Buzzi Unicem

SAFETY DATA SHEET FOR CEMENTS AND HYDRAULIC BINDERS

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Section 1. IDENTIFICATION OF THE MIXTURE AND OF THE COMPANY

1.1 Product identifier:

Cement and/or cement-based powder mixture, conforming to specific technical standards.

1.2 Relevant identified uses of the mixture and uses advised against

The cement is used as a hydraulic binder for the manufacture of concrete, hydraulic mortar, plaster, etc. Cements and hydraulic binders in accordance with the product and chemical/physical requirements of technical standards EN 197-1, UNI EN 413-1, UNI EN 14216 and UNI EN 15368, are used industrially, by professionals as well as by consumers in building and construction work.

The identified uses of cements and cement containing mixtures (hydraulic binders) include both dry products, and the products in a wet suspension (paste).

PROC	Process categories - Identified uses (use description)	Manufacture/ Formulation of building materials	Professional/ Industrial use of building materials
2	Use in closed, continuous process with occasional controlled exposure	X	X
3	Use in closed batch process (synthesis or formulation)	X	X
5	Mixing or blending in batch process for formulation of preparations and articles (contact in various phases and/or significant contact)	X	X
7	Industrial spraying		X
8a	Transfer of substance or preparation (*) (filling/emptying) from / to vessels /large containers at non-dedicated facilities		X
8b	Transfer of substance or preparation (*) (filling/emptying) from / to vessels /large containers at dedicated facilities	X	X
9	Transfer of substance or preparation (*) into small containers (dedicated filling line, including weighing)	X	X
10	Roller application or brushing		X
11	Non-industrial spraying		X
13	Treatment of articles by dipping and pouring		X
14	Production of preparations (*) or articles by tabletting, compression, extrusion, pelletisation	X	X
19	Hand mixing with intimate contact, only using personal protective equipment (PPE)		X
22	Potentially closed processing operations with minerals/metals at elevated temperature Industrial setting		X
26	Handling of solid inorganic substances at ambient temperature	X	X

(*) N.B.: In order to remain consistent with the descriptors system indicated in IUCLID 5.2, the term “preparation” has not been replaced by the new definition of “mixture” in the table.

1.3 Details of the supplier of the Safety Data Sheet (SDS)

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1.4 Emergency telephone number: **+39 0382 24444 -** Centro Antiveleni di Pavia (*Pavia Poison Center*)

(see also Subsection 16.7)

Available outside of business hours? [X] YES 24 hours/day

Section 2. HAZARDS IDENTIFICATION

2.1 Classification of the mixture

In accordance with Regulation (EC) No. 1272/2008 (CLP)

Hazard class	Hazard Category	Risk phases
Skin irritation	2	H315: causes skin irritation
Serious eye damage / irritation	1	H318: causes serious eye damage
Skin sensitisation	1B	H317: may cause an allergic skin reaction
Specific toxicity for target organs (single exposure) - STOT SE, respiratory irritation	3	H335: may cause respiratory irritation

2.2 Label elements

In accordance with Regulation (EC) No. 1272/2008 (CLP)

Warnings

Hazard

Risk phases

H318: causes serious eye damage
H315: causes skin irritation
H317: may cause an allergic skin reaction
H335: may cause respiratory irritation

Safety phases

P102: keep out of reach of children

P280: Wear protective gloves/protective clothing/eye protection/face protection.

P305+P351+P338+P312: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing. If you feel unwell, call a Poison Centre or doctor.

P302+P352+ IF ON SKIN: wash with plenty of soap and water; if skin irritation or rash occurs:

P333+P313:	Get medical advice/attention.
P261+P304+ P340+P312:	Avoid breathing the dust. IF INHALED: Remove person to fresh air and keep comfortable for breathing If you feel unwell, call a Poison Centre or doctor.
P501:	dispose of product/containers in accordance with current regulations.

2.3 Other hazards

In the presence of water, for example when manufacturing concrete or mortar, or when it gets wet, the cement produces a strong alkaline solution (high pH due to the formation of hydroxides of calcium, sodium and potassium).
Frequent inhalation of cement dust over a long period of time increases the risk of developing lung diseases (above all, for repeated and prolonged exposure to dust by some types of cement-based mixtures containing siliceous components – *for more details, see Subsection 15.1).*

Repeated and prolonged contact of cement and/or its pastes on moist skin (due to sweat or humidity) may cause irritation and contact dermatitis *[Reference (4)].*

Both cement and cement pastes, in case of prolonged contact with the skin, may cause sensitisation due to the presence of trace amounts of chromium (VI) salts; if necessary, this effect can be diminished by adding a specific reducing agent to keep the level of sensitising soluble chromium (VI) below the limit of 0.0002% (2 ppm) of the total dry weight of the ready-to-use cement, according to the legislation specified under Section 15.1 *[Reference (3)].*

If large amounts are ingested, cement may cause ulcerations of the digestive system.

Under normal conditions of use, cements and cement pastes do not pose particular risks to the environment, as long as the recommendations provided in Sections 6, 8, 12 and 13 are followed.

The cement does not meet the criteria for PBT or vPvB, in accordance with Annex XIII of Regulation (EC) No. 1907/2006 “REACH”.

Section 3. COMPOSITION / INFORMATION ON INGREDIENTS

3.1 Substances

Not applicable.

3.2 Mixture

The common cement types are made in accordance with UNI EN 197-1 (see table below)

3.2.1 Components presenting a health hazard

Substance	% in peso	EC No.	CAS No.	Registration “REACH” No.	Classification according to Regulation (EC) No. 1272/2008		
					Hazard class	Hazard category	Hazard statements
Portland cement clinker	**5÷100**	**266-043-4**	**65997-15-1**	**None (*)**	**Skin irritation**	**2**	**H315**
					Skin sensitisation	**1B**	**H317**
					Eye damage	**1**	**H318**
					STOT SE	**3**	**H335**
Flue dust [Filter (CKD) and By-pass (BPD) dust]	**0.1÷5**	**270-659-9**	**68475-76-3**	**01-2119486767 -17-0018** (10/11/2010)	**Skin irritation**	**2**	**H315**
					Skin sensitisation	**1B**	**H317**
					Eye damage	**1**	**H318**
					STOT SE	**3**	**H335**

(*) clinker: C&L Notification No. 02-2119682167-31-0000 dated 15/12/2010; updated on 1/07/2013 with the presentation of Report No. QJ420702-40.

The clinker and *flue dust* content in the various types of cement is specified in the table below; the CKD

(cement kiln dust) and/or BPD (by-pass dust) *(i.e. flue dust),* if present in the formulation of the cement mixtures, is dosed as a secondary constituent.

Cement is an inorganic product, consisting of a finely ground mixture of clinker, gypsum and other specific constituents (limestone, pozzolana, blast furnace slag, fly ash, etc.), defined by specific technical standards.

The clinker, produced by a firing kiln at about 1450 °C in sintered granular form, is an artificial mineral with several components, composed mainly of calcium silicates, aluminates and aluminoferrites and small quantities of calcium and magnesium oxide, sodium, potassium and calcium sulphates, as well as traces of other compounds, including chromium (VI) salts.

Common cements are manufactured in compliance with the requirements of standard EN 197-1 "*Composition, specifications and conformity criteria for common cements*" as amended.

Hydraulic binders for non-structural applications (HBs) are compliant with the requirements of UNI 15368 *"Non-structural construction hydraulic binder – Definition, specifications and conformity criteria".*

Masonry cements (MC) are made in accordance with the requirements of UNI EN 413-1 *"Masonry Cement – Part 1: composition, specifications and conformity criteria"*, while very low heat cements (VLH) are made according to UNI EN 14216 *"Cement - Composition, specifications and conformity criteria for very low heat special cements"*

Main types	Denomination of the 27 products (types of common cement)		Composition (mass percentage)[a]										
			Primary consituents										Secondary costituents
			Clinker	Blast furnace slag	Silica fumes	Pozzolan		Fly ash		Calcinated shale	Limestone		
			K	S	D[b]	natural P	natural calcinated Q	siliceous V	calcic W	T	L	LL	
CEM I	Portland cement	CEM I	95-100	-	-	-	-	-	-	-	-	-	0-5
CEM II	Portland slag cement	CEM II/A-S	80-94	6-20	-	-	-	-	-	-	-	-	0-5
		CEM II/B-S	65-79	21-35	-	-	-	-	-	-	-	-	0-5
	Portland cement with silica fumes	CEM II/A-D	90-94	-	6-10	-	-	-	-	-	-	-	0-5
	Portland pozzolanic cement	CEM II/A-P	80-94	-	-	6-20	-	-	-	-	-	-	0-5
		CEM II/B-P	65-79	-	-	21-35	-	-	-	-	-	-	0-5
		CEM II/A-Q	80-94	-	-	-	6-20	-	-	-	-	-	0-5
		CEM II/B-Q	65-79	-	-	-	21-35	-	-	-	-	-	0-5
	Portland fly ash cement	CEM II/A-V	80-94	-	-	-	-	6-20	-	-	-	-	0-5
		CEM II/B-V	65-79	-	-	-	-	21-35	-	-	-	-	0-5
		CEM II/A-W	80-94	-	-	-	-	-	6-20	-	-	-	0-5
		CEM II/B-W	65-79	-	-	-	-	-	21-35	-	-	-	0-5
	Portland calcinated shale cement	CEM II/A-T	80-94	-	-	-	-	-	-	6-20	-	-	0-5
		CEM II/B-T	65-79	-	-	-	-	-	-	21-35	-	-	0-5
	Portland limestone cement	CEM II/A-L	80-94	-	-	-	-	-	-	-	6-20	-	0-5
		CEM II/B-L	65-79	-	-	-	-	-	-	-	21-35	-	0-5
		CEM II/A-LL	80-94	-	-	-	-	-	-	-	-	6-20	0-5
		CEM II/B-LL	65-79	-	-	-	-	-	-	-	-	21-35	0-5
	Portland composite cement[c]	CEM II/A-M	80-94	← 6-20 →									0-5
		CEM II/B-M	65-79	← 21-35 →									0-5
CEM III	Blast furnace cement	CEM III/A	35-64	36-65									0-5
		CEM III/B	20-34	66-80									0-5
		CEM III/C	5-19	81-95									0-5
CEM IV	Pozzolanic cement[c]	CEM IV/A	65-89	-	← 11-35 →								0-5
		CEM IV/B	45-64	-	← 36-55 →								0-5
CEM V	Composite cement[c]	CEM V/A	40-64	18-30	-	← 18-30 →							0-5
		CEM V/B	20-38	31-50	-	← 31-50 →							0-5

[a] The value from the data sheet refer to the sum of primary and secondary constituents.

[b] The proportion of silica fumes is restricted to 10%.

[c] In the Portland composite cements CEM II/A-M e CEM II/B-M, in the pozzolanic cements CEM IV/A e CEM IV/B and in the composite cements CEM V/A e CEM V/B the primary constituents other than clinker must be declared in the cement denomination (see example in section 8).

Section 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 inhaling cement dust and contact with wet cement or wet cement containing preparations. If this is not possible, first aid workers should use the personal protective equipment described in Section 8.

Following contact with eyes

Do not rub eyes in order to avoid possible corneal damage by mechanical stress.
Remove contact lenses if any. Incline head to injured eye, open the eyelids 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).
If necessary, contact a specialist of occupational medicine or an eye specialist.

Following skin contact

For dry cement, remove and rinse abundantly with water.
For wet/damp cement, wash skin with plenty of water and pH neutral soap or a mild detergent. Remove contaminated clothing, footwear, watches, etc. and clean thoroughly before reusing 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. Get immediate medical attention or contact a Poison Center.

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

Eyes: Eye contact with cement dust (dry or wet) may cause serious and potentially irreversible injuries.

Skin: Cement and/or cement pastes may have an irritating effect on moist skin (due to sweat or humidity) after prolonged contact or may cause contact dermatitis after repeated and prolonged contact. Furthermore, prolonged skin contact with wet cement and/or wet cement preparations (mortars, concrete, renders, etc.) may cause irritation, serious contact dermatitis or burns. *[For more details, see Reference (1)]*

***Inhalation*:** Repeated inhalation of cement dust over a long period of time increases the risk of developing lung diseases.

***Ingestion*:** Accidental ingestion of cement may cause ulcerations of the mouth and oesophagus.

Environment: Under normal use, cement is not hazardous to the environment.

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

See the information provided in Subsection 4.1. When contacting a physician, take the Safety Data Sheet (SDS) with you.

Section 5. FIRE-FIGHTING MEASURES

5.1 Extinguishing media

Cement is not flammable. Therefore, in the event of a fire in the surrounding area, all types of fire extinguishing media may be used.

5.2 Special hazards arising from the substance or mixture

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

5.3 Advice for fire-fighters

Cement poses no fire-related hazards. Therefore, there is no need for special protective equipment for the fire-fighters.

Section 6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

6.1.1 For non-emergency personnel

Wear personal protective equipment (PPE) as described under Section 8 and follow the advice for handling and use given under Section 7.

6.1.2 For emergency responders

Special emergency procedures are not required. However, eye, skin and respiratory protections are needed in situations with high dust levels.

6.2 Environmental precautions

Avoid washing cement down sewage and drainage systems or into watercourses.

6.3 Methods and material for containment and cleaning up

Dry cement

Use dry cleanup methods such as vacuum clean-up or vacuum extraction [industrial portable units, equipped with high-efficiency particulate filters or equivalent technology], which do not cause airborne dispersion. Never use compressed air.
Alternatively, wipe up the dust by dampening it and collecting it with a broom or mop.
Where this is not possible, remove by slurrying with water (*see: wet cement*).
Ensure that the workers wear appropriate personal protective equipment (see Section 8), in order to prevent inhalation of the cement dust and contact with skin and/or eyes.
Place spilled materials into containers. In the event of large spills of cement, close or cover any water wells located nearby.

Wet cement

Clean up wet cement and place in containers. Allow the material to dry and solidify before disposal as described under Section 13.

6.4 Reference to other sections

For more details, see Sections 8 and 13.

Section 7. HANDLING AND STORAGE

7.1 Precautions for safe handling

7.1.1 Protective measures

Follow the recommendations provided under Section 8.
To clean up dry cement, see Subsection 6.3.

Measures to prevent fire
No precautions are necessary, as cement is neither combustible nor flammable.

Measures to prevent aerosol and dust generation
Do not sweep or use compressed air. Use dry cleanup methods (such as vacuum clean-up and/or vacuum extraction) which do not cause airborne dispersion of the cement dust.

Also follow the recommendations outlined under Subsection 15.1 “Good practice guide”.

Measures to protect the environment
When handling the cement, avoid releasing it into the environment (see also Subsection 6.2).

7.1.2 Information on general occupational hygiene

At the workplace, do not eat or drink in the areas where cement is handled and/or stored.

In dusty environments, wear dust masks and protective goggles.
Use protective gloves to avoid skin contact.

7.2 Conditions for safe storage, including any incompatibilities

Cement must be stored out of the reach of children, far from acids, in appropriate closed containers (storage silos and bags), in a cool, dry location in the absence of ventilation, in order to preserve its technical characteristics and, in any case, prevent the dispersion of dust (see Section 10).

Engulfment hazard: cement can build up or adhere to the walls of a confined space in which it is stored; the cement can release, collapse or fall unexpectedly.

To prevent engulfment or suffocation (during maintenance work or cleaning/unclogging operations), do not enter a confined space – such as a silo, hopper, bulk truck or other storage container or vessel that stores or contains the cement – without adopting specific safety procedures and suitable personal protective equipment.

Do not use aluminium containers due to incompatibility of the materials.

7.3 Specific end uses

No further information (see also Section 1.2).

7.4 Effectiveness of the soluble chromium (VI) reducing agent

The integrity of the package and observance of the proper storage procedures described above are essential conditions in order to guarantee the effectiveness of the reducing agent for the period of time specified on the delivery document or on each individual bag.

This time expiration concerns exclusively the activity of the reducing agent in keeping the content of soluble chromium (VI), determined according to the standard EN 196-10, below the limit of 0.0002% of the total dry weight of the ready-to-use cement, required by current legislation (see Section 15), without prejudice to the limits of use of the product imposed by the general rules of storage and use of the product itself.

Section 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

8.1 Control parameters

The threshold limit value for the time-weighted average (TLV-TWA), adopted for workplaces by the American Conference of Governmental Industrial Hygienists (ACGIH) for “Portland cement” particulates is equal to 1 mg/m^3 (respirable fraction). *[for more information, see also Subsection 15.1]*

To assess the **exposure level** (DNEL = derived no-effect level):

- DNEL (respirable fraction): 1 mg/m^3
- DNEL (dermal): not applicable
- DNEL (oral): not relevant

In contrast, the tool used for the risk assessment [MEASE, see *Reference (17)*] works with the inhalable fraction. Therefore, a further precautionary condition may be implicitly correlated to the risk assessment procedure for occupational exposure.

For workers, no DNEL for dermal exposure are available, neither from human hazard studies nor from human experience. Since cement dust is classified as irritating to skin and eyes, dermal exposure must be minimised as far as technically feasible.

To assess the **environmental risk** (PNEC = predicted no-effect concentration):

- PNEC for water: not applicable
- PNEC for sediment: not applicable
- PNEC for soil: not applicable

The risk assessment of the environmental compartments is based on the resulting pH impact on water. Possible pH changes in surface water, ground water and STP effluent should not increase the value above 9.

8.2 Exposure controls

For each Process Category (PROC), the user can choose between options (A) and (B) shown below in Table 8.2.1, depending on the relevant plant situation.
After selecting an option, it must also be selected in Table 8.2.2 of Section 8.2.2 *"Individual protection measures such as personal protective equipment (PPE) – Specifications for respiratory protection equipment"*; therefore, only combinations between (A)-(A) and (B)-(B) are possible.

8.2.1 Appropriate engineering controls

In the installations where cement is handled, transported, loaded, unloaded and stored, suitable hygienic and protective measures must be adopted to protect the workers and for the containment of the dust emission into the work environments, as specified in the table below (evaluated for a DNEL value = 1 mg/m^3).

Table 8.2.1

Exposure scenario	PROC (*)	Exposure	Localised controls (**)	Efficiency
Industrial production / 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		Generic local exhaust ventilation	78 %
Industrial uses of dry hydraulic building and construction materials (indoor and outdoor)	2		Not required	-
	14, 22, 26		A) Not required, or B) Generic local exhaust ventilation	- 78 %
	5, 8b, 9		Generic local exhaust ventilation	78 %
Industrial uses of wet suspensions of hydraulic building and construction materials	7		A) Not required, or B) Generic local exhaust ventilation	- 78 %
	2, 5, 8b, 9, 10, 13, 14		Not required	-
Professional uses of dry hydraulic building and construction materials (indoor and outdoor)	2		A) Not required, or B) Generic local exhaust ventilation	- 72 %
	9, 26		A) Not required, or B) Generic local exhaust ventilation	- 72 %
	5, 8a, 8b, 14		Generic local exhaust ventilation	72 %
	19 (#)		Localised controls are not applicable. The processes may be carried out only in well-ventilated areas or outdoors.	-
Professional uses of wet suspensions of hydraulic building and construction materials	11	(#) < 240 min	A) Not required, or B) Generic local exhaust ventilation	- 72 %
	2, 5, 8a, 8b, 9, 10, 13, 14, 19		Not required	-

(*) The PROCs are identified uses, as defined in Section 1.2.

(**) The localised controls must be defined based on the effective plant-engineering situation, and then the personal protective equipment, specified in the table in Subsection 8.2.2, will be identified accordingly.

8.2.2 Individual protection measures such as personal protective equipment (PPE)

General: Do not eat, drink or smoke when working with the cement in order to avoid contact with skin or mouth.
Remove contaminated clothing, footwear, glasses and clean thoroughly before re-using them.
When handling cement, use the PPE specified below; immediately after handling or working with cement or cement-containing products/preparations, workers should wash thoroughly with neutral soap or mild detergent or use moisturising cream.

Eye / face protection

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

Skin protection

Use impervious, abrasion and alkali-resistant gloves, certified according to EN 374-parts 1,2,3, and safety shoes and/or boots and work clothing (long-sleeved and long-legged), as well as skin care products (including moisturising creams) to ensure maximum skin protection against prolonged contact with wet cement.

Respiratory protection

When a worker may potentially be exposed to dust levels above exposure limits, use appropriate respiratory protection, proportionate to the level of dust and compliant with the relevant technical standards (such as filtering facepieces certified according to UNI EN 149).

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The personal protective equipment, based on the localised controls and evaluated for a DNEL value = 1 mg/m^3, are specified in the table below.

Table 8.2.2

Exposure scenario	PROC (*)	Exposure	Specification of respiratory protective equipment (RPE)	RPE efficiency – Assigned Protection Factor (APF)
Industrial production / 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) P2 Mask (FF, FM) or B) P1 Mask (FF, FM)	APF = 10 APF = 4
	5, 8b, 9		P2 Mask (FF, FM)	APF = 10
Industrial uses of dry hydraulic building and construction materials (indoor and outdoor)	2		Not required	--
	14, 22, 26		A) P2 Mask (FF, FM) or B) P1 Mask (FF, FM)	APF = 10 APF = 4
	5, 8b, 9		P2 Mask (FF, FM)	APF = 10
Industrial uses of wet suspensions of hydraulic building and construction materials	7		A) P3 Mask (FF, FM) or B) P2 Mask (FF, FM)	APF = 20 APF = 10
	2, 5, 8b, 9, 10, 13, 14		Not required	--
Professional uses of dry hydraulic building and construction materials (indoor and outdoor)	2		A) P2 Mask (FF, FM) or B) P1 Mask (FF, FM)	APF = 10 APF = 4
	9, 26		A) P3 Mask (FF, FM) or B) P2 Mask (FF, FM)	APF = 20 APF = 10
	5, 8a, 8b, 14		P3 Mask (FF, FM)	APF = 20
	19 (#)	(#) < 240 min	P3 Mask (FF, FM)	APF = 20
Professional uses of wet suspensions of hydraulic building and construction materials	11		A) P3 Mask (FF, FM) or B) P2 Mask (FF, FM)	APF = 20 APF = 10
	2, 5, 8a, 8b, 9, 10, 13, 14, 19		Not required	--

(*) The PROCs are identified uses, as defined in Section 1.2.

An example of the assigned protection factors (APF) for various respiratory protective equipment (RPE), according to EN 529:2005, can be found in the glossary of the MEASE approach *[see Reference (17)].*

Thermal hazards

Not applicable.

8.2.3 Environmental exposure controls

In the installations where cement is handled, transported, loaded, unloaded and stored, suitable measures must be adopted for the containment of the dispersion of cement dust into the work environments (see also Subsections 8.2.1 and 15.1).

In particular, preventive measures must ensure the containment of the respirable particulate concentration within the threshold limit value for the time-weighted average (TLV-TWA), adopted by the American Conference of Governmental Industrial Hygienists (ACGIH) for Portland cement.

Similarly, all the appropriate engineering-organisational steps must be taken in order to prevent the dispersion or accidental release of cement dust during the various production and use phases, mainly to prevent dumping onto the soil or into watercourses or the sewage and drainage systems.

The aquatic effect and risk assessment cover the effect on organisms / ecosystems due to possible pH changes related to hydroxides discharges. The eco-toxicity of the other dissolved inorganic components (ions) is negligible compared to the negative pH effect.

Any effects that might occur during production and use of the cement would be expected to take place on a local scale at the industrial installation. The pH of the 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 assessment of the exposure, a stepwise approach is recommended:

- Tier 1: Retrieve information on effluent pH and the contribution of the cement dust on the resulting pH. Should the pH be above 9 and be predominantly attributable to cement dust, 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 must not exceed the value of 9.
- Tier 3: Sample and measure the pH in the receiving water after the discharge point. If the pH is below 9, safe use is reasonably demonstrated. If the pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thereby ensuring safe use of cement during production and/or use phases.

No special preventive measures are necessary for the exposure to the terrestrial environment, except for correct application of ordinary, effective managerial practices.

Section 9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

(a) Appearance: dry cement is a finely ground solid inorganic material (main particle size: 5÷30 µm)

(b) Odour: odourless

(c) Odour threshold: no odour threshold, odourless

(d) pH (T = 20°C in water, water-solid ratio 1:2): 11 ÷ 13,5

(e) Melting point: >1,250 °C

(f) Initial boiling point and boiling range: not applicable, as under normal atmospheric conditions, the melting point is > 1,250°C.

(g) Flash point: not applicable, as it is not a liquid.

(h) Evaporation rate: not applicable, as it is not a liquid.

(i) Flammability (solid, gas): not applicable, as it 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 it is not a flammable gas.

(k) Vapour pressure: not applicable, as the melting point is > 1,250 °C.

(l) Vapour density: not applicable, as the melting point is > 1,250 °C.

(m) Relative density: 2.7 ÷ 3.2 g/cm³
Apparent density: 0.9 ÷ 1.5 g/cm³

(n) Solubility in water (T = 20 °C): slight (0.1 ÷ 1.5 g/l)

(o) Partition coefficient; n-octanol / water: not applicable, as it is an inorganic substance.

(p) Auto-ignition temperature: not applicable (no pyrophoricity – no organo-metallic, organo-metalloid or organo-phosphine bindings or their derivatives, and no other pyrophoric constituent in the composition).

(q) Decomposition temperature: not applicable, as there is no organic peroxide present.

(r) Viscosity: not applicable, as it is not a liquid.

(s) Explosive properties: not applicable; it is not explosive or pyrotechnic.
It is not in itself capable of producing gas by chemical reaction at temperatures, pressures and speeds such as to cause damage to surroundings.
It is not capable of a self-sustaining exothermic chemical reaction.

(t) Oxidising properties: not applicable, as it does not cause or contribute to the combustion of other materials.

9.2 Other information

Not applicable.

Section 10. STABILITY AND REACTIVITY

10.1 Reactivity

When mixed with water, cement will harden into a stable mass that is not reactive in normal environments. Dry cement is chemically stable and compatible with most other building materials.

10.2 Chemical stability

Dry cement is stable as long as it is properly stored (see Section 7). It must be kept dry, and contact with incompatible materials should be avoided.

The integrity of the package and observance of proper storage procedures, specified under Subsection 7.2, are essential conditions in order to preserve the effectiveness of the reducing agent for the period of time specified on the bag or on the transport document.

Wet cement is alkaline and incompatible with acids, ammonium salts, aluminium and other non-noble metals. Cement dissolves in hydrofluoric acid to produce corrosive silicon tetrafluoride gas.

Cement also reacts with water to form silicates and calcium hydroxide. Silicates in cement react with powerful oxidisers such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride and oxygen difluoride.

10.3 Possibility of hazardous reactions

Not applicable, as cement does not cause hazardous reactions.

10.4 Conditions to be avoided

Humid conditions during storage may cause loss of product quality and the formation of lumps (or blocks), with consequent difficulty in handling.

10.5 Incompatible materials

Contact with acids, ammonium salts, aluminium or other non-noble metals may cause exothermic reactions (temperature increase). Furthermore, hydrogen is produced when aluminium powder comes into contact with wet cement.

10.6 Hazardous decomposition products

Cement will not decompose into any hazardous products.

Section 11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Hazard class	Cat	Effect	Reference
Acute toxicity - dermal	-	Limit test, in vivo and in vitro on animals (rabbit, 24 hours contact, 2 g/kg body weight) – no lethality. Based on the available data, the classification criteria are not met.	(2)
Acute toxicity - inhalation	-	No acute toxicity by inhalation observed. Based on the available data, the classification criteria are not met.	(9)
Acute toxicity - oral	-	No indication of oral toxicity from studies with cement kiln dust. Based on the available data, the classification criteria are not met.	Literature survey
Skin corrosion / irritation	2	Cement in contact with wet skin may cause thickening, cracking or fissuring of the skin. Prolonged contact in combination with existing abrasions may cause severe burns.	(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. Common cements contain varying quantities of Portland cement clinker, fly ash, blast furnace slag, gypsum, natural pozzolana, burnt shale, silica fume and limestone. Direct contact with cement may cause corneal damage by mechanical stress, immediate or delayed irritation or inflammation. Direct contact by larger amounts of dry cement or splashes of wet cement may cause effects ranging from moderate eye irritation (e.g. conjunctivitis or blepharitis) to chemical burns and blindness.	(10), (11)
Skin sensitisation	1B	Some individuals may develop eczema upon exposure to wet cement 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. The response may appear in a variety of forms ranging from a mild rash to severe dermatitis and is a combination of the two abovementioned mechanisms. No sensitising effect is expected if the cement contains a soluble Cr (VI) reducing agent, as long as the specified period of effectiveness of the reducing agent is not exceeded [Reference (3)].	(3), (4), (16)
Respiratory sensitisation	-	There is no indication of sensitisation of the respiratory system. Based on the available data, the classification criteria are not met.	(1)
Germ cell mutagenicity	-	No indication. Based on the available data, the classification criteria are not met.	(12), (13)
Carcinogenicity	-	No causal association has been established between Portland cement 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 the available data, the classification criteria are not met.	(1) (14)
Reproductive toxicity	-	Based on the available data, the classification criteria are not met.	No evidence from human experience

STOT – single exposure	3	Cement 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 (Chronic obstructive pulmonary disease). The effects are acute and due to high exposures. No chronic effects or effects at low concentration have been observed. Based on the available data, the classification criteria are not met.	(15)
Aspiration risk	-	Not applicable, as cements are not used as an aerosol.	

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

- **Medical conditions aggravated by exposure**

  Prolonged exposure to high concentrations of respirable cement dust may aggravate existing respiratory system diseases and/or medical conditions such as emphysema or asthma and/or existing skin and/or eye conditions.

Section 12. ECOLOGICAL INFORMATION

12.1 Toxicity

Cement is not hazardous to the environment.

Eco-toxicological tests with Portland cement on Daphnia magna [Reference (5)] and Selenastrum coli [Reference (6)] have shown little toxicological impact. Therefore LC50 and EC50 values could not be determined [Reference (7)].

There is no indication of sediment phase toxicity [Reference (8)].

The addition of large amounts of cement in water may, however, cause a rise in pH and may, therefore, be toxic to aquatic life under certain circumstances.

12.2 Persistence and degradability

Not relevant, as cement is an inorganic material. After hardening, cement presents no toxicity risks.

12.3 Bio-accumulative potential

Not relevant, as cement is an inorganic material. After hardening, cement presents no toxicity risks.

12.4 Mobility in soil

Not relevant, as cement is an inorganic material. After hardening, cement presents no toxicity risks.

12.5 Results of PBT and vPvB assessment

Not relevant, as cement is an inorganic material. After hardening, cement presents no toxicity risks.

12.6 Other adverse effects

Not relevant.

Section 13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Cements and cement mixtures which are being disposed of must be managed according to the provisions of Legislative Decree No. 152 of 3/04/2006 - Part 4 “Waste management regulations”, as amended, and subsequent implementing decrees.
Cements and cement mixtures, classified as non-hazardous special waste, do not pose particular risks for disposal, taking care to avoid its dumping or release into sewage systems or surface waters.

The empty bags must also be managed in compliance with current legislation on non-hazardous waste.

Section 14. TRANSPORT INFORMATION

Cement does not fall under any hazard class for the transport of dangerous goods and, therefore, is not covered by the relative international regulations: IMDG (sea), ADR (road), RID (rail), ICAO/IATA (air).
During transport, avoid wind dispersion by using closed containers.

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 MARPOL 73/78 and the IMSBC Code
Application of the provisions of the IMSBC code for maritime transport of solid bulk cargoes (see Annex C), adopted by the International Maritime Organisation (IMO) with Resolution MSC 268(85):2008 as amended and implemented in Italy with Ministry of Transport Decree No. 1340 of 30/11/2010

Section 15. REGULATORY INFORMATION

15.1 Safety, health and environmental regulations /legislation for the mixture

- **Regulation (EC) 18/12/2006 No. 1907**
  "*Registration, Evaluation, Authorisation and Restriction of Chemicals"* (**REACH***)*

- **Regulation (EC) 9/10/2008 No. 987**
  "*Amendment of Regulation (EC) No. 1907/2006, as regards the exclusions defined in Annexes IV and V"*

- **Amendment of Regulation (EC) No. 987/2008 of the Commission – 8/10/2008**
  "*Modification of Annexes IV and V of Regulation (EC) No. 1907/2006"*

- **Regulation (EC) 22/06/2009 No. 552**
  "*Amendment of Regulation (EC) No. 1907/2006 of the European Parliament and Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (**REACH**), regarding Annex XVII "Restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations".*

- **Regulation (EC) 16/12/2008 No. 1272**
  "*Classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC and Regulation (EC) 1907/2006"*

- **Regulation (EU) 20/05/2010 No. 453**
  "*Amendment of Regulation (EC) No. 1907/2006, as regards Annex II Guide to the compilation of safety data sheets (SDS)"*

- **Regulation (EU) 8/05/2013 No. 487**
  "Amendment for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No. 1272/2008 of the European Parliament and of the Council on classification, labelling and

packaging of substances and mixtures"

- **Ministry of Health Decree 10/05/2004**
  "*Implementation of Directive 2003/53/EC containing the twenty-sixth amendment to Directive 76/769/EEC of 27/07/1976, regarding the restrictions for placing on the market and use of certain hazardous substances and preparations (nonylphenol, nonylphenol ethoxylates,* ***cement****)"*

- **Ministry of Health Decree 17/02/2005**
  "Adoption of a test method regarding cements, in reference to Ministerial Decree 10/05/2004, which implemented the twenty-sixth amendment of Directive 76/769/EC"

- **Legislative Decree 3/04/2006 No. 156 as amended**
  "*Regarding environmental regulations" (see TUA)*

- **EN 197-1** *"Cement – Composition, specifications and conformity criteria for common cements"*

- **UNI EN 15368** *"Building hydraulic binder – Definition, specifications and conformity criteria"*

- **UNI EN 413-1** *"Masonry Cement – Part 1: composition, specifications and conformity criteria"*

- **UNI EN 14216** *"Cement – Composition, specifications and conformity criteria for very low heat special cements"*

- **EN 196-10** *"Methods of testing cement – Part 10: Determination of the water-soluble chromium (VI) content of cement*"

- **Legislative Decree 9/04/2008 No. 81 as amended**
  "Relevant to the health and safety of the workers"

  The cement user must apply the technical and organisational measures provided for by the abovementioned legislative decree and relative applicable decrees, also taking into account the information on exposure limits and suitable PPE provided in Section 8.

- The so-called "**Good practice guide**", which contains advice on safe handling and use of **crystalline silica** and products containing it, can be found from: http://www.nepsi.eu/good-practice-guide.aspx.

  These plant and operating methods were implemented under the Social Dialogue "*Agreement on Workers' Health Protection through the Good Handling and Use of Crystalline Silica and Products Containing it"* signed on 25/04/2006 by Employee and Employer European sectoral associations, among which cement companies.

  In particular, according to the specific cement mixture (referring to siliceous components and respirable crystalline silica content) and to the methods of use, it is suitable to apply preventive technical and organisational measures and periodic occupational exposure controls, taking into account that the threshold limit value for the time-weighted average (TLV-TWA), adopted for workplaces by the American Conference of Governmental Industrial Hygienists (ACGIH) for "crystalline silica" is equal to 0.025 mg/m^3 (respirable fraction).

- Restrictions on the marketing and use of cement due to the content of chromium VI

Regulation (EC) No. 1907/2006 concerning the registration, evaluation, authorisation and restriction of chemicals ("REACH"), **under Section 47 of Annex XVII**, as amended by **Regulation (EC) No. 552/2009**, prohibits the marketing and use of cement and cement preparations (mixtures) if they have, once mixed with water, a soluble chromium VI content of more than 0.0002% (2 ppm) of the total dry weight of ready-to-use cement.

The compliance with this limit threshold is ensured by adding a reducing agent to the cement, the effectiveness of which is guaranteed for a predetermined time period and with constant observance of suitable storage methods (specified in Subsection 7.2 and Section 10.2).

According to the abovementioned Regulation, the use of the reducing agent entails the publication of the following information:

PACKAGING DATE	specified on the bag and/or on the delivery document
STORAGE CONDITIONS	in appropriate closed containers in a cool, dry place and in the absence of ventilation, guaranteeing the integrity of the package
STORAGE PERIOD *(*)*	as specified on the delivery document (both for products in bags and in bulk) and on every individual bag

(*) *for continued effectiveness of the reducing agent.*

This time expiration concerns exclusively the effectiveness of the reducing agent for chromium (VI) salts, without prejudice to the limits of use of the product imposed by the general rules of storage and use of the product itself.

- **Requirements of Regulation (EC) No. 1907/2006 "REACH"**

Cement is a mixture according to REACH and, as such, is not subject to the obligation for registration, which instead concerns substances.

Portland cement clinker *(classifiable as an inorganic substance UVCB)* is exempt from registration pursuant to Article 2.7 (b) and Annex V.10 of Regulation (EC) No. 1907/2006 "REACH"; the European ECHA Agency has also been regularly provided with the necessary information to create the classifications inventory and labels (C&L), in accordance with Article 40 of Regulation (EC) No. 1272/2008 "CLP" *(see Notification No. 02-2119682167-31-0000 dated 15/12/2010 and updated on 1/07/2013 with the presentation of Report No. QJ420702-40.*

The Annex outlines are reported the identified uses of *"Flue dust" (CKD and BPD)* (ref. to Chemical Safety Report) and particularly the exposure scenario of substance usually used in the manufacturing cycle of hydraulic binders (*ref. e-SDS*):

Exposure scenario	Sector of use SU	Product category PC	Process category PROC	Environmental release category ERC
9.1 Industrial manufacture of hydraulic building and construction materials	not applicable	0, 9a, 9b	2, 3, 5, 8b, 9, 14, 26	2

Moreover, if some substances used in the manufacturing of cements should become subject to registration, and particularly if the new descriptors of use, exposure scenarios, classification, etc. entail repercussions on the previously effective risk assessment, this Safety Data Sheet will be suitably updated based on the information made available by the Registrant.

15.2 Chemical safety assessment

No chemical safety assessment has been carried out.

Section 16. OTHER INFORMATION

16.1 Indication of changes

This Safety Data Sheet has undergone a comprehensive review to reflect the provisions introduced by Regulation (EC) No. 1272/2008 **"CLP"** on the classification, labelling and packaging of substances and mixtures, and by Annex II of Regulation (EU) No. 453/2013 **(see SDS), in force on 1 June 2015**.

16.2 Abbreviations and acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ADR /RID	European Agreements on the transport of Dangerous goods by Road/Railway
APF	Assigned protection factor
CAS	Chemical Abstracts Service
EC	European Community
CLP	Classification, labelling and packaging (Regulation (EC) 1272/2008)
DNEL	Derived no-effect level
EC50	Half maximal effective concentration

ECHA	European Chemicals Agency
EINECS	European Inventory of Existing Commercial chemical Substances
ERC	Environmental release category
ES	Exposure Scenario
FFP	Filtering Facepiece against Particles
FMP	Filtering Mask against Particles with filter cartridge
IATA	International Air Transport Association
IMDG	International agreement on the Maritime transport of Dangerous Goods
IMO	International Maritime Organisation
IMSBC	International Maritime Solid Bulk Cargoes
LC50	Median lethal dose
LD50	Lethal Dose
MEASE	Metal Estimation and Assessment of Substance Exposure
MS	Member State
NOEL	No Observed Effect Level
OELV	Occupational Exposure Limit Value
PBT	Persistent, bio-accumulative and toxic
PC	Product category
PNEC	Predicted no-effect concentration
PPE	Personal protective equipment
PROC	Process category
REACH	Registration, Evaluation and Authorisation of Chemicals (Regulation (EC) 1907/2006)
RPE	Respiratory protective equipment
SCOEL	Scientific Committee on Occupational Exposure Limit Values
SDS	Safety Data Sheet
e-SDS	Extended Safety Data Sheet
SE	Single exposure
STP	Sewage treatment plant
STOT	Specific Target Organ Toxicity
SU	Sector of use
TLV-TWA	Threshold Limit Value - Time-Weighted Average
UVCB	Substance of Unknown or Variable composition, Complex reaction products or Biological materials
VLE	Exposure limit value
vPvB	Very persistent, very Bio-accumulative
w/w	Weight by weight
WWTP	Waste water treatment plant

16.3 Key literature 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, 4th ed. EPA-821-R-02-013, US EPA, office of water, Washington D.C. (October 2002).

(6) U.S. EPA, *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*, 5th ed. EPA-821-R-02-012, US EPA, office of water, Washington D.C. (October 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-fine in rats* (August 2010).

(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., (September 2009); 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) Occurrence of allergic contact dermatitis caused by chromium in cement. A review of epidemiological investigations, Kåre Lenvik, Helge Kjuus, NIOH, Oslo (December 2011).

(17) MEASE, Metals estimation and assessment of substance exposure, EBRC Consulting GmbH for Eurometaux, *http://www.ebrc.de/industrial-chemicals-reach/projects-and-references/mease.php*

16.4 Training advice

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

16.5 Further information

The data and test methods used for the purpose of classification of common cements are given or referred to in Subsection 11.1.

The table below lists the classification and procedures used to derive the classification of the mixture under Regulation (EC) No. 1272/2008 “CLP”.

Classification pursuant to Regulation (EC) No. 1272/2008		**Classification Procedure**
Skin irritation 2	H315	Based on test data
Skin sensitisation 1B	H317	Human experience
Eye damage 1	H318	Based on test data
STOT SE 3	H335	Human experience

This Safety Data Sheet, along with any subsequent revisions, is available in electronic form on the company website: www.buzziunicem.it/prodotti/cemento

- *For more information, contact*: **BUZZI UNICEM S.p.A.**
  Centro Ricerche
  00012 Guidonia RM, Italy tel. +39 0774 385450
  fax +39 0774 343228

16.6 Disclaimer

The information on this Safety 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 package 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 applying appropriate operating procedures regarding the prevention of risks in his/her own activities, in compliance with current legislation.

16.7 Emergency telephone numbers – Poison Centres in Italy

	CAV - Hospital	City	Address - Postcode	Telephone *
1	Azienda Ospedaliero - Universitaria "Ospedali Riuniti"	Foggia	Viale Luigi Pinto, no. 1 - 71122	0881 732326
2	Azienda Ospedaliera "A. Cardarelli"	Naples	Via A. Cardarelli, no. 9 - 80131	081 7472870
3	Policlinico Universitario "Umberto I"	Rome	Viale del Policlinico, no. 155 - 00161	06 49978000
4	Policlinico Universitario "A. Gemelli"	Rome	Largo Agostino Gemelli, no. 8 - 00168	06 3054343
5	Azienda Ospedaliero - Universitaria "Careggi" - Tossicologia Medica	Florence	Largo Brambilla, no. 3 - 50134	055 7947819
6	Centro Nazionale di Informazione Tossicologica, IRCCS Fondazione S. Maugeri, Clinica del Lavoro	Pavia	Via Salvatore Maugeri, no. 10 - 27100	0382 24444
7	Ospedale "Niguarda Ca' Granda"	Milan	P.za Ospedale Maggiore no. 3 - 20162	02 66101029
8	Azienda Ospedaliera "Papa Giovanni XXII" – Tossicologia Clinica	Bergamo	Piazza OMS, no. 1 - 24127	800 883300
9	Ospedale Pediatrico "Bambino Gesù"	Rome	Piazza Sant'Onofrio, no. 4 - 00165	06 68593726

* when calling from abroad: +39 xxx xxxxxx

18/15/EAS/R

ANNEX

CEMENT KILN DUST (CKD) AND BY-PASS DUST (BPD) EXPOSURE SCENARIO

Exposure Scenario No 9.1:

Industrial manufacture of hydraulic building and construction materials

Exposure Scenario addressing uses carried out by workers	
1. Title: Industrial manufacture of hydraulic building and construction materials	
Title	Manufacture of Flue Dust containing mixtures: cement, hydraulic binder, controlled low strength material, concrete (ready-mixed or precast), mortar, grout and others for building and construction work.
Sector of uses	Not applicable
Market sectors	PC 0: Building and construction products PC 9b: Fillers, putties, plasters, modelling clay PC 9a: Coatings and paints, thinners and fillers
Environmental scenario	ERC 2: Formulations of preparations
Worker scenarios	PROC 2: Use in closed, continuous process with occasional controlled exposure PROC 3: Use in closed batch process PROC 5: Mixing or blending in batch process for formulation of preparations and articles. PROC 8b: Transfer of substance or preparation from / to vessels/large containers at dedicated facilities PROC 9: Transfer of substance or preparation into small containers PROC 14: Production of preparations or articles by tabletting, compression extrusion, pelletising PROC 26: Handling of solid inorganic substances at ambient temperature
Assessment method	The assessment of inhalation exposure is based on the dustiness / fugacity of the substance, using the exposure estimation tool MEASE. The environmental assessment is based on a qualitative approach, described in the introduction. Relevant parameter is the pH in water and soil.

2. Operational conditions and risk management measures

2.1 Control of workers' exposure

Product characteristics

Hydraulic building and construction materials are inorganic binders. Generally, these products are mixtures of Portland cement clinker and other hydraulic or non-hydraulic constituents.

Flue Dust can be part of common cements, like Portland cement. In this main application, **the Flue Dust content is below 5 %**.

In other hydraulic binders, the Flue Dust content could be up to 50 %. Generally, the content in a hydraulic mixture is not restricted. Flue Dust is a highly dusty powder.

At all end uses, the substance will intentionally come into contact with water. Partly, the substance reacts with water and forms hydration products. At this stage of a wet or pasty suspension, the product is irritating, due to the pH, which is above 11. Finally, the end product is hardened (e.g. as mortar, concrete) and not irritating, since no free alkaline moisture remains.

Amounts used

The actual tonnage handled per shift is not considered to influence the workers' exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/ automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.

Frequency and duration of use/exposure

Processes	Duration of exposure
PROC 2, 3, 5, 8b, 9, 14, 26 (all)	not restricted (480 minutes)

Human factors not influenced by risk management

The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m³/shift (8 hours).

Other given operational conditions affecting workers' exposure

Operational conditions like process temperature and process pressure are not considered relevant for occupational exposure assessment of the conducted processes.

Technical conditions and measures at process level (source) to prevent release

Risk management measures at the process level are generally not required in the process.

Technical conditions and measures to control dispersion from source towards the worker

Processes	Localised controls (LC)	Efficiency of LC (according to MEASE)	Further information
PROC 2, 3	general ventilation	17 %	-
PROC 5, 8b, 9, 14, 26	generic local exhaust ventilation	78 %	-

Organisational measures to prevent/limit releases, dispersion and exposure

Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

Conditions and measures related to personal protection, hygiene and health evaluation

Processes	Specification of respiratory protective equipment (RPE)	RPE efficiency - Assigned Protection Factor (APF)	Specification of gloves	Further personal protective equipment (PPE)
PROC 2, 3	not required	not applicable	Impervious, abrasion and alkali resistant gloves, internally lined with cotton. The use of gloves is mandatory, since Flue Dust is classified as irritating to skin.	Safety goggles or visors (in accordance with EN 166) are mandatory, since Flue Dust is classified as highly irritating to eyes. Additional face protection, protective clothing and safety shoes are required to be worn as appropriate.
PROC 5, 8b, 9	FF P2 mask	APF = 10		
PROC 14, 26	FF P1 mask	APF = 4		

Gloves and eye protective equipment must be worn, unless potential contact with the skin and eyes can be excluded by the nature and type of application (i.e. closed process).

An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE.

Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head.

In addition, it shall be considered that the worker's capability of using tools and communicating are reduced during the wearing of RPE.

For the reasons given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair).

The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely.

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 programme including training of the workers.

2.2 Control of environmental exposure

Product characteristics

Hydraulic building and construction materials are inorganic binders. Generally, these products are mixtures of Portland cement clinker and other hydraulic or non-hydraulic constituents.

Flue Dust can be part of common cements, like Portland cement. In this main application, **the Flue Dust content is below 5 %.**

In other hydraulic binders the Flue Dust content could be up to 50 %. Generally, the content in a hydraulic mixture is not restricted. Flue Dust is a highly dusty powder.

At all end uses, the substance will intentionally come into contact with water. Partly, the substance reacts with water and forms hydration products. At this stage of a wet or pasty suspension, the product is irritating, due to the pH, which is above 11. Finally, the end product is hardened (e.g. as mortar, concrete) and not irritating, since no free alkaline moisture remains.

Amounts used

The daily and annual amount per site (relating to the emission point source) is not considered to be the main determinant for the environmental exposure.

Frequency and duration of use

Intermittent (used < 12 times per year for not more than 24 h) or continuous use/release

Environment factors not influenced by risk management

Flow rate of receiving surface water: 18,000 m³/d

Other given operational conditions affecting environmental exposure

Effluent discharge rate: 2,000 m³/d

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Risk management measures related to the environment aim to avoid discharging suspensions containing Flue Dust into municipal waste water or to surface water, in case such discharges are expected to cause significant pH changes. Regular control of the pH value during introduction into open waters is therefore required. Usually, discharges should be carried out such that pH changes in receiving surface waters are minimised (e.g. through neutralisation). In general, most aquatic organisms can tolerate pH values in the range of 6-9. This is also reflected in the description of standard OECD tests with aquatic organisms.

Organisational measures to prevent/limit release from site

Training for the workers, based on the Safety Data Sheet (SDS).

Conditions and measures related to municipal sewage treatment plant

The pH of the waste water going into the municipal sewage treatment plant has to be controlled on a regularly base and neutralised if necessary.

Solid Flue Dust constituents must be separated from the sewage effluent.

Conditions and measures related to waste

Solid industrial waste of Flue Dust should be reused or discharged after hardening and/or neutralisation.

3 Exposure estimation and reference to its source

3.1 Occupational exposure (health)

The exposure estimation tool MEASE was used for the assessment of inhalation exposure.

The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use.

For inhalation exposure, the RCR is based on the DNEL of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust).

Therefore, the RCR includes an additional safety margin since the respirable fraction is a sub-fraction of the inhalable fraction in accordance with EN 481.

Processes	Method used for inhalation exposure assessment	Inhalation exposure estimate (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate (RCR)
PROC 2, 3, 5, 8b, 9, 14, 26	MEASE	< 1 mg/m³ (0.44 - 0.83)	Since Flue Dust is classified as irritating to skin and eyes, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Therefore, dermal exposure is not assessed in this exposure scenario.	

3.2 Environmental emissions

Significant emissions or exposure to air are not expected due to the low vapour pressure of Flue Dust.

However, specific preventive measures are not necessary for the terrestrial impact, apart from proper implementation of ordinary, effective management practices. Therefore, these emissions are not deemed relevant for this exposure scenario.

The environmental exposure assessment is only relevant for the aquatic environment as emissions of Flue Dust in the different life-cycle stages (production and use) mainly apply to ground and waste water.

The environmental impact and potential harmful impact on aquatic organisms/ecosystems are correlated to the increase in the pH, due to hydroxide discharges. Whereas, the toxicity of the various solved inorganic (ions) is negligible compared to the negative pH effect. In any case, any negative effect correlated to the manufacturing cycle and use of Flue Dust provides a localised impact within the industrial plant. Indeed, the pH level may have a negative impact on the municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs). For this assessment, a stepwise approach is adopted, bearing in mind that the pH of surface water should not exceed 9.	
Environmental emissions	The production of Flue Dust can potentially result in an aquatic emission, whereby locally the pH and the amount of the following ions can be increased in the aquatic environment: K^+, Na^+, Ca^{2+}, Mg^{2+}, SO_4^{2-}, Cl^-. When the pH is not neutralised, the effluent of the production sites may impact the pH of the receiving water. Generally, the pH of the effluents is measured frequently and can be neutralised easily as often as required by national legislation.
Exposure concentration in waste water treatment plant (WWTP)	Waste water from Flue Dust production is an inorganic waste water stream, for which no biological treatment is necessary. Waste water streams from Flue Dust production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid waste water streams that are treated in biological WWTPs.
Exposure concentration in aquatic pelagic compartment	When Flue Dust is emitted to surface water the following happens. Some Flue Dust constituents (sulphate and chloride salts from sodium, potassium, calcium and magnesium) are highly or moderate soluble and will remain in water. These chloride and sulphate salts are naturally occurring in sea water and groundwater. The amount in groundwater depends on the geological soil formation and varies between different regions. Whereas, some constituents react with water and form highly insoluble inorganic hydration products. Due to the hydration reaction, the pH of the water may increase, depending on the buffer capacity of the water. The higher the buffer capacity of the water, the lower the effect on pH will be. In general, the buffer capacity preventing shifts in acidity or alkalinity in natural waters is regulated by the equilibrium between carbon dioxide (CO_2), the bicarbonate ion (HCO_3^-) and the carbonate ion (CO_3^{2-}).
Exposure concentration in sediments	A risk assessment for the sediment compartment is considered as not relevant and therefore not included. When Flue Dust is emitted to this compartment the following happens. Some Flue Dust constituents are inert and insoluble (calcite, quartz, clay minerals), they are naturally occurring minerals and will have no impact on the sediment. Some Flue Dust constituents react with water and form highly insoluble inorganic hydration products. Even these products have no bio-accumulation potential. Other constituents are highly soluble and will remain in water.
Exposure concentrations in soil and groundwater	When Flue Dust is emitted to the soil and groundwater compartment the following happens. Some Flue Dust constituents are inert and insoluble (calcite, quartz, clay minerals), they are naturally occurring minerals and will have no impact on the soil. Some Flue Dust constituents (sulphate and chloride salts from sodium, potassium, calcium and magnesium) are moderate or highly soluble and will remain in groundwater. These chloride and sulphate salts are naturally occurring in sea water und ground water. The amount in groundwater depends on the geological soil formation and is therefore variable. Some other constituents react with water and form highly insoluble inorganic hydration products. Due to the hydration reaction, the pH of the groundwater may increase, depending on the buffer capacity of the groundwater. The higher the buffer capacity of the groundwater, the lower the effect on pH will be. In general the buffer capacity preventing shifts in acidity or alkalinity in natural waters is regulated by the equilibrium between carbon dioxide (CO_2), the bicarbonate ion (HCO_3^-) and the carbonate ion (CO_3^{2-}).
Exposure concentration in atmospheric compartment	A risk assessment for the air compartment is considered as not relevant and therefore not included. When Flue Dust particles are emitted to air, they will sediment or washed out by rain in a reasonably short timeframe. Thereby, the atmospheric emissions end up in soil and water.
Exposure concentration relevant for the food chain (secondary poisoning)	A risk assessment for secondary poisoning is not required, because bio-accumulation in organisms is not relevant for Flue Dust, which is an inorganic substance.
4 Guidance for the DU to evaluate whether he/she is working inside the boundaries set out by the ES	
Occupational exposure (health)	

A DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his/her own that his/her operational conditions and implemented technical-organisational measures for risk management are adequate and efficient.

This must be supported by the actual guarantee that the exposure respects the limit set out according to the processes and/or activities identified by the PROCs (listed in Section 1), with a DNEL inhalation of 1 mg/m³ (as respirable dust). If measured data is not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the working exposure associated with the inhalable fraction.

Important note: The DU has to be aware of the fact that, apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m³.

By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (*according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2*).

It is noted that if the MEASE is used to calculate workers' exposure (relating to the inhalable fraction), the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

Environmental exposure

For this assessment, a stepwise approach is recommended:

- Tier 1: Retrieve information on effluent pH and the contribution of flue dust on the resulting pH. Should the pH be above 9 and be predominantly attributable to flue dust, 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: Sample and measure the pH in the receiving water after the discharge point. If the pH is below 9, safe use is reasonably demonstrated and the ES ends here. If the pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thereby avoiding any environmental impacts arising from the dispersion of flue dust during production or use phase.