Pollution inventory reporting - cement and lime guidance note

Environmental Permitting (England and Wales) Regulations 2010

Regulation 60(1)

LIT 7673 and 1216_10

Version 4 December 2012

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1. Introduction

If we regulate your activity as an A1 installation under the Environmental Permitting (England and Wales) Regulations 2010 (EPR) you will need to submit data to the Pollution Inventory.

You need to report each year. The system opens for reporting on 1 January and the deadline for submitting is 28 February.

Our general guidance sets out how to report and provides information applicable to all business and industries.

In this guidance you will find helpful information specific to the cement and lime sector.

Please also see the combustion guidance and if you burn waste you also need to read the incineration guidance.

You can find additional information on the web:

Pollution Inventory Guidance and glossary: www.environment-agency.gov.uk/pi

REPI: http://www.environment-agency.gov.uk/business/topics/pollution/32272.aspx

2. Emissions to air

2.1. Relevant pollutants

The main air emissions from cement and lime production activities are shown in Table1. Use the table as a guide only and check that there are no other pollutants emitted from your process. See appendices B and C for a summary of currently used release estimation techniques and guidance for releases of substances to air from various sources.

Table 1 - Main air pollutants emitted by cement and lime related activities and their release points

Main air pollutants	Release point
CO	Kiln exhaust gas
CO_2	Kiln exhaust gas
Dioxins & furans	Kiln exhaust gas
HCl	Kiln exhaust gas
Fluorine and inorganic compounds – as HF	Kiln exhaust gas
NO_x	Kiln exhaust gas
Particulate matter	Kiln exhaust gas, other point sources and fugitive sources (smaller bag

(including PM10)	filters) such as raw material preparation, handling and storage, fuel preparation, handling and storage, kiln, hydrator, cooler, cement milling, product handling and storage
SO_2	Kiln exhaust gas
NMVOCs	Kiln exhaust gas, fugitive sources from fuel preparation, handling and storage
Metals	Kiln exhaust gas (semi volatile/volatile metals only)

2.2. Emission sources

2.2.1. Point source emissions

These emissions are exhausted via a stack or vent, that is, a single point source into the atmosphere. Abatement equipment, for example, scrubbing units, fabric filters (bag house) can be incorporated into the exhaust system prior to discharge to atmosphere. Point source (main stack) emissions will normally be the most significant emission source (in terms of annual mass releases) for combustion activities taking place within kilns and clinker coolers at cement and lime production sites.

2.2.2. Fugitive emissions

Fugitive emissions are those that are not released from a point source such as a stack.

Some examples are:

- external stockpiled materials
- transferring material between vessels
- uncovered conveyor systems
- pipework and ductwork systems (e.g. pumps, valves, flanges)
- accidental loss of containment from failed plant and equipment
- packing plant
- ancillary bag filters

2.2.3. Emission factors and normalisation

Process emission factors are shown in appendices B and C.

Where measured concentrations are used take care to ensure that the emission concentration and flow rate are compatible. For example, normalised emission concentrations should be multiplied by normalised volumetric flow rates or actual, measured emission concentrations multiplied by actual, measured volumetric flow rates.

Normalised emission rates are quoted in terms of a standard oxygen concentration, and are usually dry gas, at a temperature of 273K and a pressure of 101.3 kPa. Formulae for conversion between normalised and actual emission concentrations are contained in appendix A of this note.

3. Emissions to water

Emissions of substances to water can be either direct to controlled waters or indirect following transfer to off-site effluent treatment plant. There is usually no process water discharge from cement or lime manufacture. Discharges to water result from the use of, mainly abstracted, cooling water or surface water (rain) run-off. Under normal conditions cooling water discharge would be the same quality as that abstracted or supplied.

Guidance on what constitutes an emission or transfer is contained in the general PI guidance document.

3.1 Relevant pollutants and emission sources

Water discharges from cement and lime processes arise from storm water, cooling water, accidental emissions of raw materials, products or waste materials and from fire fighting. The main pollutant emitted to water is suspended solids from raw material preparation, storage and handling. Suspended solids alone are not a PI reportable substance. You should check that there are no other substances emitted from the process, including those in association with suspended particulate.

Discharges of substances depend on the ‘in process’ preventative measures (good housekeeping, re-use) and the presence and technical standards of wastewater treatment facilities.

4. Off-site waste transfers

Wastes must be classified by the List of Wastes Regulations 6-digit code(s) and by the relevant Waste Framework Directive disposal or recovery code(s) (D&R).

There is no reporting threshold for hazardous wastes, which are indicated by an asterisk in the EWC. For all other EWC/D&R code combinations, a reporting threshold of 5 tonnes applies.

Any transfer of waste off-site to a third party is covered by the Duty of Care provisions of the Environmental Protection Act 1990. This includes the requirement to describe the waste and record the quantity. You should use data generated in compliance with Duty of Care requirements to complete the PI return.

4.1. Relevant wastes

In general the waste streams from cement and lime production comprise:

- cement and lime kiln dust collected in particulate abatement devices
- materials arising from process clean outs
- spent kiln liner and refractory bricks
- waste oils and lubricants
- chemical containers and general inert industrial waste
- by-pass dust (cement works)

4.2. Quantification of emissions

Do not report wastes that are temporarily stored on site by yourself, but you do need to report waste transferred to third parties (even if stored on your site).

Appendix A Normalisation of emission concentrations

In many cases, pollutant emission concentrations to air are reported as normalised concentrations, the actual measured emission concentration having been adjusted to a normalised temperature (273K), oxygen, pressure and/or water vapour concentration. In calculating mass emissions to air, it is important that either the actual release concentration is multiplied by the actual volumetric flowrate, or the normalised concentration is multiplied by the normalised volumetric flowrate

The following equations can be used to correct measured concentrations and flowrates for temperature, oxygen, pressure and water vapour content.

Concentrations

To correct for moisture concentration to dry (0% oxygen)

$$C_d = C_m \times (100/(100 - \%H_20))$$

Where: C_d is the dry concentration
C_m is the measured concentration
$\%H_20$ is the measured water vapour percentage

To correct the % oxygen to dry basis (if required – may already be measured dry)

$$O_{2(dry)} = O_2m \times (100/(100 - \%H_20))$$

Where: $O_{2(dry)}$ is the dry oxygen percentage
O_{2m} is the measured oxygen percentage

To correct to normalised oxygen concentration

$$C_{corr} = C_d \times (20.9 - O_{2norm})/(20.9 - O_{2(dry)})$$

Where: C_{corr} is the corrected concentration for oxygen concentration
O_{2norm} is the stated normalised oxygen percentage

To correct for temperature

$$C_{normT} = C_{corr} \times ((273 + T_m)/273)$$

Where: C_{normT} is the normalised concentration for temperature
T_m is the measured temperature in degrees centigrade

To correct for pressure

$$C_{norm} = C_{normT} \times (101.3/P_m)$$

Where: C_{norm} is the normalised concentration
P_m is the measured pressure in kPa

Volumetric flowrates

To correct for moisture concentration to dry (0% oxygen)

$$Q_d = Q_m \times ((100 - \%H_20))/100)$$

Where: Q_d is the dry volumetric flowrate
Q_m is the measured volumetric flowrate
$\%H_20$ is the measured water vapour percentage

To correct the % oxygen to dry basis (if required – may already be measured dry)

$$O_{2(dry)} = O_{2m} \times (100/(100 - \%H_20))$$

Where: $O_{2(dry)}$ is the dry oxygen percentage
O_{2m} is the measured oxygen percentage

To correct to normalised oxygen concentration

$$Q_{corr} = Q_d \times (20.9 - O_{2(dry)})/(20.9 - O_{2norm})$$

Where: Q_{corr} is the corrected volumetric flowrate for oxygen concentration
O_{2norm} is the stated normalised oxygen percentage

To correct for temperature

$$Q_{normT} = Q_{corr} \times (273/(273 + T_m))$$

Where: Q_{normT} is the normalised volumetric flowrate for temperature
T_m is the measured temperature in degrees centigrade

To correct for pressure

$$C_{norm} = C_{normT} \times (P_m /101.3)$$

Where: C_{norm} is the normalised volumetric flowrate
P_m is the measured pressure in kPa

Appendix B Cement source factors

The table below shows the pollutants likely to be reported from typical cement production processes. For pollutants not contained within this table a return of not applicable, **n/a**, is expected, to indicate that this pollutant is not knowingly discharged by the site.

Emissions to air

Determinand	Method[1]	Emission Source	Reference	Factors and guidance
CO	M/C	Cement kiln	BCA 2004	1.94 kg / te of clinker produced
CO2[2]	C	Site combustion and process sources	EU ETS	Guidance from EU Commission– as part of EU ETS[3]
CH4[4]	C	Cement kiln	BCA 2004	0.036 kg / te of clinker produced
Dioxins & Furans	M/C	Cement kiln	BCA 2004	2 x 10-9 kg TEQ / te of clinker produced
HCl	M/C	Cement kiln	BCA 2004	2.3 x 10-2 kg / te of clinker produced
Fluorine and inorganic compounds – as HF	M/C	Cement kiln		
NH3	M/C	Cement kiln	BCA 2004	1.4 x 10-2 kg / te of clinker produced
NMVOCs	M/C	Cement kiln	BCA 2004	0.1 kg / te of clinker produced
Nox	M/C	Cement kiln	BCA 2004	3.19 kg / te of clinker produced
PAHs	M/C	Cement kiln	BCA 2004	2.43 x 10-4 kg / te of clinker produced
Total Particulate Matter	M/C	Cement kiln	BCA 2004	0.16 kg / te of clinker produced

[1] M=measurement, C=calculation, E=estimation (engineering judgement).
[2] The PI Schedule requires separate reporting of "thermal" and "chemical" CO_2, to note emissions from an installation's combustion and non-combustion activities respectively. The threshold for CO_2 applies to the overall CO_2 emission (thermal and chemical combined).
[3] It is anticipated that N_2O emissions will be included in future phases of the EU ETS – estimation methodologies may therefore require adaptation when EU monitoring and reporting decisions are published.
[4] It is anticipated that methane emissions will be included in future phases of the EU ETS – estimation methodologies may therefore require adaptation when EU monitoring and reporting decisions are published

PM10	M/C	Cement kiln	BCA 2004	0.09 kg / te of clinker produced
SOx	M/C	Cement kiln	BCA 2004	1.69 kg / te of clinker produced
Metals				
As	M/C	Cement kiln	BCA 2004	2.0 x 10-6 kg / te of clinker produced
Cd	M/C	Cement kiln	BCA 2004	6.0 x 10-6 kg / te of clinker produced
Cu	M/C	Cement kiln	BCA 2004	1.9 x 10-5 kg / te of clinker produced
Cr	M/C	Cement kiln	BCA 2004	4.8 x 10-5 kg / te of clinker produced
Hg	M/C	Cement kiln	BCA 2004	2.2 x 10-5 kg / te of clinker produced
Mn	M/C	Cement kiln	BCA 2004	6.0 x 10-5 kg / te of clinker produced
Ni	M/C	Cement kiln	BCA 2004	2.3 x 10-5 kg / te of clinker produced
Pb	M/C	Cement kiln	BCA 2004	6.95 x 10-4 kg / te of clinker produced
V	M/C	Cement kiln	BCA 2004	1.1 x 10-5 kg / te of clinker produced

Appendix C Lime source factors

The table below shows the pollutants likely to be reported from typical lime production processes. For pollutants not contained within this table a return of not applicable, **n/a**, is expected, to indicate that this pollutant is not knowingly discharged by the site.

Emissions to air

Determinand	Method[5]	Emission Source	Reference	Factors and guidance
CO	M	Lime kiln		
CO2[6]	C	Site combustion and process sources	EU ETS	Guidance from EU Commission– as part of EU ETS[7]
CH4[8]	C	Lime kiln		
Dioxins & Furans	M	Lime kiln		
HCl	M	Lime kiln		
Fluorine and inorganic compounds – as HF	M	Lime kiln		
NMVOCs	M	Lime kiln		
NOx	M	Lime kiln		
PAHs[9]	M	Lime kiln		
Total Particulate Matter	M	Lime kiln		
PM10	M	Lime kiln		

[5] M=measurement, C=calculation, E=estimation (engineering judgement).
[6] The PI Schedule requires separate reporting of "thermal" and "chemical" CO_2, to note emissions from an installation's combustion and non-combustion activities respectively. The threshold for CO_2 applies to the overall CO_2 emission (thermal and chemical combined). N.B. CO_2 from all sources including biomass needs to be reported for PI purposes.
[7] It is anticipated that N_2O emissions will be included in future phases of the EU ETS – estimation methodologies may therefore require adaptation when EU monitoring and reporting decisions are published.
[8] It is anticipated that methane emissions will be included in future phases of the EU ETS – estimation methodologies may therefore require adaptation when EU monitoring and reporting decisions are published

SOx	M	Lime kiln		
Metals				
As	M	Lime kiln		
Cd	M	Lime kiln		
Cu	M	Lime kiln		
Cr	M	Lime kiln		
Hg	M	Lime kiln		
Mn	M	Lime kiln		
Pb	M	Lime kiln		

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