of its enterprise for the year _____, and filled in the data in the relevant tables. The reporting entity herewith reports the relevant information as follows:

I. Basic Information of the Company

II. Greenhouse Gas Emissions

III. Activity Level Data and Source

IV. Data of Emission Factors and Sources

V. Other issues

This report is true and reliable. If the information provided in this report fails to reflect the reality, this enterprise will bear the corresponding legal responsibility.

Legal Representative (Signature):

Day/Month/Year

Attachments:

Table 1.1: Greenhouse gas emissions of the reporting entities in the year of ___

Table 1.2: Activity level data and emission factor of fossil fuels burning

Table 1.3: Activity data and emission factor of nitrates decomposition

Table 1.4: Activity data and emission factor of carbonization (absorbing CO_2)

Table 1.5: Activity data and emission factor of net purchased electricity and heat

Table 1-1: Greenhouse gas emissions of the reporting entities in the year of ___

Category of source		Amount of emissions (Unit: ton CO_2)
Emissions from burning of fossil fuels		
Emissions from the decomposition of nitrates		
Carbon dioxide absorbed in the carbonation process		
Emissions of carbon dioxide from purchased electricity		
Emissions of carbon dioxide from purchased heat		
Total amount of greenhouse gas emissions	Emissions of carbon dioxide except purchased electricity and heat	
	Emissions of carbon dioxide including purchased electricity and heat	

Table 1-2:Activity data and emission factor of fossil fuels burning

Type of fossil fuel	Quantity of combusted fuels (ton or 10.000 Nm^3)	Carbon content (ton C/ton or ton C/10,000 Nm^3)	Data source	Net calorific value [2](GJ/ton or GJ/10,000Nm^3)	Data source	Carbon content per heating unit [2] （tC/GJ）	Carbon oxygenation efficiency (%)	Data source
Blind coal			☐Detected		☐Detected value			☐Detected
Soft coal			☐Detected		☐Detected value			☐Detected
Brown coal			☐Detected		☐Detected value			☐Detected
Cleaned coal			☐Detected		☐Detected value			☐Detected
Other washed			☐Detected		☐Detected value			☐Detected
Briquette coal			☐Detected		☐Detected value			☐Detected
Coke			☐Detected		☐Detected value			☐Detected
Crude oil			☐Detected		☐Detected value			☐Detected
Fuel oil			☐Detected		☐Detected value			☐Detected
Gasoline			☐Detected		☐Detected value			☐Detected
Diesel			☐Detected		☐Detected value			☐Detected
Aviation			☐Detected		☐Detected value			☐Detected

Table 1-2:Activity data and emission factor of fossil fuels burning

Type of fossil fuel	Quantity of combusted fuels (ton or 10.000 Nm^3)	Carbon content (ton C/ton or ton C/10,000 Nm^3)	Data source	Net calorific value [2](GJ/ton or GJ/10,000Nm^3)	Data source	Carbon content per heating unit [2] （tC/GJ）	Carbon oxygenation efficiency (%)	Data source
General			☐Detected		☐Detected value			☐Detected
Naphtha			☐Detected		☐Detected value			☐Detected
Petroleum coke			☐Detected		☐Detected value			☐Detected
Liquefied			☐Detected		☐Detected value			☐Detected
Liquefied			☐Detected		☐Detected value			☐Detected
Other			☐Detected		☐Detected value			☐Detected
Coke oven gas			☐Detected		☐Detected value			☐Detected
Blast furnace			☐Detected		☐Detected value			☐Detected
Converter gas			☐Detected		☐Detected value			☐Detected
Other coal gases			☐Detected		☐Detected value			☐Detected
Natural gas			☐Detected		☐Detected value			☐Detected
Refinery dry gas			☐Detected		☐Detected value			☐Detected

Table 1-2:Activity data and emission factor of fossil fuels burning

Type of fossil fuel	Quantity of combusted fuels (ton or 10.000 Nm^3)	Carbon content (ton C/ton or ton C/10,000 Nm^3)	Data source	Net calorific value [2](GJ/ton or GJ/10,000Nm^3)	Data source	Carbon content per heating unit [2] （tC/GJ）	Carbon oxygenation efficiency (%)	Data source
Other energy			☐Detected		☐Detected value			☐Detected

Note: [1] if the fossil fuel type used by the reporting entities does not appear in this list, please add it into the list.

[2] If the carbon content is estimated through net calorific value or per unit heating value, please fill in this form.

Table 1-3: Activity data and emission factor of nitrates decomposition

Ore Type	The amount of calcinated or roasted ores (unit: ton)	Ore decomposition rate	Type of carbonates	Mass fraction of nitrates	Emission factor of nitrates (ton of CO_2/ton of nitrates)	Amount of CO_2 emissions (ton)
Lime stone			$CaCO_3$			
			$MgCO_3$			
Dolomite			$CaMg(CO_3)_2$			
Magnesite			$MgCO_3$			
……[1]						

Note: reporting entities can add the type of nitrates not covered in this list.

Table 1-4: Activity data and emission factor of carbonization (absorbing CO_2)

Carbonization product	Quantity of carbonization product (ton)	Carbonate Type	Mass fraction of nitrates	Emission factor of nitrates (ton of CO_2/ton of nitrates)	Amount of CO_2 emissions (ton)
Light calcium carbonate		$CaCO_3$			
Light magnesium carbonate		$MgCO_3$			
Barium carbonate		$BaCO_3$			
……[1]					

Note: reporting entities can add the type of carbonates not covered in this list.

Table 1-5: Activity data and emission factor of net purchased electricity and heat

Type	Net purchased	Emission factor of CO_2

	amount (MWh or GJ)	Net purchased amount (MWh or GJ)	Amount for external users (MWh or GJ)	(ton of CO_2/MWh or ton of CO_2/GJ)
Electricity				
Steam				
Hot water				

Appendix II: Relevant Default Values

Table 2-1: Default Value of Relevant Parameters of Common Fossil Fuels

Type of fossil fuel		Net calorific value	Unit of heating value	Carbon content per heating unit （tC/GJ）	Carbon oxygenation efficiency
Solid fuels	Blind coal	24.515	GJ/ton	27.49	94%
	Soft coal	23.204	GJ/ton	26.18	93%
	Brown coal	14.449	GJ/ton	28.00	96%
	Cleaned coal	26.344	GJ/ton	25.40	93%
	Other washed coal	15.373	GJ/ton	25.40	90%
	Briquette coal	17.460	GJ/ton	33.60	90%
	Coke	28.446	GJ/ton	29.40	93%
Liquid fuels	Crude oil	42.620	GJ/ton	20.10	98%
	Fuel oil	40.190	GJ/ton	21.10	98%
	Gasoline	44.800	GJ/ton	18.90	98%
	Diesel	43.330	GJ/ton	20.20	98%
	General kerosene	44.750	GJ/ton	19.60	98%
	Petroleum coke	31.000	GJ/ton	27.50	98%
	Other petroleum products	40.190	GJ/ton	20.00	98%
	Tar	33.453	GJ/ton	22.00	98%
	Crude benzene	41.816	GJ/ton	22.70	98%
Gas fuels	Refinery dry gas	46.050	GJ/ton	18.20	99%
	Liquefied petroleum gas	47.310	GJ/ton	17.20	99%
	Liquefied natural gas	41.868	GJ/ton	15.30	99%
	Natural gas	389.310	GJ/10.000 Nm^3	15.30	99%
	Coke oven gas	173.854	GJ/10.000 Nm^3	13.60	99%
	Blast furnace gas	37.69	GJ/10.000 Nm^3	70.80	99%
	Converter gas	79.54	GJ/10.000 Nm^3	49.60	99%
	Closed calcium	111.190	GJ/10.00	39.51	99%

	carbide furnace gas		0 Nm^3		
	Other coal gases	52.340	GJ/10.000 Nm^3	12.20	99%

Data source: 1) *Net calorific value: Research on List of Greenhouse Gases in China in 2005*

2) Carbon content per heating unit: *2006 IPCC Guidelines for National Greenhouse Gas Inventories*; *Provincial Guidelines on the Compilation of Greenhouse Gas Inventories* (Trial)

3) Carbon oxygenation efficiency: *Provincial Guidelines on the Compilation of Greenhouse Gas Inventories* (Trial)

Table 2-2: Default Value of the CO2emission factor of some common nitrates

Chemical formula of carbonate	Emission factor (ton of CO_2/ton of nitrates)
$CaCO_3$	0.4397
$MgCO_3$	0.5220
Na_2CO_3	0.4149
$NaHCO_3$	0.5237
$FeCO_3$	0.3799
$MnCO_3$	0.3829
$BaCO_3$	0.2230
Li_2CO_3	0.5955
K_2CO_3	0.3184
$SrCO_3$	0.2980
$CaMg(CO_3)_2$	0.4773

Table 2-3: Enthalpy of saturated steam

Pressure (MPa)	Temperature (℃)	Enthalpy (kJ /kg)	Pressure (MPa)	Temperature (℃)	Enthalpy (kJ /kg)
0.001	6.98	2513.8	1.00	179.88	2777.0
0.002	17.51	2533.2	1.10	184.06	2780.4
0.003	24.10	2545.2	1.20	187.96	2783.4
0.004	28.98	2554.1	1.30	191.6	2786.0
0.005	32.90	2561.2	1.40	195.04	2788.4
0.006	36.18	2567.1	1.50	198.28	2790.4
0.007	39.02	2572.2	1.60	201.37	2792.2
0.008	41.53	2576.7	1.40	204.3	2793.8
0.009	43.79	2580.8	1.50	207.1	2795.1
0.010	45.83	2584.4	1.90	209.79	2796.4
0.015	54.00	2598.9	2.00	212.37	2797.4
0.020	60.09	2609.6	2.20	217.24	2799.1
0.025	64.99	2618.1	2.40	221.78	2800.4
0.030	69.12	2625.3	2.60	226.03	2801.2
0.040	75.89	2636.8	2.80	230.04	2801.7
0.050	81.35	2645.0	3.00	233.84	2801.9
0.060	85.95	2653.6	3.50	242.54	2801.3
0.070	89.96	2660.2	4.00	250.33	2799.4
0.080	93.51	2666.0	5.00	263.92	2792.8
0.090	96.71	2671.1	6.00	275.56	2783.3
0.10	99.63	2675.7	7.00	285.8	2771.4
0.12	104.81	2683.8	8.00	294.98	2757.5
0.14	109.32	2690.8	9.00	303.31	2741.8
0.16	113.32	2696.8	10.0	310.96	2724.4
0.18	116.93	2702.1	11.0	318.04	2705.4
0.20	120.23	2706.9	12.0	324.64	2684.8
0.25	127.43	2717.2	13.0	330.81	2662.4
0.30	133.54	2725.5	14.0	336.63	2638.3
0.35	138.88	2732.5	15.0	342.12	2611.6
0.40	143.62	2738.5	16.0	347.32	2582.7
0.45	147.92	2743.8	17.0	352.26	2550.8
0.50	151.85	2748.5	18.0	356.96	2514.4
0.60	158.84	2756.4	19.0	361.44	2470.1
0.70	164.96	2762.9	20.0	365.71	2413.9

0.80	170.42	2768.4	21.0	369.79	2340.2
0.90	175.36	2773.0	22.0	373.68	2192.5

Table 2-4: Enthalpy of superheated steam

(unit: kJ/kg)

Temperature	Pressure											
	0.01 MPa	0.1 MPa	0.5 MPa	1 MPa	3 MPa	5 MPa	7 MPa	10 MPa	14 MPa	20 MPa	25 MPa	30 MPa
0℃	0	0.1	0.5	1	3	5	7.1	10.1	14.1	20.1	25.1	30
10℃	42	42.1	42.5	43	44.9	46.9	48.8	51.7	55.6	61.3	66.1	70.8
20℃	83.9	84	84.3	84.8	86.7	88.6	90.4	93.2	97	102.5	107.1	111.7
40℃	167.4	167.5	167.9	168.3	170.1	171.9	173.6	176.3	179.8	185.1	189.4	193.8
60℃	2611.3	251.2	251.2	251.9	253.6	255.3	256.9	259.4	262.8	267.8	272	276.1
80℃	2649.3	335	335.3	335.7	337.3	338.8	340.4	342.8	346	350.8	354.8	358.7
100℃	2687.3	2676.5	419.4	419.7	421.2	422.7	424.2	426.5	429.5	434	437.8	441.6
120℃	2725.4	2716.8	503.9	504.3	505.7	507.1	508.5	510.6	513.5	517.7	521.3	524.9
140℃	2763.6	2756.6	589.2	589.5	590.8	592.1	593.4	595.4	598	602	605.4	603.1
160℃	2802	2796.2	2767.3	675.7	676.9	678	679.2	681	683.4	687.1	690.2	693.3
180℃	2840.6	2835.7	2812.1	2777.3	764.1	765.2	766.2	767.8	769.9	773.1	775.9	778.7
200℃	2879.3	2875.2	2855.5	2827.5	853	853.8	854.6	855.9	857.7	860.4	862.8	856.2
220℃	2918.3	2914.7	2898	2874.9	943.9	944.4	945.0	946	947.2	949.3	951.2	953.1
240℃	2957.4	2954.3	2939.9	2920.5	2823	1037.8	1038.0	1038.4	1039.1	1040.3	1041.5	1024.8
260℃	2996.8	2994.1	2981.5	2964.8	2885.5	1135	1134.7	1134.3	1134.1	1134	1134.3	1134.8
280℃	3036.5	3034	3022.9	3008.3	2941.8	2857	1236.7	1235.2	1233.5	1231.6	1230.5	1229.9
300℃	3076.3	3074.1	3064.2	3051.3	2994.2	2925.4	2839.2	1343.7	1339.5	1334.6	1331.5	1329
350℃	3177	3175.3	3167.6	3157.7	3115.7	3069.2	3017.0	2924.2	2753.5	1648.4	1626.4	1611.3
400℃	3279.4	3278	3217.8	3264	3231.6	3196.9	3159.7	3098.5	3004	2820.1	2583.2	2159.1
420℃	3320.96	3319.68	3313.8	3306.6	3276.9	3245.4	3211.0	3155.98	3072.72	2917.02	2730.76	2424.7
440℃	3362.52	3361.36	3355.9	3349.3	3321.9	3293.2	3262.3	3213.46	3141.44	3013.94	2878.32	2690.3
450℃	3383.3	3382.2	3377.1	3370.7	3344.4	3316.8	3288.0	3242.2	3175.8	3062.4	2952.1	2823.1

Table 2-4: Enthalpy of superheated steam (continued)

(unit: kJ/kg)

Temperature	Pressure											
	0.01 MPa	0.1 MPa	0.5 MPa	1 MPa	3 MPa	5 MPa	7 MPa	10 MPa	14 MPa	20 MPa	25 MPa	30 MPa
460℃	3404.42	3403.34	3398.3	3392.1	3366.8	3340.4	3312.4	3268.58	3205.24	3097.96	2994.68	2875.26
480℃	3446.66	3445.62	3440.9	3435.1	3411.6	3387.2	3361.3	3321.34	3264.12	3169.08	3079.84	2979.58
500℃	3488.9	3487.9	3483.7	3478.3	3456.4	3433.8	3410.2	3374.1	3323	3240.2	3165	3083.9
520℃	3531.82	3530.9	3526.9	3521.86	3501.28	3480.12	3458.6	3425.1	3378.4	3303.7	3237	3166.1
540℃	3574.74	3573.9	3570.1	3565.42	3546.16	3526.44	3506.4	3475.4	3432.5	3364.6	3304.7	3241.7
550℃	3593.2	3595.4	3591.7	3587.2	3568.6	3549.6	3530.2	3500.4	3459.2	3394.3	3337.3	3277.7
560℃	3618	3617.22	3613.64	3609.24	3591.18	3572.76	3554.1	3525.4	3485.8	3423.6	3369.2	3312.6
580℃	3661.6	3660.86	3657.52	3653.32	3636.34	3619.08	3601.6	3574.9	3538.2	3480.9	3431.2	3379.8
600℃	3705.2	3704.5	3701.4	3697.4	3681.5	3665.4	3649.0	3624	3589.8	3536.9	3491.2	3444.2