Ministry for the
Environment
Manatū Mō Te Taiao

Guide to Reporting for *Industrial Process* Activities under the New Zealand Emissions Trading Scheme

New Zealand Government

This report may be cited as:
Guide to Reporting for Industrial Process Activities under the New Zealand Emissions Trading Scheme. Wellington: Ministry for the Environment.

Published in December 2009 by the
Ministry for the Environment
Manatū Mō Te Taiao
PO Box 10362, Wellington 6143, New Zealand

ISBN: 978-0-478-33251-3 (electronic)

Publication number: ME 982

This document is available on the Ministry for the Environment's website:
www.mfe.govt.nz

Ministry for the
Environment
Manatū Mō Te Taiao

Contents

1 Overview

As part of the New Zealand Emissions Trading Scheme (NZ ETS), persons who carry out the following industrial processes must monitor and report on their greenhouse gas emissions from 1 January 2010:

- producing iron or steel
- producing aluminium
- producing clinker or burnt lime
- producing glass using soda ash
- producing gold.

The details of these reporting obligations are set out in the Climate Change (Stationary Energy and Industrial Processes) Regulations 2009 (SEIP regulations).[1]

---

[1] The Climate Change Response Act 2002 and related regulations are available at www.legislation.govt.nz

2 Registering as a participant

The Climate Change Response Act 2002 (the Act) requires persons carrying out these industrial process activities to register as a participant in the NZ ETS within 20 working days of carrying out the particular ETS activity. In most cases, this will be by 1 February 2010, 20 working days after reporting obligations begin on 1 January 2010. Surrender obligations begin on 1 July 2010.

To register as a participant you must:

- first, apply to open a holding account which will ultimately be used for surrendering and receiving New Zealand Units (NZUs) when the surrender obligations for the particular sector begin. A participant who will be involved in more than one activity can use a single holding account for all of them.

  To open a holding account, register as a user on the New Zealand Emission Unit Register (NZEUR) website at http://www.eur.govt.nz and, once the user registration is approved, use the online application form to open an account
- second, register as a participant by completing an online participant notification form at www.eur.govt.nz.

3 Principles of calculating emissions

For each industrial process activity, the SEIP regulations set out the information that must be collected and an approach that must be followed to calculate and report emissions.

The basic calculation is:

Emissions = activity measure multiplied by emissions factor

The activity measure for each process emission source is the amount in tonnes of a pure substance eg, calcium carbonate in limestone or pure carbon in coke. The participant only needs to report the number of tonnes of the pure substance used (or produced, in the case of clinker or lime) in the year.

The emissions factors that will be applied in an annual emissions return are the relevant fixed chemical or stoichiometric ratios. These factors represent the number of tonnes of CO_2 that would be emitted when one tonne of a pure carbon-containing substance is fully oxidised or calcined.

This approach to calculating emissions provides flexibility for participants to account for variations in composition of the materials used over time. Participants are not required to go through the process of having a unique emissions factor (UEF) verified and approved.

It is the participant's responsibility to carry out the necessary measurements and analysis to determine tonnes of a pure substance present in the (typically impure) materials actually used. It is expected this measurement and analysis will be done according to established industry standards.

Good practice would include measurements performed using calibrated equipment, and analysis by a laboratory certified to ISO17025 or an equivalent covering the relevant methodologies.

Participants must retain sufficient records, including of the underlying measurements and analysis work, to enable the Chief Executive of the Ministry of Economic Development to verify the emissions a participant reports in their emissions return.

Records must be retained for a period of at least seven years after the end of the year to which they relate.

4 Producing iron or steel

Climate Change (Stationary Energy and Industrial Processes) Regulations 2009: 30–32

4.1 Overview

Process emissions in iron and steel-making may come from any carbon in material added in processing, from raw material to finished product. There are no non-CO_2 emissions to be reported from this activity. Carbon already contained in steel, and carbon in additives put in to adjust the carbon content of the product (added at, or after, the stage of tapping hot metal) is excluded.

4.2 Information to be collected

Information to report	How to collect and report
• tonnes of uncalcined limestone used during the year	• as tonnes of pure calcium carbonate • determine quantity of limestone • determine properties of limestone
• tonnes of uncalcined dolomite used during the year	• as tonnes of pure calcium magnesium carbonate • determine quantity of the dolomite used • determine properties of the dolomite
• tonnes of each additional carbon-containing input used in processing	• as tonnes of pure carbon • all types of carbon-containing input used in any stage of processing, up to but not including the tapping of hot metal • exclude any carbon associated with obligation coal* • exclude any carbon associated with limestone or dolomite already counted

* Obligation coal is coal for which another ETS participant is required to report on for the activities of importing, mining, or purchasing coal.

4.3 Example calculation

The Rusty Nail Pty Ltd is an iron and steel producer. It uses the following types and quantities of reducing agents: obligation coal (95,000 tonnes, and 60.0 per cent carbon from analysis) and industrial coke (56,000 tonnes, and 80.0 per cent carbon) which the firm imports. The obligation coal would be reported on by another ETS participant and is not included in the process emissions calculation.

The company uses 6050 tonnes of uncalcined limestone during the year. Laboratory tests determined its weight averaged composition to be 85 per cent calcium carbonate. There is no material amount of dolomite in this material, and the company uses no dolomite as a separate input during the year.

Input	**Tonnes of impure input**	**Purity (%)**	**Carbon or other pure component (tonnes)**	**Emission factor (tCO_2-e /t)**	**Emissions (tCO_2-e)**
Uncalcined limestone ($CaCO_3$)	6050	85.0	5142.5	0.4397	2261
Uncalcined dolomite ($MgCa(CO_3)_2$)	0	N/A	0	0.4773	0
Carbon input: industrial coke	56,000	80.0	44,800	3.6641	164,152
Total Emissions					**166,413**

Using the formula set out in the regulations:

$$TE = (5142.5 \times 0.4397) + (0 \times 0.4773) + (44{,}800 \times 3.6641)$$

$$TE = 2261 + 164{,}152$$

$$TE = 166{,}413 \text{ tonnes } CO_2\text{-e}$$

5 Producing aluminium

Climate Change (Stationary Energy and Industrial Processes) Regulations 2009: 33–35

5.1 Overview

The anodes used for aluminium smelting are baked before use, which results in CO_2 emissions from combustion of pitch volatiles and from oxidation of packing coke used to cover the anodes. Aluminium smelting generates CO_2 emissions when anode carbon reacts either with alumina (reducing it to metallic aluminium) or with oxygen in the reduction cells. In addition, anode effects can occur during operation of the cells, and result in emissions of two perfluorocarbon (PFC) gases.

5.2 Information you are required to collect

The regulations require the following information to be collected:

- the CO_2 emissions resulting from baked anodes used in the year
- the CO_2 emissions resulting from pitch volatiles used in the year
- the CO_2 emissions resulting from packing material, other than obligation coal, used in the year
- tonnes of hot metal aluminium produced in the year
- anode effect (in minutes per cell day) experienced in the year
- the slope coefficients given in the IAI Protocol for calculation of PFC emissions based on the occurrence of anode effects.

Emissions associated with aluminium production must be estimated using the International Aluminium Institute's *Aluminium Sector Greenhouse Gas Protocol* (IAI Protocol).[2] This standard incorporates the relevant emissions factors, consistent with IPCC guidelines and New Zealand's National Greenhouse Gas Inventory.

The IAI Protocol is accompanied by a downloadable spreadsheet tool that may be useful to help develop the data and calculations to provide the inputs for these calculations. Whether or not such a tool is used, it is important these calculations and the underlying data are documented and retained in case of audit.

---

[2] International Aluminium Institute 2006 *The Aluminium Greenhouse Gas Protocol (Addendum to the WRI/WBCSD Greenhouse Gas Protocol)*.

6 Producing cement clinker or burnt lime

Climate Change (Stationary Energy and Industrial Processes) Regulations 2009: 36–38

6.1 Overview

The production of cement clinker and burnt lime involves calcination, or the decomposition of calcium carbonate in limestone by heating. Magnesium carbonate can also occur in the inputs for clinker and lime manufacture, as dolomite ($Ca.Mg(CO_3)_2$) or in other mineral forms. Calcination is carried out in a kiln heated to high temperatures.

6.2 Information you are required to collect

Information to collect	How to collect and report
• tonnes of calcium oxide in clinker or burnt lime products	• as tonnes of pure calcium oxide • may include up to 5 per cent of magnesium oxide • includes all oxide material derived from calcination in the kiln • excludes any oxides derived from already-calcined input to the kiln
• tonnes of magnesium oxide in clinker or burnt lime products	• as tonnes of pure magnesium oxide • where not accounted for as calcium oxide
• tonnes of calcium oxide or magnesium oxide in kiln dust	• total tonnes of calcium oxide • magnesium oxide can be counted as CaO • exclude any tonnes recycled into the kiln

Unlike other processes that use limestone, the specified emissions calculation for clinker and lime production is in terms of tonnes of the pure calcined material in the process outputs (oxides) rather than tonnes of carbonates in limestone or other input materials. The information is required in this form for consistency with IPCC guidelines. This does not restrict the analysis and calculation methods that may be used in practice. An understanding of the full mass balance for the calcination process, including both input and output quantities, is important for accurate emissions reporting.

Limestone used for cement manufacture contains small amounts of magnesium carbonate in various mineral forms including dolomite. Product standards limit the amount of magnesium oxide (MgO) allowed in cement. In current industry practice, and in the national inventory, small amounts of magnesium in clinker or lime are included in a single analysis and treated as if they were calcium. The regulations recognise this, and allow this approach to be used for up to 5 per cent of MgO.

If dolomite or similar materials containing a significant proportion of magnesium are used as separate process inputs, or if the proportion of MgO as an impurity is more than 5 per cent, the tonnes of MgO must be reported separately.

A proportion of partially or fully calcined material is expected to leave the kiln as dust, rather than as product. The CO_2 emissions from calcination of this material must be added, unless the dust is collected and recycled into the kiln. It is expected measurement and analysis will be carried out to determine the amount of kiln dust, and the fraction of it that is calcined. It is not necessary to account separately for MgO in kiln dust, as the amount expected would not have a material impact on emissions. Al oxides in kiln dust are treated as calcium oxide (CaO).

The total tonnes of calcium oxide and magnesium oxide in cement clinker produced over the reporting period might be determined by direct weighing and analysis of clinker or by a mass balance based, in part, on the amount and composition of the limestone or other inputs used.

6.3 Example calculation – clinker production

Southward Products Ltd is a cement manufacturer. During the reporting period, 20,000 tonnes of clinker were produced. The production process included the collection and reintroduction of cement kiln dust. A programme of clinker sampling and testing in the on-site laboratory (certified to ISO17025) was in place, and the mean calcium oxide and magnesium oxide content by weight of the clinker were determined to be 65 per cent and 3 per cent, respectively. The firm decides to account for the MgO separately, although this is not mandatory.

The process also produced 800 tonnes of cement kiln dust in the year, which was not recycled. Analysis showed this dust contained 300 tonnes of calcined material (assumed to be all CaO although it may also contain a small amount of MgO).

Clinker product	**Gross quantity (tonnes)**	**CaO or MgO (tonnes)**	**Emission factor (tCO_2-e per t CaO or MgO)**	**Emissions (tCO_2-e)**
Calcium oxide (CaO) in clinker	20,000	13,000	0.7848	10,202.4
Magnesium oxide (MgO) in clinker	20,000	600	1.0919	655.1
Cement kiln dust	800	300	0.7848	235.4
Emissions				**11,093**

Using the formula provided in the regulations:

$$E = (13{,}000 \times 0.7848) + (600 \times 1.0919) + (300 \times 0.7848)$$
$$E = 11{,}093 \text{ t } CO_2\text{-e}$$

6.4 Example calculation – burnt lime production

Elgood Lime Ltd manufactured 80,000 tonnes of burnt lime. The limestone was selectively sourced from an on-site quarry. Rock samples were analysed ahead of quarrying, by a laboratory certified to ISO17025. The quarried rock was high grade limestone.

Analysis of the final product confirmed 99 per cent calcium oxide purity, with the balance composition comprising iron and silica impurities.

Burnt lime class	**Burnt lime production (tonnes)**	**CaO content (tonnes)**	**Emission factor (tCO_2e per tonne)**	**Emissions (tonnes of CO_2-e)**
Calcium Oxide (CaO) from limestone ($CaCO_3$)	80,000	79,200	0.7848	62,568

Using the formula provided in the regulations:

$$E = (79{,}200 \times 0.7848) + (0 \times 1.0919) + (0 \times 0.7848)$$
$$E = 62{,}568 \text{ t } CO_2\text{-e}$$

7 Producing glass using soda ash

Climate Change (Stationary Energy and Industrial Processes) Regulations 2009: 39–41

7.1 Overview

The manufacture of glass using soda ash involves crushing, blending, melting and reaction of materials which primarily comprise silica sand (SiO_2), soda ash (Na_2CO_3), limestone ($CaCO_3$) and recycled glass (cullet). Process emissions result mainly from the decomposition of soda ash (sodium carbonate) and calcium carbonate during melting of these raw materials. The SEIP regulations also include the possible use of magnesium carbonate in the form of dolomite.

7.2 Information you are required to collect

Information to collect	How to collect and report
• tonnes of soda ash used in the melting process	• as tonnes of pure soda ash (Na_2CO_3) • determine quantity and properties of the soda ash used in the year
• tonnes of uncalcined limestone used in the melting process	• as tonnes of pure calcium carbonate • determine quantity and properties of the limestone used in the year
• tonnes of uncalcined dolomite used in the melting process	• as tonnes of pure calcium magnesium carbonate • determine quantity and properties of the dolomite used in the year

Quantities are likely to be determined by direct weighing, with sampling and analysis to determine the carbonate content. Weighing devices would be expected to be calibrated and traceable back to New Zealand national measurement standard, where possible. Accreditation to ISO17025 for the relevant test methodology is recommended.

7.3 Example calculation

Oamaru Glass Company Ltd manufactures glass bottles from raw materials and cullet. The following materials were used in its glass furnace during the reporting year: 3500 tonnes of soda ash, with a purity of 99 per cent; 3000 tonnes of limestone which also contains dolomite; and 10,000 tonnes of cullet. All materials were weighed using a calibrated weigh bridge. Fortnightly analysis of the limestone in the on-site ISO17025-certified laboratory showed the weighted average composition of the material used was 80 per cent of $CaCO_3$, 15 per cent of ($Ca.Mg(CO_3)_2$), and 5 per cent of non-carbonate impurities.

Raw material	**Gross quantity (tonnes)**	**Pure substance (tonnes)**	**Emission factor (tCO_2-e per tonne)**	**Emissions (tonnes of CO_2-e)**
Soda Ash	3500	3465	0.4152	1438.7
Limestone ($CaCO_3$)	3000	2400	0.4397	1055.3
Dolomite ($Mg.Ca(CO_3)_2$)	–	450	0.4773	214.8
Cullet	10,000		n/a	n/a
Emissions				**2709**

Using the formula provided in the regulations:

$$E = (3{,}465 \times 0.4152) + (2{,}400 \times 0.4397) + (450 \times 0.4773)$$
$$E = 2709 \text{ tonnes } CO_2\text{-e}$$

8 Producing gold

Climate Change (Stationary Energy and Industrial Processes) Regulations 2009: 42–44

8.1 Overview

The process emissions from gold manufacture arise from limestone and/or dolomite used to control the acidity of stockpile leachate. The carbonates react with sulphuric acid in the leachate, to form calcium and magnesium sulphates, carbon dioxide and water. In addition, there may be smaller amounts of CO_2 emissions from limestone used in other gold processing activities. Not all of the calcium and magnesium carbonate used for acidity control is likely to be reacted.

8.2 Information you are required to collect

Information to collect	How to collect and report
• tonnes of uncalcined limestone reacted in use	• as tonnes of pure calcium carbonate • determine quantity and properties of the limestone used in the year • determine proportion of the uncalcined limestone reacted during the year
• tonnes of uncalcined dolomite used in the year	• as tonnes of pure calcium magnesium carbonate • determine quantity and properties of the dolomite used in the year • determine proportion of the uncalcined dolomite reacted during the year

The total tonnes of uncalcined limestone or dolomite used over the reporting period would normally be determined by direct weighing with sampling and analysis to determine the carbonate content. ISO17025 accreditation is recommended.

8.3 Example calculation

Goldrush Goldmine Ltd is a gold producer. During the reporting period, 5000 tonnes of uncalcined limestone and 4000 tonnes of uncalcined dolomite were used to control the acidity of stockpile leachate. Additional limestone and burnt lime were used for on-site roading purposes, but are not reported. Goldrush Goldmine Ltd has undertaken laboratory testing to determine the purity of the limestone and dolomite used, and the results came back as 75 per cent and 85 per cent purity, respectively. There is no data to indicate that any of this limestone remains unreacted in use, so Goldrush Goldmine Ltd will assume that it is all reacted for the purposes of reporting its emissions.

Using the formula provided in the regulations:

$$E = (3750 \times 0.4397) + (3400 \text{ x } 0.4773)$$
$$E = 3272 \text{ tonnes } CO_2\text{-e}$$

Class	Gross quantity (tonnes)	Quantity of pure carbonates (tonnes)	Emission factor (tCO_2-e per tonne)	Emissions (tonnes of CO_2-e)
Uncalcined limestone (A)	5000	3750	0.4397	1,648.9
Uncalcined dolomite (B)	4000	3400	0.4773	1,622.8
Emissions				**3272**

9 Reference list

Review of Draft Climate Change Legislation – report pertaining to draft Industrial Processes Regulations prepared for the Ministry of the Environment (Aurecon, 2009) http://www.climatechange.govt.nz/consultation/draft-regulations-seip/review-draft-climate-change-legislation.pdf