Safety Data Sheet for Portland Cement Clinker

According to Regulation (EC) REACH) Number 1907/2006 as amended by EC Regulation number 453/2010

According to "Guidelines for the safety data sheet template for common cements" dated March 31st, 2011, approved by the Board of CEMBUREAU on April 6th, 2011.

Product: Portland Cement Clinker
Sectorial version: 2.0
Edition: July 1st, 2013 Substitutes all previous editions.
Date of printing: July 1st, 2013

1. Identification of the substance or mixture and of the company undertaking.

1.1. Product identifier.

Portland Cement Clinker.

Substance	EINECS	CAS	Reference number C&L notification
Portland cement clinker	266-043-4*	65997-15-1	02-2119682167-31-0000

* Entry is referred to as Cement, Portland, chemicals but actually describes Portland cement clinker.

Cement clinker is exempt from registration (Art. 2.7 (b) and Annex V.10 of REACH).

1.2. Relevant identified uses of the substance or mixture and uses advised against.

Portland cement clinker is used for the production of common cements or other hydraulic binders in industrial installations.

Cement and hydraulic binders are used in the production of building materials and in construction by professional users or consumers.

Category of Process (PROC)	Identified Uses- Use Description	Manufacture/ /Formulation of	Professional/ /Industrial use of
		Building and construction materials	
2	Use in closed, continuous process with occasional controlled exposure	X	X
3	Use in closed batch process	X	X
5	Mixing or blending in batch process for formulation of preparations and articles	X	X
8b	Transfer of substance or preparation from/to vessels/large containers at dedicated facilities	X	X
9	Transfer of substance or preparation into small containers	X	X
14	Production of preparations or articles by tabletting, compression extrusion, pelletisation	X	X
26	Handling of solid inorganic substances at ambient temperature	X	X

1.3. Details of the supplier of the safety data sheet.

Company name: CEMENTOS LEMONA, S. A.
Location of the Plant: Lemona
Full address: Arraibi, 40. 48330 Lemona (Vizcaya)
Telephone number: 94 487 22 55
E-mail address of the person responsible for the SDS: lemona@lemona.com

1.4. Emergency telephone number.

Call the medical emergency telephone number of your location or the universal emergency telephone number **112** and tell the operator the details of this data sheet.

2. Hazards identification

2.1. Classification of the substance or mixture.

2.1.1. According to Regulation (EC) Number 1272/2008

Hazard class	Hazard category	Classification procedure
Skin irritation	2	On the basis of test data
Serious eye damage/eye irritation	1	On the basis of test data
Skin sensitisation	1	On the basis of literature survey
Specific target organ toxicity single exposure respiratory tract irritation	3	On the basis of literature survey

Hazard statements
H318: Causes serious eye damage

H315: Causes skin irritation
H317: May cause an allergic skin reaction
H335: May cause respiratory irritation

2.1.2. According to Directive 1999/45/EC

Xi (Irritant)
R36/37/38: Irritating to respiratory system and skin
R41: Risk of serious damage to eyes
R 43: May cause sensitization by skin contact

Portland cement clinker dust may cause irritation of the respiratory system. When Portland cement clinker accidently comes into contact with water or when clinker or clinker dust becomes damp, a strong alkaline solution is produced.
Due to the high alkalinity, wet Portland cement clinker may provoke skin and eye irritation. It may also cause an allergic reaction in some individuals due to the soluble Cr (VI) content.

2.2. Label elements

2.2.1. According to Regulation (EC) Number 1999/45/CE

Xi Irritant
R36/37/38: Irritating to respiratory system and skin

R43	May cause sensitisation by skin contact
S2	Keep out of reach of children
S22	Do not breathe dust
S24/25	Avoid contact with skin and eyes
S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S36/37/39	Wear suitable protective clothing, gloves and eye/face protection
S46	If swallowed, seek medical advice immediately and show this container label

2.3. Other hazards

Portland cement clinker does not meet the criteria for PBT or vPvB in accordance with Annex XIII of REACH (Regulation (EC) Number 1907/2006.

3. Composition/Information on componentes

3.1. Substances

Portland cement clinker is a UVCB substance (Substances of Unknown or Variable composition. Complex reaction products or Biological materials) consisting of 4 main clinker phases, namely tri-and dicalcium-silicates ($3CaO.SiO_2$ and $2CaO.SiO_2$), tricalcium-aluminate ($3CaO.Al_2O_3$) and tetracalcium-aluminoferrite ($4CaO.Al_2O_3.Fe_2O_3$), usually together with some unreacted CaO

(free lime). It is made by mineralogical transformation of a precisely specified mixture of raw materials based on oxides of calcium, silicon, aluminium and iron and small quantities of other elements.

IUPAC name	EC number	CAS number	Mol. Formula	Typical conc. (%w/w)	Conc. Range (%w/w)
Tricalcium silicate	235-336-9	12168-85-3	$3CaO.SiO_2$	63	0-85
Dicalcium silicate	233-107-8	10034-77-2	$2CaO.SiO_2$	15	0-85
Tetracalcium aluminoferrite	235-094-4	12068-35-8	$4CaO.Al_2O_3.Fe_2O_3$	10	0-30
Tricalcium aluminate	234-932-6	12042-78-3	$3CaO.Al_2O_3$	10	0-20
Calcium oxide (free lime)	215-138-9	1305-78-8	CaO	1	0-10
Magnesium oxide	215-171-9	1309-48-4	MgO	0,5	0-5

4. First aid measures

4.1. Description of first aid measures

General notes

No personal protective equipment is needed for first aid responders. First aid workers should avoid contact with wet cement or wet cement containing preparations.

Following contact with eyes

Do not rub eyes in order to avoid possible cornea damage as a result of mechanical stress. Remove contact lenses if any. Incline head to injured eye, open the eyelid(s) widely and flush eye(s) immediately by thoroughly rinsing with plenty of clean water for at least 20 minutes to remove all particles (if possible, use isotonic water 0,9% NaCl). Contact a specialist of occupational medicine or an eye specialist.

Following skin contact

For dry cement, remove and rinse abundantly with water.
For wet cement, wash skin with plenty of water.
Remove contaminating clothing, footwear, watches, etc. and clean thoroughly before re-using them.
Seek medical treatment in all cases of irritation or burns.

Following inhalation

Move the person to fresh air. Dust in throat and nasal passages should clear spontaneously. Contact a physician if irritation persists or later develops or if discomfort, coughing or other symptoms persist.

Following ingestion

Do not induce vomiting. If the person is conscious, wash out mouth with water and give plenty of water to drink and get immediate medical attention or contact the anti poison centre.

4.2. Most important symptoms and effects, both acute and delayed

Eyes: Eye contact with cement (dry or wet) may cause serious and potentially irreversible injuries.
Skin: Cement may have an irritating effect on moist skin (due to sweat or humidity) after prolonged contact or may cause contact dermatitis after repeated contact.
Prolonged skin contact with wet cement or wet concrete may cause irritation and contact sensitization.
For more details see Reference (1).
Inhalation: Repeated inhalation of dust of common cements over a long period of time increases the risk of developing lung diseases.
Environment: Under normal use, common cement is not hazardous to the environment.

4.3. Indication of any immediate medical attention and special treatment needed

When contacting a physician, take this Safety Data Sheet with you.

5. Fire-fighting measures

5.1. Extinguishing media

Portland cement clinker is not flammable.

5.2. Special hazards arising from the substance or mixture

Clinkers are non-combustible and non-explosive and will not facilitate or sustain the combustion of other materials.

5.3. Advice for fire-fighters

Clinker poses no fire-related hazards. No need for special protective equipment for fire fighters.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Wear protective equipment as described under Section 8 and follow the advice for safe handling and use given under Section 7.

6.1.1. For non-emergency personnel

Wear protective equipment as described under Section 8 and follow the advice for safe handling and use given under Section 7.

6.1.2. For emergency responders

Emergency procedures are not required.
However, respiratory protection is needed in situations with high dust level.

6.2. Environmental precautions

Do not wash Portland cement clinker down sewage and drainage systems or into bodies of water (for example, streams).

6.3. Methods and material for containment and cleaning up

Collect the spillage in a dry state if possible.
Use dry clean-up methods such as vacuum clean-up or vacuum extraction (industrial portable units, equipped with high efficiency air filters (EPA and HEPA, UNE-EN 1822-1:2010) or equivalent technique). Never use compressed air.

Ensure that the workers wear appropriate personal protective equipment and prevent dust from spreading.
Avoid inhalation of Portland cement clinker and contact with skin. Place spilled materials into a container for future use.

6.4. Reference to other sections
See sections 8 and 13 for more details.

7. Handling and storage

7.1. Precautions for safe handling
Do not handle or store near food and beverages or smoking materials.

7.1.1. Protective measures
Follow the recommendations as given under Section 8.
To clean up dry Portland cement clinker, see Subsection 6.3.

Measures to prevent fire:
Not applicable.

Measures to prevent aerosol and dust generation:
Do not sweep. Use dry cleanup methods such as vacuum clean-up or vacuum extraction, which do not cause airborne dispersion.

Measures to protect the environment:
No particular measures.

7.1.2. Information on general occupational hygiene
No not handle or store near food and beverages or smoking materials.
In dusty environment wear dust mask and protective goggles.
Use protective gloves to avoid skin contact.

7.2. Conditions for safe storage, including any incompatibilities
Portland cement clinker should be stored under waterproof, dry (i.e. with internal condensation minimised) conditions, clean and protected from contamination.

Engulfment hazard: Portland cement clinker can build-up or adhere to the walls of a confined space. The clinker can release, collapse or fall unexpectedly. To prevent engulfment or suffocation, do not enter a confined space, such as a silo, bin, bulk truck, or other storage container or vessel that stores or contains Portland cement clinker without taking the proper safety measures.
When pile storage, unstable walls or slopes can be formed that suppose a risk of landslide.
Do not use aluminum containers due to incompatibility of the materials.

7.3. Specific end use(s)
No additional information for the specific end uses (see section 1.2).

8. Exposure controls/personal protection

8.1. Control parameters

Name of value limit	Type of value limit	Value (at 8h TWA)	Units	Legal references
Dust (insoluble or little soluble)	VLA-ED Inhalible faction	10	mg/m^3	"Lista de Exposición Profesional para agentes químicos de España" from INSHT.
Dust (insoluble or little soluble)	VLA-ED Respirable fraction	3	mg/m^3	ORDEN itc/2585/2007 "Lista de Exposición Profesional para agentes químicos de España" from INSHT.
Portland cement	VLA-ED Inhalible faction	10	mg/m^3	"Lista de Exposición Profesional para agentes químicos de España" from INSHT.

8.2. Exposure controls

8.2.1. Appropiate engineering controls

Measures to reduce generation of dust and to avoid dust propagating in the environment such as dedusting, exhaust ventilation, and dry clean-up methods which do not cause airborne dispersion.

Exposure Scenario	PROC*	Exposure	Localised controls	Efficiency
Industrial manufacture/formulation of hydraulic building and construction materials	2,3	Duration is not restricted (up to 480 minutes per shift, 5 shifts a week)	not required	-
	14,26		A) not required or B) generic local exhaust ventilation	- 78%
	5,8b,9		A) general ventilation or B) generic local exhaust ventilation	17% 78%

** PROC are identified uses and defined in section 1.2.*

8.2.2. Individual protection measures such as personal protection equipment

General: Do not eat, drink or smoke when working with cement to avoid contact with skin or mouth.

Immediately after working with cement or cement-containing materials, workers should wash or shower or use skin moisturizers.

Remove contaminated clothing, footwear, watches, etc. and clean thoroughly before re-using them.

Eye/face protection:

Wear approved glasses or safety goggles according to EN 166 when handling dry or wet Portland cement clinker to prevent contact with eyes.

Skin protection:

Use impervious, abrasion and alkali resistant gloves (made of low soluble Cr (VI) containing material), boots, closed long sleeved protective clothing as well as skin care products (including barrier creams) to protect the skin from prolonged contact with wet Portland cement clinker.

Respiratory protection:
When a person is potentially exposed to dust levels above exposure limits, use appropriate respiratory protection. The type of respiratory protection should be adapted to the dust level and conform to the relevant EN standard, (for example UNE EN149, UNE EN 140, UNE EN 14387, UNE EN 1827 or national standard).

Thermal hazards:
Not applicable.

Exposure Scenario	PROC*	Exposure	Specification of respiratory protective equipment (RPE)	RPE Efficiency assigned protection factor (APF)
Industrial manufacture/formulation of hydraulic building and construction materials	2,3	La duración no esta limitada (hasta 480 min/turno; 5 turnos/semana)	Not required	-
	14,26		A) P1 mask (FF, FM) or B) Not required	FPA = 4 -
	5,8b,9		A) P2 mask (FF, FM) or B) P1 mask (FF, FM)	FPA = 10 FPA = 4

** PROC are identified uses and defined in section 1.2.*

The employer and self employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device program including training of the workers.

8.2.3. Environmental exposure controls

Environmental exposure control for the emission of clinker particles into air has to be in accordance with the available technology and regulations for the emission of general dust particles.
Environmental exposure control is relevant for the aquatic environment as emissions of clinker in the different life-cycle stages (production and use) mainly apply to ground and waste water. The aquatic effect and risk assessment cover the effect on organisms/ecosystems due to possible pH changes related to hydroxide discharges. The toxicity of other dissolved inorganic ions is expected to be negligible compared to the potential pH effect.
Any effects that might occur during production and use would be expected to take place on a local scale. The pH of effluent and surface water should not exceed 9. Otherwise it could have an impact on municipal sewage treatment plants (STPs) and industrial waste water treatment plants (WWTPs). For that assessment of the exposure, a stepwise approach is recommended:
Tier 1: Retrieve information on effluent pH and the contribution of the clinker on the resulting pH. Should de pH be above 9 and be predominantly attributable to clinker, then further actions are required to demonstrate safe use.
Tier 2: Retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9.
Tier 3: Measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably remonstrated. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralization, thus ensuring safe use

of cement during production or use phase. No special emission control measures are necessary for the exposure to the terrestrial environment.

9. Physical and chemical properties

9.1. Information on basic physical and chemical properties

This information applies to the whole mixture.

a) **Appearance:** Portland cement clinker is a grey or white, granular inorganic solid material.
b) **Odour:** odourless.
c) **Odour threshold:** no odour threshold, odourless.
d) **pH:** (Tª = 20 °C; in water, water-solid ratio 1:2): basic in between 11 y 13,5
e) **Melting point:** > 1250 ºC
f) **Initial boiling point and boiling range**: not applicable as under normal atmospheric conditions, melting point >1250 ºC.
g) **Flash point:** not applicable as is not a liquid.
h) **Evaporation rate:** not applicable as is not a liquid.
i) **Flammability (solid, gas):** not applicable as is a solid which is non combustible and does not cause or contribute to fire through friction.
j) **Upper/lower flammability or explosive limits:** not applicable as is not a flammable gas.
k) **Vapour pressure:** not applicable as melting point >1250 ºC.
l) **Vapour density:** not applicable as melting point >1250 ºC.
m) **Relative density:** 2,75 - 3,20 g/cm^3 at 20 °C; apparent density 0,9-1,5 g/cm^3 at 20 °C
n) **Solubility(ies) in water:** (T 20 ºC): slight (0.1-1.5 g/l)
o) **Partition coefficient: n-octanol/water:** not applicable as is inorganic mixture
p) **Auto-ignition temperature:** not applicable (no phyrophoricity – no organo-metallic, organo-metalloid or organo-phosphine bindings or of their derivatives, and no other pyrophoric constituent in the composition).
q) **Decomposition temperature:** not applicable as no organic peroxide present
r) **Viscosity:** not applicable as not a liquid
s) **Explosive properties:** Not applicable. Not explosive or pyrotechnic. Not in itself capable by chemical reaction of producing gas at such temperature and pressure and at such a speed as to cause damage to the surroundings. Not capable of a self-sustaining exothermic chemical reaction.
t) **Oxidising properties:** Not applicable as does not cause or contribute to the combustion of other materials.

9.2. Other information

Not applicable.

10. Stability and reactivity

10.1. Reactivity

When mixed with water, Portland cement clinker will harden into a stable and hardy mass in normal environments.

10.2. Chemical stability

Portland cement clinker is stable as long as it is properly stored (see Section 7). Contact with incompatible materials should be avoided.

Wet clinker is alkaline and incompatible with acids, with ammonium salts, with aluminum or other non-stable metals. Clinker dissolves in hydrofluoric acid to produce corrosive silicon tetrafluoride gas. Clinker reacts with water to form silicates and calcium hydroxide. Silicates in clinker react with powerful oxidizers such as fluorine, boron trifluoride, chlorine trifluoride, managanese trifluoride, and oxygen difluoride.

10.3. Possibility of hazardous reactions

Not applicable.

10.4. Conditions to avoid

Humid conditions during storage may cause lump formation and loss of product quality.

10.5. Incompatible materials

Acids, ammonium salts, aluminum or other non-noble metals.

10.6. Hazardous decomposition products

Portland cement clinker will not decompose into any hazardous products.

11. Toxicological information

11.1. Information on toxicological effects

Hazard class	Cat	Effect	Reference
Acute toxicity – dermal	-	Limit test, rabbit, 24 hours contact, 2.000 mg/kg body weight – no lethality. Cement used in the study is Portland cement with over 90% Portland cement clinker. Based on available data, the classification criteria are not met.	(2)
Acute toxicity – inhalation	-	No acute toxicity by inhalation observed. Based on available data, the classification criteria are not met.	(8)
Acute toxicity – oral	-	No indication of oral toxicity from studies with cement kiln dust. Cement kiln dust contains Portland cement clinker in varying amounts. Based on available data, the classification criteria are not met.	Literature survey
Skin corrosión/irritation	2	Portland cement clinker in contact with wet skin may cause thickening, cracking or fissuring of the skin. Prolonged contact in combination with abrasion may cause severe burns. Cement used in the study is Portland cement with over 90% Portland cement clinker.	(2) Human experience
Serious eye damage/irritation	1	Portland cement clinker caused a mixed picture of corneal effects and the calculated irritation index was 128. Direct contact with Portland cement clinker may cause corneal damage by mechanical stress, immediate or delayed irritation or inflammation. Direct contact by larger amounts of dry Portland cement clinker or splashes of wet clinker may cause effects ranging from moderate eye irritation (for example conjunctivitis or blepharitis) to chemical burns and blindness.	(10), (11)
Skin sensitisation	1	Some individuals develop eczema upon exposure to wet clinker dust, caused either by the high pH which induces irritant contact dermatitis after prolonged contact, or by an immunological reaction to soluble Cr (VI) which elicits allergic contact dermatitis.	(3), (4)

Hazard class	Cat	Effect	Reference
Respiratory sensitisation	-	There is no indication of sensitization of the respiratory system. Based on available data, the classification criteria are not met.	(1)
Germ cell mutagenity	-	No indication. Based on available data, the classification criteria are not met.	(12), (13)
Carcinogenicity	-	No casual association has been established between Portland cement clinker exposure and cancer. The epidemiological literature does not support the designation of Portland cement as a suspected human carcinogen. Portland cement is not classifiable as a human carcinogen (according to ACGIH A4: Agents that cause concern that they could be carcinogenic for humans but which cannot be assessed conclusively because of a lack of data. In vitro or animal studies do not provide indications of carcinogenicity that are sufficient to classify the agent with one of the other notations). Based on available data, the classification criteria are not met. Portland cement contains over 90% Portland cement clinker.	(1), (14)
Reproductive toxicity	-	Based on available data, the classification criteria are not met.	No evidence from human experience
STOT – single exposure	3	Portland cement clinker dust may irritate the throat and respiratory tract. Coughing, sneezing, and shortness of breath may occur following exposures in excess of occupational exposure limits. Overall, the pattern of evidence clearly indicates that occupational exposure to cement dust has produced deficits in respiratory function. However, evidence available at the present time is insufficient to establish with any confidence the dose-response relationship for these effects.	(1)
STOT – repeated exposure	-	There is an indication of COPD. The effects are acute and due to high exposures. No chronic effects or effects at low concentration have been observed. Based on available data, the classification criteria are not met.	(15)
Aspiration hazard	-	Not applicable as Portland cement clinker are not used as an aerosol.	-

Apart from skin sensitisation, Portland cement clinker and common cements have the same toxicological and eco-toxicological properties.

11.2. Medical conditions aggravated by exposure

Portland cement clinker may dust aggravate existing respiratory system disease(s) and/or medical conditions such as emphysema or asthma and/or existing skin and/or eye conditions.

12. Ecological information

12.1. Toxicity

The product is not hazardous to the environment. Ecotoxicological test with Portland cement – whose composition is very closely related to that of clinker - on Daphnia magna (Reference (4)) and Selenastrum coli (Reference (5)) have shown little toxicological impact. Therefore LC50 and EC50 values could not be determined (Reference (6)). There is no indication of sediment phase toxicity (Reference (7)). The addition of large amounts of Portland cement clinker to water may, however, cause a rise in pH and may, therefore, be toxic to aquatic life under certain circumstances.

12.2. Persistance and degradability

Not relevant as Portland cement clinker is an inorganic material. After hydration, Portland cement clinker presents no toxicity risks.

12.3. Bioaccumulative potential

Not relevant as Portland cement clinker is an inorganic material. After hydration Portland cement clinker lumps present no toxicity risks.

12.4. Mobility in soil

Not relevant as cement is an inorganic material. After hydration Portland cement clinker lumps present no toxicity risks.

12.5. Results of PBT and vPvB assessment

Not relevant as Portland cement clinker is an inorganic material. After hydration, Portland cement clinker lumps present no toxicity risks.

12.6. Other adverse effects

Not relevant.

13. Disposal considerations

13.1. Waste treatment methods

Cement clinker may always be reused, so waste treatment methods do not apply.
Do not dispose of into sewage systems or surface waters.

14. Transport information

Portland cement clinker is not covered by the international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID); no classification is required.
No special precautions are needed apart from those mentioned under Section 8.

14.1. UN number

Not relevant.

14.2. UN proper shipping name

Not relevant.

14.3. Transport hazard class(es)

Not relevant.

14.4. Packing group
Not relevant.

14.5. Environmental hazards
Not relevant.

14.6. Special precautions for user
Not relevant.

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code
Not relevant.

15. Regulatory information

15.1. Safety. Health and environmental regulations/legislation specific for the substance mixture

Cement clinker is exempt from registration (Art. 2.7 (b) and Annex V.10 of REACH).

Social Dialogue Agreement on Crystalline Silica
The so-called «Good practice guides" with contain advice on safe handling practices can be found from http:// www.nepsi.eu/good-practice-guide.aspx. These good practices have been adopted under the Social Dialogue "Agreement on Workers' Health Protection through the Good Handling and Use of Crystalline Silica and Products Containing it by Employee and Employer European sectorial associations, among which is CEMBUREAU. The Spanish cement industry voluntarily adopted the terms of the Agreement and has elaborated a protocol of application specific to the Spanish cement industry http:// www.oficemen.com/reportajePag.asp?id_rep=139.

15.2. Chemical Safety Assessment
No chemical safety assessment has been carried out.

16. Other information

16.1. Indication of changes
To this edition has been incorporated the classification and labeling of Portland cement clinker according to CLP Regulation and updates the Safety Data Sheet to new Annex II of REACH "Requirements for the elaboration of the safety data sheets" that has been modified by EU Regulation Number 453/2010 dated May 20th 2010.

16.2. Abbreviations and acronyms

ADR/RID	European Agreements on the transport of Dangerous goods by Road/Railway
CAS	Chemical Abstracts Service
CLP	Classification, labelling and packaging (Regulation (EC), number 1272/2008)
DNEL	Derived no-effect level
EC50	Half Maximal effective concentration
ECHA	European CHemicals Agency
EINECS	European Inventory of Existing Commercial chemical Substances
EPA	Type of high efficiency air filter
COPD	Chronic Obstructive Pulmonary Disease
FDS	Safety data sheet
FPA	Assigned protection factor

FFP	Filtering facepiece against particles (disposable)
HEPA	Type of high efficiency air filter
IATA	International Air Transport Association
IMDG	International agreement on the Maritime transport of Dangerous Goods LC50 Median lethal dose
LC50	Letal concentration of a compound in air or water that kills the 50% of the studied organisms in particular conditions
MS	Member State
PBT	Persistant, bio-accumulative and toxic
PNEC	Predicted no-effect concentration
PROC	Process category
RE	Repeated exposure
REACH	Registration, Evaluation and Authorization of Chemicals
STOT	Specific Target Organ Toxicity
UVCB	Sustancias de composición desconocida o variable, productos de reacción complejos o materiales biológicos
VLE-MP	Exposure limit value-weighted average in mg by cubic meter of air
vPvB	Very persistant, very bio-accumulative
VLA/ED	Environmental limit value for daily professional exposure.

16.3. Hey literatura references and sources of data.

1) Portland Cement Dust - Hazard assessment document EH75/7, UK Health and Safety Executive, 2006. Available from: http://www. hse.gov.uk/pubns/web/portlandcement.pdf
2) Observations on the effects of skin irritation caused by cement, Kietzman et al, Dermatosen, 47, 5, 184-189 (1999).
3) European Commission's Scientific Committee on Toxicology, Ecotoxicology and the Environment (SCTEE) opinion of the risks to health from Cr (VI) in cement (European Commission, 2002). http://ec.europa.eu/health/archive/ph_risk/committees/sct/documents/out158_ en.pdf
4) Epidemiological assessment of the occurrence of allergic dermatitis in workers in the construction industry related to the content of Cr (VI) in cement, NIOH, Page 11, 2003.
5) U.S. EPA, Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, 3rd ed. EPA/600/7-91/002, Environmental Monitoring and Support Laboratory, U.S. EPA, Cincinnati, OH (1994a) and 4th ed. EPA-821-R-02-013, US EPA, office of water, Washington D.C. (2002).
6) U.S. EPA, Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 4th ed. EPA/600/4-90/027F, Environmental Monitoring and Support Laboratory, U.S. EPA, Cincinnati, OH (1993). and 5th ed. EPA-821-R-02-012, US EPA, office of water, Washington D.C. (2002).
7) Environmental Impact of Construction and Repair Materials on Surface and Ground Waters. Summary of Methodology, Laboratory Results, and Model Development. NCHRP report 448, National Academy Press, Washington, D.C., 2001.
8) Final report Sediment Phase Toxicity Test Results with Corophium volutator for Portland clinker prepared for Norcem A.S. by AnalyCen Ecotox AS, 2007.
9) TNO report V8801/02, An acute (4-hour) inhalation toxicity study with Portland Cement Clinker CLP/GHS 03-2010-fi ne in rats, July 2010 – unaudited draftapproved
10) TNO report V8815/09, Evaluation of eye irritation potential of cement clinker G in vitro using the isolated chicken eye test, April 2010
11) TNO report V8815/10, Evaluation of eye irritation potential of cement clinker W in vitro using the isolated chicken eye test, April 2010

12) Investigation of the cytotoxic and proinflammatory effects of cement dusts in rat alveolar macrophages, Van Berlo et al, Chem. Res. Toxicol., 2009 Sept; 22(9): 1548-58
13) Cytotoxicity and genotoxicity of cement dusts in A549 human epithelial lung cells in vitro; Gminski et al, Abstract DGPT conference Mainz, 2008
14) Comments on a recommendation from the American Conference of governmental industrial Hygienists to change the threshold limit value for Portland cement, Patrick A. Hessel and John F. Gamble, EpiLung Consulting, June 2008
15) Prospective monitoring of exposure and lung function among cement workers, Interim report of the study after the data collection of Phase I-II 2006-2010, Hilde Notø, Helge Kjuus, Marit Skogstad and Karl-Christian Nordby, National Institute of Occupational Health, Oslo, Norway, March 2010,

16.4. Training advice.

In addition to health, safety and environmental training programs for their workers, companies must ensure that workers read, understand and apply the requirements of this SDS.

16.5. Disclaimer.

The information on this data sheet reflects the currently available knowledge and is reliable provided that the product is used under the prescribed conditions and in accordance with the application specified on the packaging and/or in the technical guidance literature. Any other use of the product, including the use of the product in combination with any other product or any other process, is the responsibility of the user.

It is implicit that the user is responsible for determining appropriate safety measures and for applying the legislation covering his/her own activities.

This safety data sheet about cement cancels and replaces version 1.0 of November 2008 and the safety data sheet of Portland cement clinker of Cementos Lemona dated February 2010.