

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product identifier

| | |
|----------------------------|--|
| Substance name: | Calcium oxide |
| Synonyms: | Quicklime , burnt lime , lime , high calcium lime, lump lime , fine ground high calcium lime Branntkalk, gebrannter Kalk, Kalk, Weißkalk, Stückkalk, Weißfeinkalk. Please note that this list may not be exhaustive. |
| Chemical name and formula: | Calcium oxide – CaO |
| Trade name: | FELS Branntkalk BK / Weißkalk WK / Weißstückkalk WSK / Weißfeinkalk WFK / Meisterkalk WK / Meisterkalk WFK |
| CAS No: | 1305-78-8 |
| EC No: | 215-138-9 |
| Molecular Weight: | 56.08 g/mol |
| REACH Registration number: | 01-2119475325-36-0068 |

1.2 Relevant identified uses of the substance and uses advised against

Use of the substance:

The substance is intended for the following non-exhaustive list of uses:
Building material industry, Chemical industry, Metal industry, Agriculture, Biocidal use, Environmental protection (e.g. Flue gas treatment, Wastewater treatment, Sludge treatment, Drinking water treatment), Feed, Food and pharmaceutical industry, Civil engineering, Paper and paint industry.

1.2.1 Identified uses

All uses listed in table 1 of the Appendix of this SDS are identified uses.

1.2.2 Uses advised against

No use identified in Table 1 of the Appendix of this SDS is advised against. Other applications are to be checked if necessary.

1.3 Details of the supplier of the Safety Data Sheet

| | |
|--|---|
| Name: | Fels Vertriebs und Service GmbH & Co. KG |
| Address: | Geheimrat-Ebert-Straße 12, D-38640 Goslar |
| Phone N°: | +49(0) 5321 703 408 |
| Fax N°: | +49(0) 5321 703 425 |
| E-mail of competent person responsible for SDS in the MS or in the EU: | reach@fels.de |

1.4 Emergency telephone number

| | |
|---|---|
| European Emergency N°: | 112 |
| National centre for Prevention and Treatment of Intoxications N°: | +49(0) 551 19240 (Universitätsklinikum Göttingen – GIZ Nord) |
| Emergency telephone at the company | +49(0) 39454 58 441 |
| Available outside office hours: | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the substance

2.1.1. Classification according to Regulation (EC) 1272/2008

Skin Irrit. 2; H315

Eye Dam. 1; H318

STOT SE 3; H335

2.1.2. Additional information

For full text of classifications and hazard statements: see SECTION 16

2.2. Label elements

2.2.1. Labelling according to Regulation (EC) 1272/2008

Signal word: Danger

Hazard pictogram:



Hazard statements:

H315: Causes skin irritation
H318: Causes serious eye damage
H335: May cause respiratory irritation

Precautionary statements:

P102: Keep out of reach of children
P280: Wear protective gloves/protective clothing/eye protection/face protection
P305+P351+P338: If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P302+P352: IF ON SKIN: Wash with plenty of water
P310: Immediately call a POISON CENTER / doctor
P261: Avoid breathing dust/spray
P304+P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P501: Dispose of contents / container for proper disposal in accordance with national regulations

2.3. Other hazards

The substance does not meet the criteria for PBT or vPvB substance.
No other hazards identified.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substance

Main constituent

| CAS number | EC number | Registration No | Identification name | Weight % content (or range) | Classification according to Regulation (EC) No 1272/2008 [CLP] |
|------------|-----------|-----------------------|---------------------|-----------------------------|---|
| 1305-78-8 | 215-138-9 | 01-2119475325-36-0068 | Calcium oxide | > 80% | <i>Skin Irrit. 2; H315</i> <i>Eye Dam. 1; H318</i> <i>STOT SE 3; H335</i> |

Substances of Very High Concern (SVHC), which have been published pursuant to Article 59 of Regulation (EC) No 1907/2006, are not contained in a concentration of more than 0.1 percent by mass.

SECTION 4: FIRST AID MEASURES

4.1. Description of first aid measures

General advice

No known delayed effects. Consult a physician for all exposures except for minor instances.

Following inhalation

Move source of dust or move person to fresh air. Obtain medical attention immediately.

Following skin contact

Carefully and gently brush the contaminated body surfaces in order to remove all traces of product. Wash affected area immediately with plenty of water. Remove contaminated clothing. If necessary seek medical advice.

Following eye contact

Rinse eyes immediately with plenty of water and seek medical advice.

After ingestion

Clean mouth with water and drink afterwards plenty of water. Do NOT induce vomiting. Obtain medical attention.

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

Calcium oxide is not acutely toxic via the oral, dermal, or inhalation route. The substance is classified as irritating to skin and the respiratory tract, and entails a risk of serious damage to the eye. There is no concern for adverse systemic effects because local effects (pH-effect) are the major health hazard.

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

Follow the advises given in section 4.1

SECTION 5: FIRE FIGHTING MEASURES

5.1. Extinguishing media

5.1.1. Suitable extinguishing media

Calcium oxide is non-flammable and not combustible. Use a dry powder, foam or CO₂ fire extinguisher to extinguish the surrounding fire.

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.1.2. Unsuitable extinguishing media

Do not use water. Avoid moistening.

5.2. Special hazards arising from the substance or mixture

Calcium oxide reacts with water and generates heat. Possible hazard for flammable material.

5.3. Advice for fire fighters

Avoid generation of dust. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Use breathing apparatus.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Ensure adequate ventilation.

Keep dust levels to a minimum.

Keep unprotected persons away.

Avoid contact with skin, eyes, and clothing – wear suitable protective equipment (see section 8).

Avoid inhalation of dust – ensure that sufficient ventilation or suitable respiratory protective equipment is used, wear suitable protective equipment (see section 8).

Avoid moistening.

6.1.2. For emergency responders

Ensure adequate ventilation.

Keep dust levels to a minimum.

Keep unprotected persons away.

Avoid contact with skin, eyes, and clothing – wear suitable protective equipment (see section 8).

Avoid inhalation of dust – ensure that sufficient ventilation or suitable respiratory protective equipment is used, wear suitable protective equipment (see section 8).

Avoid moistening.

6.2. Environmental precautions

Contain the spillage. Keep the material dry if possible. Cover area to avoid unnecessary dust hazard.

Avoid uncontrolled spills to watercourses and drains (pH increase). Any large spillage into watercourses must be alerted to the Environment Agency or other regulatory body.

6.3. Methods and material for containment and cleaning up

In all cases avoid dust formation.

Keep the material dry if possible.

Pick up the product mechanically in a dry way.

Use vacuum suction unit, or shovel into bags.

6.4. Reference to other sections

For more information on exposure controls/personal protection or disposal considerations, please check section 8 and 13 and the annex of this safety data sheet.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for safe handling

7.1.1. Protective measures

Avoid contact with skin and eyes. Wear protective equipment (refer to section 8 of this safety data sheet). Do not wear contact lenses when handling this product. It is also advisable to have individual pocket eyewash. Keep dust levels to a minimum. Minimize dust generation. Enclose dust sources, use exhaust ventilation (dust collector at handling points). Handling systems should preferably be enclosed. When handling bags usual precautions should be paid to the risks outlined in the Council Directive 90/269/EEC.

7.1.2. Advice on general occupational hygiene

Avoid inhalation or ingestion and contact with skin and eyes. General occupational hygiene measures are required to ensure safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no drinking, eating and smoking at the workplace. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home.

7.2. Conditions for safe storage, including any incompatibilities

The substance should be stored under dry conditions. Any contact with air and moisture should be avoided. Bulk storage should be in purpose – designed silos. Keep away from acids, significant quantities of paper, straw, and nitro compounds. Keep out of reach of children. Do not use aluminium for transport or storage if there is a risk of contact with water.

7.3. Specific end use(s)

Please check the identified uses in table 1 of the Appendix of this SDS.

For more information please see the relevant exposure scenario, available via your supplier/given in the Appendix, and check section 2.1: Control of worker exposure.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

DNELs:

| | Workers | | | |
|-------------------|--|------------------------|--|--------------------------|
| Route of exposure | Acute effect local | Acute effects systemic | Chronic effects local | Chronic effects systemic |
| Oral | Not required | | | |
| Inhalation | 4 mg / m ³ (Respirable dust) | No hazard identified | 1 mg / m ³ (Respirable dust) | No hazard identified |
| Dermal | Hazard identified but no DNEL available | No hazard identified | Hazard identified but no DNEL available | No hazard identified |

| | Consumers | | | |
|-------------------|--|------------------------|--|--------------------------|
| Route of exposure | Acute effect local | Acute effects systemic | Chronic effects local | Chronic effects systemic |
| Oral | No exposure expected | No hazard identified | No exposure expected | No hazard identified |
| Inhalation | 4 mg / m ³ (Respirable dust) | No hazard identified | 1 mg / m ³ (Respirable dust) | No hazard identified |
| Dermal | Hazard identified but no DNEL available | No hazard identified | Hazard identified but no DNEL available | No hazard identified |

PNECs:

| Environment protection target | PNEC | Remarks |
|------------------------------------|-----------------------|----------------------------------|
| Fresh water | 0.37 mg / L | |
| Freshwater sediments | No PNEC available | Insufficient data available |
| Marine water | 0.24 mg / L | |
| Marine sediments | No PNEC available | Insufficient data available |
| Food (bioaccumulation) | No hazard identified | No potential for bioaccumulation |
| Microorganisms in sewage treatment | 2.27 mg / L | |
| Soil (agricultural) | 817,4 mg / kg soil dw | |
| Air | No hazard identified | |

OELs (Europe):

| CAS-No. | Type of limit | Time-weighted average (mg/m ³) | | Short-term exposure limit (mg/m ³) | | Origin |
|----------------------|---------------|--|-------|--|-------|-------------------------|
| | | 8 h | 1 (A) | 15 min | 4 (A) | |
| Calcium oxide | | | | | | |
| 1305-78-8 | Reference OEL | 8 h | 1 (A) | 15 min | 4 (A) | Directive (EU) 2017/164 |

A = respirable (alveoli) dust fraction

National OELs (Germany):

| CAS-No. | Type of assessment value | Assessment value (mg/m ³) | Short-term exposure limit fact. (cat.) period of time | Origin | Monitoring procedures, e.g. |
|--|--------------------------|---------------------------------------|---|-------------|-----------------------------|
| Calcium oxide | | | | | |
| 1305-78-8 | OEL | 8 h 1 (E) | 2 (I) 15 min | TRGS 900 | TRGS 402 |
| General dust limit (not substance specific) | | | | | |
| | OEL | 8 h 1,25 (A) 10 (E) | 2 (II) 15 min | TRGS 900 | TRGS 402 |

A = respirable (alveoli) dust fraction

E = inhalable (total) dust fraction

8.2. Exposure controls

To control potential exposures, generation of dust should be avoided. Further, appropriate protective equipment is recommended. Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate.

Please check the relevant exposure scenario, given in the Appendix/available via your supplier.

8.2.1. Appropriate engineering controls

If user operations generate dust, use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne dust levels below recommended exposure limits.

8.2.2. Individual protection measures, such as personal protective equipment

8.2.2.1. Eye/face protection

Do not wear contact lenses. For powders, closely fitting goggles with side shields, or wide vision full goggles. It is also advisable to have individual pocket eyewash.

8.2.2.2. Skin protection

Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. The use of protective gloves (nitrile), protective standard working clothes fully covering skin, full length trousers, long sleeved overalls, with close fittings at openings and shoes resistant to caustics and avoiding dust penetration are required to be worn.

8.2.2.3. Respiratory protection

Local ventilation to keep levels below established threshold values is recommended. A suitable particle filter mask is recommended, depending on the expected exposure levels - please check the relevant exposure scenario, given in the Appendix/available via your supplier.

8.2.2.4. Thermal hazards

The substance does not represent a thermal hazard, thus special consideration is not required.

8.2.3. Environmental exposure controls

All ventilation systems should be filtered before discharge to atmosphere.

Avoid releasing to the environment.

Contain the spillage. Any large spillage into watercourses must be alerted to the regulatory authority responsible for environmental protection or other regulatory body.

For detailed explanations of the risk management measures that adequately control exposure of the environment to the substance please check the relevant exposure scenario, available via your supplier.

For further detailed information, please check the Appendix of this SDS.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

| | |
|----------------------------|---|
| Appearance: | White or off white (beige), solid material in different sizes: lumpy, granular or fine powder |
| Odour: | odourless |
| Odour threshold: | not applicable |
| pH: | 12.3 (saturated solution at 20 °C) |
| Melting point: | > 450 °C (study result, EU A.1 method) |
| Boiling point: | not applicable (solid with a melting point > 450 °C) |
| Flash point: | not applicable (solid with a melting point > 450 °C) |
| Evaporation rate: | not applicable (solid with a melting point > 450 °C) |
| Flammability: | non flammable (study result, EU A.10 method) |
| Explosive limits: | non explosive (void of any chemical structures commonly associated with explosive properties) |
| Vapour pressure: | not applicable (solid with a melting point > 450 °C) |
| Vapour density: | not applicable |
| Relative density: | 3.31 (study result, EU A.3 method) |
| Solubility in water: | 1337.6 mg/L (study results, EU A.6 method) |
| Partition coefficient: | not applicable (inorganic substance) |
| Auto ignition temperature: | no relative self-ignition temperature below 400 °C (study result, EU A.16 method) |
| Decomposition temperature: | not applicable |
| Viscosity: | not applicable (solid with a melting point > 450 °C) |
| Oxidising properties: | no oxidising properties (Based on the chemical structure, the substance does not contain a surplus of oxygen or any structural groups known to be correlated with a tendency to react exothermally with combustible material) |

9.2. Other information

The product is not covered by current knowledge not covered by the definition of Nano-materials of recommendation 2011/696 EU.

SECTION 10: STABILITY AND REACTIVITY**10.1. Reactivity**

Calcium oxide reacts exothermically with water to form Calcium dihydroxide.

10.2. Chemical stability

Under normal conditions of use and storage (dry), calcium oxide is stable.

10.3. Possibility of hazardous reactions

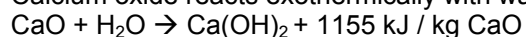
Calcium oxide reacts exothermically with acids to form calcium salts.

10.4. Conditions to avoid

Minimise exposure to air and moisture to avoid degradation.

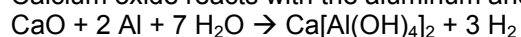
10.5. Incompatible materials

Calcium oxide reacts exothermically with water to form calcium dihydroxide:



Calcium oxide reacts exothermically with acids to form calcium salts.

Calcium oxide reacts with the aluminum and brass in the presence of moisture to form hydrogen:

**10.6. Hazardous decomposition products**

None.

Further information: Calcium oxide reacts with moisture and carbon dioxide to form calcium carbonate, which is a common material in nature.

SECTION 11: TOXICOLOGICAL INFORMATION**11.1. Information on toxicological effects****11.1.1. Acute toxicity**

Oral LD50 > 2000 mg / kg body weight (calcium dihydroxide, OECD 425, rat)

Dermal LD50 > 2500 mg / kg body weight (calcium dihydroxide, OECD 402, rabbit); these results can be transferred to calcium oxide since calcium hydroxide is formed upon contact with moisture.

Inhalation no data available

Calcium oxide is not acutely toxic.

11.1.2. Skin corrosion/irritation

Calcium dihydroxide irritates the skin (in vivo, rabbit). Through read-across, these results can also be transferred to calcium oxide.

Calcium dihydroxide is non-corrosive (in vitro, OECD 431). Through read-across, these results are also transferable to calcium oxide.

11.1.3. Serious eye damage/irritation

Calcium oxide carries the risk of serious eye damage (OECD 405, in vivo, rabbit).

11.1.4. Respiratory or skin sensitisation

No data available. Calcium oxide is not classified as sensitizing due to the mode of action (pH change) and the importance of calcium in the human nutrition. Classification for sensitisation is not warranted.

11.1.5. Germ cell mutagenicity

Calcium dihydroxide is not genotoxic (in vitro, OECD 471, 473 and 476). Through read-across, these results are also transferable to calcium oxide.

Considering the omnipresence and essentiality of calcium and the physiological non-relevance of any pH shift induced by lime in aqueous media, calcium oxide is apparently devoid of any genotoxic potential.

11.1.6. Carcinogenicity

Calcium (administered as Ca-lactate) is not carcinogenic (test result, rat).

The pH effect of calcium oxide does not lead to a carcinogenic risk.

Human epidemiological data support the lack of carcinogenic potential of calcium oxide.

11.1.7. Reproductive toxicity

Calcium (administered as Ca-carbonate) is not toxic to reproduction (test result, mouse). The pH effect does not cause any risk of reproduction. Human epidemiological data show that there is no potential for the reproductive toxicity of calcium oxide.

No effects on reproduction or development were found in animal experiments or human clinical trials on various calcium salts. Therefore, calcium oxide is not toxic for reproduction and / or development.

11.1.8. STOT-single exposure

From human data it is concluded that calcium oxide irritates the respiratory tract. As summarized and evaluated in the SCOEL Recommendation (Anonymous, 2008), calcium oxide based on human data is irritating to the respiratory system.

11.1.9. STOT-repeated exposure

The toxicity of calcium by ingestion was considered. The upper limit for the total daily intake of calcium (UL) as determined by the Scientific Center on Food (SCF) for adults is: UL = 2500 mg / day, corresponding to 36 mg / kg body weight / day (70 kg person).

Toxicity of CaO by dermal uptake is not considered relevant because significant uptake is not expected and local skin irritation has been identified as a primary local effect.

Inhalation toxicity of CaO (local effect, irritation to mucous membranes) was determined by the 8 hour TWA value reported by the Scientific Committee on Occupational Exposure Limits (SCOEL) with 1 mg / m³ A dust (see section 8.1).

11.1.10. Aspiration hazard

It is not known that there is an aspiration hazard when handling CaO.

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity

12.1.1. Acute/Prolonged toxicity to fish

LC₅₀ (96h) for freshwater fish: 50.6 mg/l (Calcium dihydroxide)

LC₅₀ (96h) for marine water fish: 457 mg/l (Calcium dihydroxide)

12.1.2. Acute/Prolonged toxicity to aquatic invertebrates

EC₅₀ (48h) for freshwater invertebrates: 49.1 mg/l (Calcium dihydroxide)

LC₅₀ (96h) for marine water invertebrates: 158 mg/l (Calcium dihydroxide)

12.1.3. Acute/Prolonged toxicity to aquatic plants

EC₅₀ (72h) for freshwater algae: 184.57 mg/l (Calcium dihydroxide)

NOEC (72h) for freshwater algae: 48 mg/l (Calcium dihydroxide)

12.1.4. Toxicity to micro-organisms e.g. bacteria

High calcium oxide concentration causes an increase of temperature and pH. This is used for disinfection of sewage sludge.

12.1.5. Chronic toxicity to aquatic organisms

NOEC (14d) for marine water invertebrates: 32 mg/l (Calcium dihydroxide)

12.1.6. Toxicity to soil dwelling organisms

EC₁₀/LC₁₀ or NOEC for soil macroorganisms: 2000 mg/kg soil dw (Calcium dihydroxide)

EC₁₀/LC₁₀ or NOEC for soil microorganisms: 12000 mg/kg soil dw (Calcium dihydroxide)

12.1.7. Toxicity to terrestrial plants

NOEC (21d) for terrestrial plants: 1080 mg/kg (Calcium dihydroxide)

12.1.8. General effect

Acute pH-effect. Although calcium oxide is useful to correct water acidity, an excess of more than 1 g/l may be harmful to aquatic life. pH-value of > 12 will rapidly decrease as result of dilution and carbonation.

12.1.9 Notes

The results related to calcium dihydroxide can be transferred to calcium oxide, as calcium dihydroxide is formed from calcium oxide upon contact with moisture.

12.2. Persistence and degradability

Not relevant for inorganic substances

12.3. Bioaccumulative potential

Not relevant for inorganic substances

12.4. Mobility in soil

Calcium oxide reacts with water and / or carbon dioxide to form calcium dihydroxide and / or calcium carbonate. Due to low solubility, there is little mobility in most soils.

12.5. Results of PBT and vPvB assessment

Not relevant for inorganic substances

12.6. Other adverse effects

No other adverse effects are identified

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Disposal of calcium oxide as well as containers / packaging, which have been used to transport or storage shall be in accordance with national and regional regulations.

Waste code according to European Waste Catalogue: 10 13 04 (waste from calcination and hydration of lime).

Unused residual quantities of the product

Pick up dry, store in labeled containers and re-use if possible, taking into account the maximum storage time.

Moisture products and product slurry

Do not let moisture products and product slurry enter drains or watercourses.

Packaging

Empty packaging and recycle (Interseroh). Otherwise, disposal of completely empty packaging depending on packaging type according to European Waste Catalogue Code 15 01 01 (waste paper and cardboard packaging) or 15 01 05 (composite packaging).

SECTION 14: TRANSPORT INFORMATION

Calcium oxide is not classified as hazardous for transport [ADR (road), RID (rail), ADN (inland waterways) and IMDG (sea)].

Calcium oxide is classified as hazardous for air transport (ICAO / IATA).

14.1. UN-Number

UN 1910

14.2. UN proper shipping name

Calcium oxide

14.3. Transport hazard class(es)

Class 8 (ICAO/IATA)

14.4. Packing group

Group III (ICAO/IATA)

14.5. Environmental hazards

None

14.6. Special precautions for user

Avoid any release of dust during transportation, by using air-tight tanks for powder and covered loading areas for lump lime.

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

Not regulated

SECTION 15: REGULATORY INFORMATION**15.1. Safety, health and environmental regulations/legislation specific for the substance**

Authorisations according to REACH: Not required

Restrictions on use according to REACH: None

EU regulations: Calcium oxide is not a substance acc. to directive 96/82/EC ("SEVESO"), not an ozone depleting substance and not a persistent organic pollutant.

National regulations Germany:

Water hazard class: WGK 1 (slightly hazardous for water)
Assessment acc. to AwSV
Storage class: LGK 13 by TRGS 510
(non-flammable solids)

15.2. Chemical safety assessment

A chemical safety assessment has been carried out for calcium oxide under REACH-registration.

SECTION 16: OTHER INFORMATION

Data are based on our latest knowledge but do not constitute a guarantee for any specific product features and do not establish a legally valid contractual relationship.

16.1. Classifications and Hazard Statements

Skin Irrit. 2; H315 – Skin irritation category 2; Causes skin irritation.
Eye Dam. 1; H318: - Irreversible effects on the eye category 1; Causes serious eye damage.
STOT SE 3; H335 – Specific target organ toxicity (single exposition) category 3; May cause respiratory irritation;

16.2. Precautionary Statements

P102: Keep out of reach of children
P280: Wear protective gloves/protective clothing/eye protection/face protection
P305+P351+P338: If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P302+P352: IF ON SKIN: Wash with plenty of water /...
P310: Immediately call a POISON CENTER / doctor / ...
P261: Avoid breathing dust/spray
P304+P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P501: Dispose of contents/container to ...

16.3. Abbreviations

AwSV Verordnung über Anlagen z. Umgang mit wassergefährdenden Stoffen
EC50: median effective concentration
LC₅₀: median lethal concentration
LD₅₀: median lethal dose
NOEC: no observable effect concentration
OEL: occupational exposure limit
DNEL: Limit below which the substance has no effect (Derived No-Effect Level)
PBT: persistent, bioaccumulative, toxic chemical
PNEC: predicted no-effect concentration
STEL: short-term exposure limit
TRGS 402: Technische Regel für Gefahrstoffe 402 Ermitteln und Beurteilen der Gefährdungen bei Tätigkeiten mit Gefahrstoffen: Inhalative Exposition
TRGS 510: Technische Regel für Gefahrstoffe 510 Lagerung von Gefahrstoffen in ortsbeweglichen Behältern

TRGS 900: Technische Regel für Gefahrstoffe 900 Arbeitsplatzgrenzwerte
TWA: time weighted average
vPvB: very persistent, very bioaccumulative chemical

16.4. Key literature references

Anonymous, 2006: Tolerable upper intake levels for vitamins and minerals Scientific Committee on Food, European Food Safety Authority, ISBN: 92-9199-014-0 [SCF document]

Anonymous, 2008: Recommendation from the Scientific Committee on Occupational Exposure Limits (SCOEL) for calcium oxide (CaO) and calcium dihydroxide (Ca(OH)₂), European Commission, DG Employment, Social Affairs and Equal Opportunities, SCOEL/SUM/137 February 2008

Internet:

<http://baua.de>

<http://publikationen.dguv.de>

<http://echa.europa.eu/de/candidate-list-table>

16.5. Revision

The following sections have been revised:

- | | |
|------|---|
| 1.3 | Details of the supplier of the safety data sheet |
| 8.1 | Control parameters |
| 8.2 | Exposure controls |
| 11.1 | Information on toxicological effects |
| 15.1 | Safety, health and environmental regulations / legislation specific for the substance |
| 16 | Other information |

Disclaimer

The information in this SDS is based on the current knowledge of the issuer with regard to the safety requirements of calcium oxide. It is pointed out expressly that the statements do not include any description of the nature of the product and are not guarantees of properties.

APPENDIX including Exposure Scenarios 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 9.11, 9.12, 9.13, 9.14, 9.15 and 9.16

APPENDIX: EXPOSURE SCENARIOS

The current document includes all relevant occupational and environmental exposure scenarios (ES) for the production and use of calcium oxide as required under the REACH Regulation (Regulation (EC) No 1907/2006). For the development of the ES the Regulation and the relevant REACH Guidance have been considered. For the description of the covered uses and processes, the "R.12 – Use descriptor system" guidance (Version: 2, March 2010, ECHA-2010-G-05-EN), for the description and implementation of risk management measures (RMM) the "R.13 – Risk management measures" guidance (Version: 1.1, May 2008), for the occupational exposure estimation the "R.14 – Occupational exposure estimation" guidance (Version: 2, May 2010, ECHA-2010-G-09-EN) and for the actual environmental exposure assessment the "R.16 – Environmental Exposure Assessment" (Version: 2, May 2010, ECHA-10-G-06-EN) was used.

Methodology used for environmental exposure assessment

The environmental exposure scenarios only address the assessment at the local scale, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, for industrial and professional uses as any effects that might occur is expected to take place on a local scale.

1) Industrial uses (local scale)

The exposure and risk assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions in the industrial stages mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH⁻ discharges. The exposure assessment for the aquatic environment only deals with the possible pH changes in STP effluent and surface water related to the OH⁻ discharges at the local scale and is performed by assessing the resulting pH impact: the surface water pH should not increase above 9 (In general, most aquatic organisms can tolerate pH values in the range of 6-9).

Risk management measures related to the environment aim to avoid discharging calcium oxide solutions into municipal wastewater 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 required. Discharges should be carried out such that pH changes in receiving surface waters are minimised. The effluent pH is normally measured and can be neutralised easily, as often required by national laws.

2) Professional uses (local scale)

The exposure and risk assessment is only relevant for the aquatic and terrestrial environment. The aquatic effect and risk assessment is determined by the pH effect. Nevertheless, the classical risk characterisation ratio (RCR), based on PEC (predicted environmental concentration) and PNEC (predicted no effect concentration) is calculated. The professional uses on a local scale refer to

applications on agricultural or urban soil. The environmental exposure is assessed based on data and a modelling tool. The modelling FOCUS/ Exposit tool is used to assess terrestrial and aquatic exposure (typically conceived for biocidal applications).

Details and scaling approach indications are reported in the specific scenarios.

Methodology used for occupational exposure assessment

By definition an exposure scenario (ES) has to describe under which operational conditions (OC) and risk management measure (RMMs) the substance can be handled safely. This is demonstrated if the estimated exposure level is below the respective derived no-effect level (DNEL), which is expressed in the risk characterisation ratio (RCR).

For workers, the repeated dose DNEL for inhalation as well as the acute DNEL for inhalation are based on the respective recommendations of the scientific committee on occupational exposure limits (SCOEL) being 1 mg/m³ and 4 mg/m³, respectively.

In cases where neither measured data nor analogous data are available, occupational exposure is assessed with the aid of a modelling tool. At the first tier screening level, the MEASE tool (<http://www.ebrc.de/mease.html>) is used to assess inhalation exposure according to the ECHA guidance (R.14).

Since the SCOEL recommendation refers to respirable dust while the exposure estimates in MEASE reflect the inhalable fraction, an additional safety margin is inherently included in the exposure scenarios below when MEASE has been used to derive exposure estimates.

Methodology used for consumer exposure assessment

By definition an ES has to describe under which conditions the substances, preparation or articles can be handled safely. In cases where neither measured data nor analogous data are available, exposure is assessed with the aid of a modelling tool.

For consumers, the repeated dose DNEL for inhalation as well as the acute DNEL for inhalation are based on the respective recommendations of the Scientific Committee on Occupational Exposure Limits (SCOEL), being 1 mg/m³ and 4 mg/m³, respectively.

For inhalation exposure to powders the data, derived from van Hemmen (van Hemmen, 1992: Agricultural pesticide exposure data bases for risk assessment. Rev Environ Contam Toxicol. 126: 1-85.), has been used to calculate the inhalation exposure. The inhalation exposure for consumers is estimated at 15 µg/hr or 0.25 µg/min. For larger tasks the inhalation exposure is expected to be higher. A factor of 10 is suggested when the product amount exceeds 2.5 kg, resulting in the inhalation exposure of 150 µg/hr. To convert these values in mg/m³ a default value of 1.25 m³/hr for the breathing volume under light working conditions will be assumed (van Hemmen, 1992) giving 12 µg/m³ for small tasks and 120 µg/m³ for larger tasks.

When the preparation or substance is applied in granular form or as tablets, reduced exposure to dust was assumed. To take this into account if data about particle size distribution and attrition of the granule are lacking, the model for powder formulations is used, assuming a reduction in dust formation by 10 % according to Becks and Falks (Manual for the authorisation of pesticides. Plant protection products. Chapter 4 Human toxicology; risk operator, worker and bystander, version 1.0., 2006).

For dermal exposure and exposure to the eye a qualitative approach has been followed, as no DNEL could be derived for this route due to the irritating properties of calcium oxide. Oral exposure was not assessed as this is not a foreseeable route of exposure regarding the uses addressed.

Since the SCOEL recommendation refers to respirable dust while the exposure estimates by the model from van Hemmen reflect the inhalable fraction, an additional safety margin is inherently included in the exposure scenarios below, i.e. the exposure estimates are very conservative.

The exposure assessment of calcium oxide professional and industrial and consumer use is performed and organized based on several scenarios. An overview of the scenarios and the coverage of substance life cycle is presented in Table 1.

Table 1: Overview on exposure scenarios and coverage of substance life cycle

| ES number | Exposure scenario title | Manufacture | Identified uses | | | Resulting life cycle stage Service life (for articles) | Linked to Identified Use | Sector of use category (SU) | Chemical Product Category (PC) | Process category (PROC) | Article category (AC) | Environmental release category (ERC) |
|-----------|---|-------------|-----------------|---------|----------|---|---|---|--|------------------------------------|--|--------------------------------------|
| | | | Formulation | End use | Consumer | | | | | | | |
| 9.1 | Manufacture and industrial uses of aqueous solutions of lime substances | X | X | X | X | 1 | 3; 1, 2a, 2b, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7, 12a, 12b, 10a, 10b, 11a, 11b | |
| 9.2 | Manufacture and industrial uses of low dusty solids/powders of lime substances | X | X | X | X | 2 | 3; 1, 2a, 2b, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 1, 2, 3, 4, 5, 6, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27a, 27b | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7, 12a, 12b, 10a, 10b, 11a, 11b | |
| 9.3 | Manufacture and industrial uses of medium dusty solids/powders of lime substances | X | X | X | X | 3 | 3; 1, 2a, 2b, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27a, 27b | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7, 12a, 12b, 10a, 10b, 11a, 11b | |

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| ES number | Exposure scenario title | Manufacture | Identified uses | | | Resulting life cycle stage Service life (for articles) | Linked to Identified Use | Sector of use category (SU) | Chemical Product Category (PC) | Process category (PROC) | Article category (AC) | Environmental release category (ERC) |
|-----------|---|-------------|-----------------|---------|----------|---|---|---|---|------------------------------------|--|--------------------------------------|
| | | | Formulation | End use | Consumer | | | | | | | |
| 9.4 | Manufacture and industrial uses of high dusty solids/powders of lime substances | X | X | X | X | 4 | 3; 1, 2a, 2b, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27a, 27b | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7, 12a, 12b, 10a, 11a | |
| 9.5 | Manufacture and industrial uses of massive objects containing lime substances | X | X | X | X | 5 | 3; 1, 2a, 2b, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 6, 14, 21, 22, 23, 24, 25 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7, 12a, 12b, 10a, 10b, 11a, 11b | |
| 9.6 | Professional uses of aqueous solutions of lime substances | | X | X | X | 6 | 22; 1, 5, 6a, 6b, 7, 10, 11, 12, 13, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 2, 3, 4, 5, 8a, 8b, 9, 10, 12, 13, 15, 16, 17, 18, 19 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 2, 8a, 8b, 8c, 8d, 8e, 8f | |

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| ES number | Exposure scenario title | Manufacture | Identified uses | | | Resulting life cycle stage Service life (for articles) | Linked to Identified Use | Sector of use category (SU) | Chemical Product Category (PC) | Process category (PROC) | Article category (AC) | Environmental release category (ERC) |
|-----------|---|-------------|-----------------|---------|----------|---|--------------------------|---|---|---|------------------------------------|--------------------------------------|
| | | | Formulation | End use | Consumer | | | | | | | |
| 9.7 | Professional uses of low dusty solids/powders of lime substances | | X | X | | X | 7 | 22; 1, 5, 6a, 6b, 7, 10, 11, 12, 13, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 2, 3, 4, 5, 8a, 8b, 9, 10, 13, 15, 16, 17, 18, 19, 21, 25, 26 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 2, 8a, 8b, 8c, 8d, 8e, 8f |
| 9.8 | Professional uses of medium dusty solids/powders of lime substances | | X | X | | X | 8 | 22; 1, 5, 6a, 6b, 7, 10, 11, 12, 13, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 2, 3, 4, 5, 8a, 8b, 9, 10, 13, 15, 16, 17, 18, 19, 25, 26 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 2, 8a, 8b, 8c, 8d, 8e, 8f, 9a, 9b |
| 9.9 | Professional uses of high dusty solids/powders of lime substances | | X | X | | X | 9 | 22; 1, 5, 6a, 6b, 7, 10, 11, 12, 13, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 2, 3, 4, 5, 8a, 8b, 9, 10, 13, 15, 16, 17, 18, 19, 25, 26 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 2, 8a, 8b, 8c, 8d, 8e, 8f |

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| ES number | Exposure scenario title | Manufacture | Identified uses | | | Resulting life cycle stage Service life (for articles) | Linked to Identified Use | Sector of use category (SU) | Chemical Product Category (PC) | Process category (PROC) | Article category (AC) | Environmental release category (ERC) |
|-----------|---|-------------|-----------------|---------|----------|---|---|-----------------------------|--------------------------------|------------------------------------|---------------------------|--------------------------------------|
| | | | Formulation | End use | Consumer | | | | | | | |
| 9.10 | Professional use of lime substances in soil treatment | | X | X | | 10 | 22 | 9b | 5, 8b, 11, 26 | | 2, 8a, 8b, 8c, 8d, 8e, 8f | |
| 9.11 | Professional uses of articles/containers containing lime substances | | | X | X | 11 | 22; 1, 5, 6a, 6b, 7, 10, 11, 12, 13, 16, 17, 18, 19, 20, 23, 24 | | 0, 21, 24, 25 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 10a, 11a, 11b, 12a, 12b | |
| 9.12 | Consumer use of building and construction material (DIY) | | | | X | X | 21 | 9b, 9a | | | 8 | |
| 9.13 | Consumer use of CO ₂ absorbent in breathing apparatuses | | | | X | X | 21 | 2 | | | 8 | |

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| ES number | Exposure scenario title | Manufacture | Identified uses | | | Resulting life cycle stage Service life (for articles) | Linked to Identified Use | Sector of use category (SU) | Chemical Product Category (PC) | Process category (PROC) | Article category (AC) | Environmental release category (ERC) |
|-----------|---|-------------|-----------------|---------|----------|---|--------------------------|-----------------------------|--------------------------------|-------------------------|-----------------------|--------------------------------------|
| | | | Formulation | End use | Consumer | | | | | | | |
| 9.14 | Consumer use of garden lime/fertilizer | | | | X | X | 21 | 20, 12 | | | 8e | |
| 9.15 | Consumer use of lime substances as water treatment chemicals in aquaria | | | | X | X | 21 | 20, 37 | | | 8 | |
| 9.16 | Consumer use of cosmetics containing lime substances | | | | X | X | 21 | 39 | | | 8 | |

ES number 9.1: Manufacture and industrial uses of aqueous solutions of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers | | |
|---|---|---|
| 1. Title | | |
| Free short title | Manufacture and industrial uses of aqueous solutions of lime substances | |
| Systematic title based on use descriptor | SU3, SU1, SU2a, SU2b, SU4, SU5, SU6a, SU6b, SU7, SU8, SU9, SU10, SU11, SU12, SU13, SU14, SU15, SU16, SU17, SU18, SU19, SU20, SU23, SU24 PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC38, PC39, PC40 AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13 (appropriate PROCs and ERCs are given in Section 2 below) | |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. | |
| Assessment Method | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. | |
| 2. Operational conditions and risk management measures | | |
| PROC/ERC | REACH definition | Involved tasks |
| PROC 1 | Use in closed process, no likelihood of exposure | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 2 | Use in closed, continuous process with occasional controlled exposure | |
| PROC 3 | Use in closed batch process (synthesis or formulation) | |
| PROC 4 | Use in batch and other process (synthesis) where opportunity for exposure arises | |
| PROC 5 | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) | |
| PROC 7 | Industrial spraying | |
| PROC 8a | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities | |
| PROC 8b | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities | |
| PROC 9 | Transfer of substance or preparation into small containers (dedicated filling line, including weighing) | |
| PROC 10 | Roller application or brushing | |
| PROC 12 | Use of blowing agents in manufacture of foam | |
| PROC 13 | Treatment of articles by dipping and pouring | |
| PROC 14 | Production of preparations or articles by tableting, compression, extrusion, pelletisation | |
| PROC 15 | Use as laboratory reagent | |
| PROC 16 | Using material as fuel sources, limited exposure to unburned product to be expected | |
| PROC 17 | Lubrication at high energy conditions and in partly open process | |
| PROC 18 | Greasing at high energy conditions | |

| | |
|--------------------|--|
| PROC 19 | Hand-mixing with intimate contact and only PPE available |
| ERC 1-7, 12 | Manufacture, formulation and all types of industrial uses |
| ERC 10, 11 | Wide-dispersive outdoor and indoor use of long-life articles and materials |

2.1 Control of workers exposure

Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential. The spraying of aqueous solutions (PROC7 and 11) is assumed to be involved with a medium emission.

| PROC | Used in preparation? | Content in preparation | Physical form | Emission potential |
|-----------------------------------|----------------------|------------------------|------------------|--------------------|
| PROC 7 | not restricted | | aqueous solution | medium |
| All other applicable PROCs | not restricted | | aqueous solution | very low |

Amounts used

The actual tonnage handled per shift is not considered to influence the 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

| PROC | Duration of exposure |
|-----------------------------------|------------------------------|
| PROC 7 | ≤ 240 minutes |
| All other applicable PROCs | 480 minutes (not restricted) |

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

Since aqueous solutions are not used in hot-metallurgical processes, operational conditions (e.g. 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 (e.g. containment or segregation of the emission source) are generally not required in the processes.

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

| PROC | Level of separation | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
|-----------------------------------|--|---------------------------|---------------------------------------|---------------------|
| PROC 7 | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant | local exhaust ventilation | 78 % | - |
| PROC 19 | | not applicable | na | - |
| All other applicable PROCs | | not required | na | - |

| | | | | |
|--|-----------|--|--|--|
| | exposure. | | | |
|--|-----------|--|--|--|

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

| PROC | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
|----------------------------|---|--|---|--|
| PROC 7 | FFP1 mask | APF=4 | Since calcium oxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| All other applicable PROCs | not required | na | | |

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 of communicating are reduced during the wearing of RPE.

For reasons as 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.

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

2.2 Control of environmental exposure

Amounts used

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

Frequency and duration of use

Intermittent (< 12 time per year) or continuous use/release

Environment factors not influenced by risk management

Flow rate of receiving surface water: 18000 m³/day

Other given operational conditions affecting environmental exposure

Effluent discharge rate: 2000 m³/day

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 lime solutions into municipal wastewater 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 required. In general 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. The justification for this risk management measure can be found in the introduction section.

Conditions and measures related to waste

Solid industrial waste of lime should be reused or discharged to the industrial wastewater and further neutralized if needed.

3. Exposure estimation and reference to its source

Occupational exposure

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 for calcium oxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
|--|--|--------------------------------------|--|---|
| PROC 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19 | MEASE | < 1 mg/m ³ (0.001 – 0.66) | | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |

Environmental exposure

The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of lime substance in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH- discharges, being the toxicity of Ca²⁺ is expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale. The high water solubility and very low vapour pressure indicate that lime substance will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure of lime substance. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario. The exposure assessment for the aquatic environment will therefore only deal with the possible pH changes in STP effluent and surface water related to the OH- discharges at the local scale. The exposure assessment is approached by assessing the resulting pH impact: the surface water pH should not increase above 9.

| | |
|--------------------------------|--|
| Environmental emissions | The production of lime substance can potentially result in an aquatic emission and locally increase the lime substance concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from lime substance production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws. |
|--------------------------------|--|

| | |
|---|--|
| Exposure concentration in waste water treatment plant (WWTP) | Waste water from lime substance production is an inorganic wastewater stream and therefore there is no biological treatment. Therefore, wastewater streams from lime substance production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid wastewater streams that are treated in biological WWTPs. |
|---|--|

| | |
|--|---|
| Exposure concentration in aquatic pelagic compartment | When lime substance is emitted to surface water, sorption to particulate matter and sediment will be negligible. When lime is rejected to surface water, the pH 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 | The sediment compartment is not included in this ES, because it is not considered relevant for lime substance: when lime substance is emitted to the aquatic compartment, sorption of to sediment particles is negligible. |
|--|--|

| | |
|--|---|
| Exposure concentrations in soil and groundwater | The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant. |
|--|---|

| | |
|--|---|
| Exposure concentration in atmospheric compartment | The air compartment is not included in this CSA because it is considered not relevant for lime substance: when emitted to air as an aerosol in water, lime substance is neutralised as a result of its reaction with CO ₂ (or other acids), into HCO ₃ ⁻ and Ca ²⁺ . Subsequently, the salts (e.g. calcium(bi)carbonate) are washed out from the air and thus the atmospheric emissions of neutralised lime substance largely end up in soil and water. |
|--|---|

| | |
|---|---|
| Exposure concentration relevant for the food chain (secondary poisoning) | Bioaccumulation in organisms is not relevant for lime substance: a risk assessment for secondary poisoning is therefore not required. |
|---|---|

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Occupational exposure

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥ 10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

Environmental exposure

If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment. For that assessment, the following stepwise approach is recommended.

Tier 1: retrieve information on effluent pH and the contribution of the lime substance on the resulting pH. Should the pH be above 9 and be predominantly attributable to lime, then further actions are required to demonstrate safe use.

Tier 2a: retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9. If the measures are not available, the pH in the river can be calculated as follows:

$$pH_{river} = \text{Log} \left[\frac{Q_{effluent} * 10^{pH_{effluent}} + Q_{riverupstream} * 10^{pH_{upstream}}}{Q_{riverupstream} + Q_{effluent}} \right] \quad (\text{Eq 1})$$

Where:

Q effluent refers to the effluent flow (in m³/day)

Q river upstream refers to the upstream river flow (in m³/day)

pH effluent refers to the pH of the effluent

pH upstream river refers to the pH of the river upstream of the discharge point

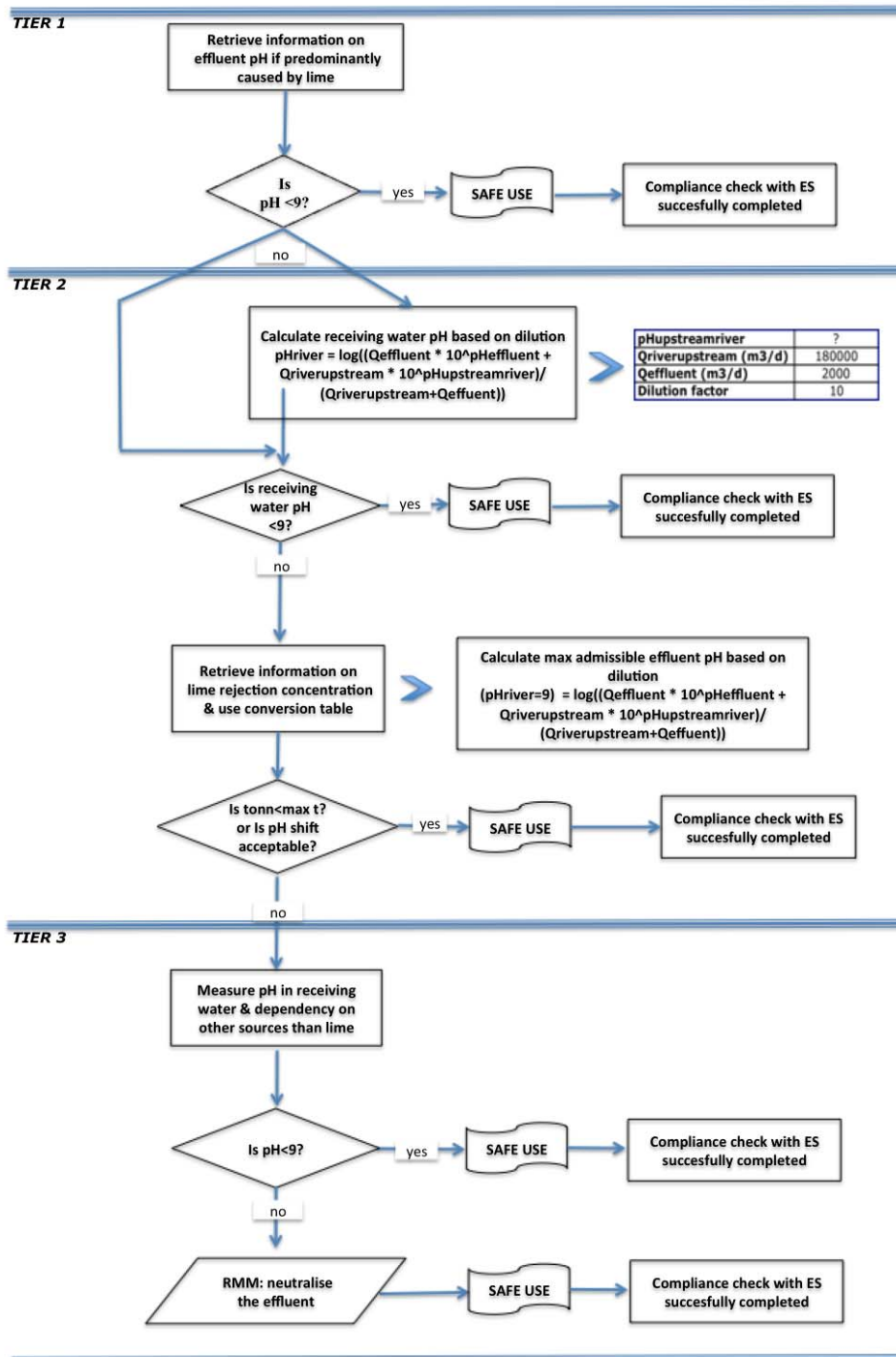
Please note that initially, default values can be used:

- Q river upstream flows: use the 10th of existing measurements distribution or use default value of 18000 m³/day
- Q effluent: use default value of 2000 m³/day
- The upstream pH is preferably a measured value. If not available, one can assume a neutral pH of 7 if this can be justified.

Such equation has to be seen as a worst case scenario, where water conditions are standard and not case specific.

Tier 2b: Equation 1 can be used to identify which effluent pH causes an acceptable pH level in the receiving body. In order to do so, pH of the river is set at value 9 and pH of the effluent is calculated accordingly (using default values as reported previously, if necessary). As temperature influences lime solubility, pH effluent might require to be adjusted on a case-by-case basis. Once the maximum admissible pH value in the effluent is established, it is assumed that the OH⁻ concentrations are all dependent on lime discharge and that there is no buffer capacity conditions to consider (this is a unrealistic worst case scenario, which can be modified where information is available). Maximum load of lime that can be annually rejected without negatively affecting the pH of the receiving water is calculated assuming chemical equilibrium. OH⁻ expressed as moles/litre are multiplied by average flow of the effluent and then divided by the molar mass of the lime substance.

Tier 3: measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably demonstrated and the ES ends here. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thus ensuring safe use of lime during production or use phase.



ES number 9.2: Manufacture and industrial uses of low dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers | | |
|---|---|---|
| 1. Title | | |
| Free short title | Manufacture and industrial uses of low dusty solids/powders of lime substances | |
| Systematic title based on use descriptor | SU3, SU1, SU2a, SU2b, SU4, SU5, SU6a, SU6b, SU7, SU8, SU9, SU10, SU11, SU12, SU13, SU14, SU15, SU16, SU17, SU18, SU19, SU20, SU23, SU24 PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC38, PC39, PC40 AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13 (appropriate PROCs and ERCs are given in Section 2 below) | |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. | |
| Assessment Method | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. | |
| 2. Operational conditions and risk management measures | | |
| PROC/ERC | REACH definition | Involved tasks |
| PROC 1 | Use in closed process, no likelihood of exposure | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 2 | Use in closed, continuous process with occasional controlled exposure | |
| PROC 3 | Use in closed batch process (synthesis or formulation) | |
| PROC 4 | Use in batch and other process (synthesis) where opportunity for exposure arises | |
| PROC 5 | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) | |
| PROC 6 | Calendering operations | |
| PROC 7 | Industrial spraying | |
| PROC 8a | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities | |
| PROC 8b | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities | |
| PROC 9 | Transfer of substance or preparation into small containers (dedicated filling line, including weighing) | |
| PROC 10 | Roller application or brushing | |
| PROC 13 | Treatment of articles by dipping and pouring | |
| PROC 14 | Production of preparations or articles by tableting, compression, extrusion, pelletisation | |
| PROC 15 | Use as laboratory reagent | |
| PROC 16 | Using material as fuel sources, limited exposure to unburned product to be expected | |
| PROC 17 | Lubrication at high energy conditions and in partly open process | |
| PROC 18 | Greasing at high energy conditions | |

| | |
|-------------|---|
| PROC 19 | Hand-mixing with intimate contact and only PPE available |
| PROC 21 | Low energy manipulation of substances bound in materials and/or articles |
| PROC 22 | Potentially closed processing operations with minerals/metals at elevated temperature Industrial setting |
| PROC 23 | Open processing and transfer operations with minerals/metals at elevated temperature |
| PROC 24 | High (mechanical) energy work-up of substances bound in materials and/or articles |
| PROC 25 | Other hot work operations with metals |
| PROC 26 | Handling of solid inorganic substances at ambient temperature |
| PROC 27a | Production of metal powders (hot processes) |
| PROC 27b | Production of metal powders (wet processes) |
| ERC 1-7, 12 | Manufacture, formulation and all types of industrial uses |
| ERC 10, 11 | Wide-dispersive outdoor and indoor use of long-life articles and materials |

2.1 Control of workers exposure

Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.

| PROC | Used in preparation? | Content in preparation | Physical form | Emission potential |
|----------------------------|----------------------|------------------------|----------------------|--------------------|
| PROC 22, 23, 25, 27a | not restricted | | solid/powder, molten | high |
| PROC 24 | not restricted | | solid/powder | high |
| All other applicable PROCs | not restricted | | solid/powder | low |

Amounts used

The actual tonnage handled per shift is not considered to influence the 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

| PROC | Duration of exposure |
|----------------------------|------------------------------|
| PROC 22 | ≤ 240 minutes |
| All other applicable PROCs | 480 minutes (not restricted) |

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. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25.

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

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

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

| PROC | Level of separation | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
|------------------------------|--|---------------------------|---------------------------------------|---------------------|
| PROC 7, 17, 18 | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | general ventilation | 17 % | - |
| PROC 19 | | not applicable | na | - |
| PROC 22, 23, 24, 25, 26, 27a | | local exhaust ventilation | 78 % | - |
| All other applicable PROCs | | not required | na | - |

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

| PROC | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
|----------------------------|---|--|---|--|
| PROC 22, 24, 27a | FFP1 mask | APF=4 | Since calcium oxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| All other applicable PROCs | not required | na | | |

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 of communicating are reduced during the wearing of RPE.

For reasons as 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.

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

2.2 Control of environmental exposure

Amounts used

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

Frequency and duration of use

Intermittent (< 12 time per year) or continuous use/release

Environment factors not influenced by risk management

Flow rate of receiving surface water: 18000 m³/day

Other given operational conditions affecting environmental exposure

Effluent discharge rate: 2000 m³/day

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 lime solutions into municipal wastewater 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 required. In general 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. The justification for this risk management measure can be found in the introduction section.

Conditions and measures related to waste

Solid industrial waste of lime should be reused or discharged to the industrial wastewater and further neutralized if needed.

3. Exposure estimation and reference to its source

Occupational exposure

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 for calcium oxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
|---|--|------------------------------------|---|--------------------------------|
| PROC 1, 2, 3, 4, 5, 6, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27a, 27b | MEASE | <1 mg/m ³ (0.01 – 0.83) | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. | |

Environmental emissions

The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of calcium oxide in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH⁻ discharges, being the toxicity of Ca²⁺ is expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale. The high water solubility and very low vapour pressure indicate that calcium oxide will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure of calcium oxide. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario. The exposure assessment for the aquatic environment will therefore only deal with the possible pH changes in STP effluent and surface water related to the OH⁻ discharges at the local scale. The exposure assessment is approached by assessing the resulting pH impact: the surface water pH should not increase above 9.

| | |
|--------------------------------|---|
| Environmental emissions | The production of calcium oxide can potentially result in an aquatic emission and locally increase the calcium oxide concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from calcium oxide production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws. |
|--------------------------------|---|

| | |
|---|--|
| Exposure concentration in waste water treatment plant (WWTP) | Waste water from calcium oxide production is an inorganic wastewater stream and therefore there is no biological treatment. Therefore, wastewater streams from calcium oxide production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid wastewater streams that are treated in biological WWTPs. |
| Exposure concentration in aquatic pelagic compartment | When calcium oxide is emitted to surface water, sorption to particulate matter and sediment will be negligible. When lime is rejected to surface water, the pH 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 | The sediment compartment is not included in this ES, because it is not considered relevant for calcium oxide: when calcium oxide is emitted to the aquatic compartment, sorption to sediment particles is negligible. |
| Exposure concentrations in soil and groundwater | The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant. |
| Exposure concentration in atmospheric compartment | The air compartment is not included in this CSA because it is considered not relevant for calcium oxide: when emitted to air as an aerosol in water, calcium oxide is neutralised as a result of its reaction with CO ₂ (or other acids), into HCO ₃ ⁻ and Ca ²⁺ . Subsequently, the salts (e.g. calcium(bi)carbonate) are washed out from the air and thus the atmospheric emissions of neutralised calcium oxide largely end up in soil and water. |
| Exposure concentration relevant for the food chain (secondary poisoning) | Bioaccumulation in organisms is not relevant for calcium oxide: a risk assessment for secondary poisoning is therefore not required. |

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Occupational exposure

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

Environmental exposure

If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment. For that assessment, the following stepwise approach is recommended.

Tier 1: retrieve information on effluent pH and the contribution of the calcium oxide on the resulting pH. Should the pH be above 9 and be predominantly attributable to lime, then further actions are required to demonstrate safe use.

Tier 2a: retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9. If the measures are not available, the pH in the river can be calculated as follows:

$$pH_{river} = \text{Log} \left[\frac{Q_{effluent} * 10^{pH_{effluent}} + Q_{riverupstream} * 10^{pH_{upstream}}}{Q_{riverupstream} + Q_{effluent}} \right] \quad (\text{Eq 1})$$

Where:

Q effluent refers to the effluent flow (in m³/day)

Q river upstream refers to the upstream river flow (in m³/day)

pH effluent refers to the pH of the effluent

pH upstream river refers to the pH of the river upstream of the discharge point

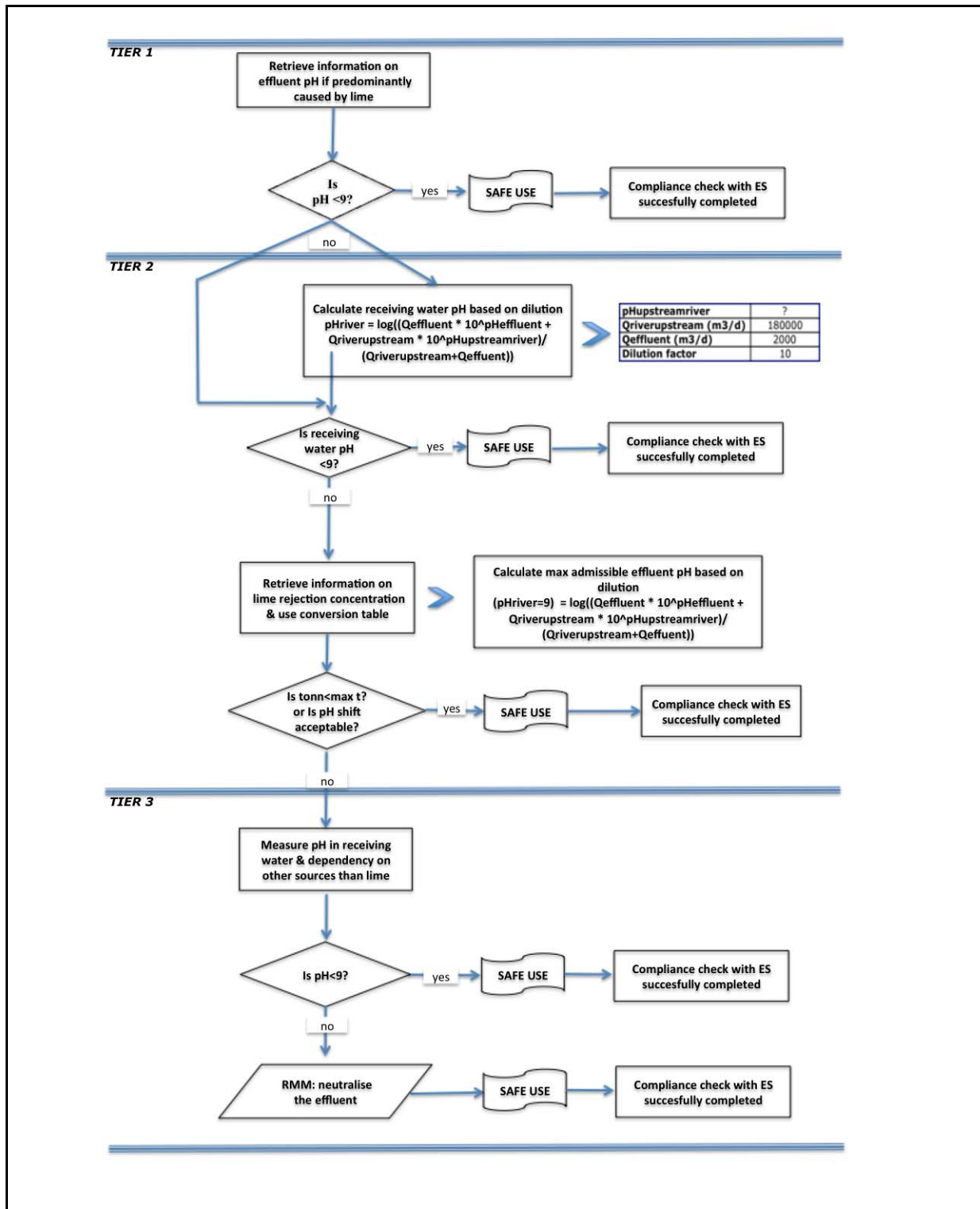
Please note that initially, default values can be used:

- Q river upstream flows: use the 10th of existing measurements distribution or use default value of 18000 m³/day
- Q effluent: use default value of 2000 m³/day
- The upstream pH is preferably a measured value. If not available, one can assume a neutral pH of 7 if this can be justified.

Such equation has to be seen as a worst case scenario, where water conditions are standard and not case specific.

Tier 2b: Equation 1 can be used to identify which effluent pH causes an acceptable pH level in the receiving body. In order to do so, pH of the river is set at value 9 and pH of the effluent is calculated accordingly (using default values as reported previously, if necessary). As temperature influences lime solubility, pH effluent might require to be adjusted on a case-by-case basis. Once the maximum admissible pH value in the effluent is established, it is assumed that the OH⁻ concentrations are all dependent on lime discharge and that there is no buffer capacity conditions to consider (this is a unrealistic worst case scenario, which can be modified where information is available). Maximum load of lime that can be annually rejected without negatively affecting the pH of the receiving water is calculated assuming chemical equilibrium. OH⁻ expressed as moles/litre are multiplied by average flow of the effluent and then divided by the molar mass of the calcium oxide.

Tier 3: measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably demonstrated and the ES ends here. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thus ensuring safe use of lime during production or use phase.



ES number 9.3: Manufacture and industrial uses of medium dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers | | |
|---|---|---|
| 1. Title | | |
| Free short title | Manufacture and industrial uses of medium dusty solids/powders of lime substances | |
| Systematic title based on use descriptor | SU3, SU1, SU2a, SU2b, SU4, SU5, SU6a, SU6b, SU7, SU8, SU9, SU10, SU11, SU12, SU13, SU14, SU15, SU16, SU17, SU18, SU19, SU20, SU23, SU24 PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC38, PC39, PC40 AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13 (appropriate PROCs and ERCs are given in Section 2 below) | |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. | |
| Assessment Method | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. | |
| 2. Operational conditions and risk management measures | | |
| PROC/ERC | REACH definition | Involved tasks |
| PROC 1 | Use in closed process, no likelihood of exposure | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 2 | Use in closed, continuous process with occasional controlled exposure | |
| PROC 3 | Use in closed batch process (synthesis or formulation) | |
| PROC 4 | Use in batch and other process (synthesis) where opportunity for exposure arises | |
| PROC 5 | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) | |
| PROC 7 | Industrial spraying | |
| PROC 8a | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities | |
| PROC 8b | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities | |
| PROC 9 | Transfer of substance or preparation into small containers (dedicated filling line, including weighing) | |
| PROC 10 | Roller application or brushing | |
| PROC 13 | Treatment of articles by dipping and pouring | |
| PROC 14 | Production of preparations or articles by tableting, compression, extrusion, pelletisation | |
| PROC 15 | Use as laboratory reagent | |
| PROC 16 | Using material as fuel sources, limited exposure to unburned product to be expected | |
| PROC 17 | Lubrication at high energy conditions and in partly open process | |
| PROC 18 | Greasing at high energy conditions | |
| PROC 19 | Hand-mixing with intimate contact and only PPE available | |

| | |
|--------------------|---|
| PROC 22 | Potentially closed processing operations with minerals/metals at elevated temperature Industrial setting |
| PROC 23 | Open processing and transfer operations with minerals/metals at elevated temperature |
| PROC 24 | High (mechanical) energy work-up of substances bound in materials and/or articles |
| PROC 25 | Other hot work operations with metals |
| PROC 26 | Handling of solid inorganic substances at ambient temperature |
| PROC 27a | Production of metal powders (hot processes) |
| PROC 27b | Production of metal powders (wet processes) |
| ERC 1-7, 12 | Manufacture, formulation and all types of industrial uses |
| ERC 10, 11 | Wide-dispersive outdoor and indoor use of long-life articles and materials |

2.1 Control of workers exposure

Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.

| PROC | Used in preparation? | Content in preparation | Physical form | Emission potential |
|-----------------------------------|----------------------|------------------------|----------------------|--------------------|
| PROC 22, 23, 25, 27a | not restricted | | solid/powder, molten | high |
| PROC 24 | not restricted | | solid/powder | high |
| All other applicable PROCs | not restricted | | solid/powder | medium |

Amounts used

The actual tonnage handled per shift is not considered to influence the 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

| PROC | Duration of exposure |
|-----------------------------------|------------------------------|
| PROC 7, 17, 18, 19, 22 | ≤ 240 minutes |
| All other applicable PROCs | 480 minutes (not restricted) |

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. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25.

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

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

| Technical conditions and measures to control dispersion from source towards the worker | | | | |
|---|--|---|---|--|
| PROC | Level of separation | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
| PROC 1, 2, 15, 27b | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | not required | na | - |
| PROC 3, 13, 14 | | general ventilation | 17 % | - |
| PROC 19 | | not applicable | na | - |
| All other applicable PROCs | | 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 | | | | |
| PROC | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
| PROC 4, 5, 7, 8a, 8b, 9, 10, 16, 17, 18, 19, 22, 24, 27a | FFP1 mask | APF=4 | Since calcium oxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| All other applicable PROCs | not required | na | | |
| 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 of communicating are reduced during the wearing of RPE. For reasons as 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. An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE. | | | | |
| 2.2 Control of environmental exposure | | | | |
| Amounts used | | | | |
| The daily and annual amount per site (for point sources) is not considered to be the main determinant for environmental exposure. | | | | |

| | | | | |
|--|---|---|---|---------------------------------------|
| Frequency and duration of use | | | | |
| Intermittent (< 12 time per year) or continuous use/release | | | | |
| Environment factors not influenced by risk management | | | | |
| Flow rate of receiving surface water: 18000 m ³ /day | | | | |
| Other given operational conditions affecting environmental exposure | | | | |
| Effluent discharge rate: 2000 m ³ /day | | | | |
| 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 lime solutions into municipal wastewater 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 required. In general 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. The justification for this risk management measure can be found in the introduction section. | | | | |
| Conditions and measures related to waste | | | | |
| Solid industrial waste of lime should be reused or discharged to the industrial wastewater and further neutralized if needed. | | | | |
| 3. Exposure estimation and reference to its source | | | | |
| Occupational exposure | | | | |
| 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 for calcium oxide of 1 mg/m ³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481. | | | | |
| PROC | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
| PROC 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27a, 27b | MEASE | < 1 mg/m ³ (0.01 – 0.88) | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. | |
| Environmental emissions | | | | |
| The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of calcium oxide in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH- discharges, being the toxicity of Ca ²⁺ is expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale. The high water solubility and very low vapour pressure indicate that calcium oxide will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure of calcium oxide. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario. The exposure assessment for the aquatic environment will therefore only deal with the possible pH changes in STP effluent and surface water related to the OH- discharges at the local scale. The exposure assessment is approached by assessing the resulting pH impact: the surface water pH should not increase above 9. | | | | |
| Environmental emissions | The production of calcium oxide can potentially result in an aquatic emission and locally increase the calcium oxide concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from calcium oxide production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws. | | | |
| Exposure concentration in waste water treatment plant (WWTP) | Waste water from calcium oxide production is an inorganic wastewater stream and therefore there is no biological treatment. Therefore, wastewater streams from calcium oxide production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid wastewater streams that are treated in biological WWTPs. | | | |

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| Exposure concentration in aquatic pelagic compartment | When calcium oxide is emitted to surface water, sorption to particulate matter and sediment will be negligible. When lime is rejected to surface water, the pH 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 | The sediment compartment is not included in this ES, because it is not considered relevant for calcium oxide: when calcium oxide is emitted to the aquatic compartment, sorption of to sediment particles is negligible. |
| Exposure concentrations in soil and groundwater | The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant. |
| Exposure concentration in atmospheric compartment | The air compartment is not included in this CSA because it is considered not relevant for calcium oxide: when emitted to air as an aerosol in water, calcium oxide is neutralised as a result of its reaction with CO ₂ (or other acids), into HCO ₃ ⁻ and Ca ²⁺ . Subsequently, the salts (e.g. calcium(bi)carbonate) are washed out from the air and thus the atmospheric emissions of neutralised calcium oxide largely end up in soil and water. |
| Exposure concentration relevant for the food chain (secondary poisoning) | Bioaccumulation in organisms is not relevant for calcium oxide: a risk assessment for secondary poisoning is therefore not required. |

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Occupational exposure

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥ 10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

Environmental exposure

If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment. For that assessment, the following stepwise approach is recommended.

Tier 1: retrieve information on effluent pH and the contribution of the calcium oxide on the resulting pH. Should the pH be above 9 and be predominantly attributable to lime, then further actions are required to demonstrate safe use.

Tier 2a: retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9. If the measures are not available, the pH in the river can be calculated as follows:

$$pH_{river} = \text{Log} \left[\frac{Q_{effluent} * 10^{pH_{effluent}} + Q_{riverupstream} * 10^{pH_{upstream}}}{Q_{riverupstream} + Q_{effluent}} \right] \quad \text{Eq 1)}$$

Where:

Q effluent refers to the effluent flow (in m³/day)

Q river upstream refers to the upstream river flow (in m³/day)

pH effluent refers to the pH of the effluent

pH upstream river refers to the pH of the river upstream of the discharge point

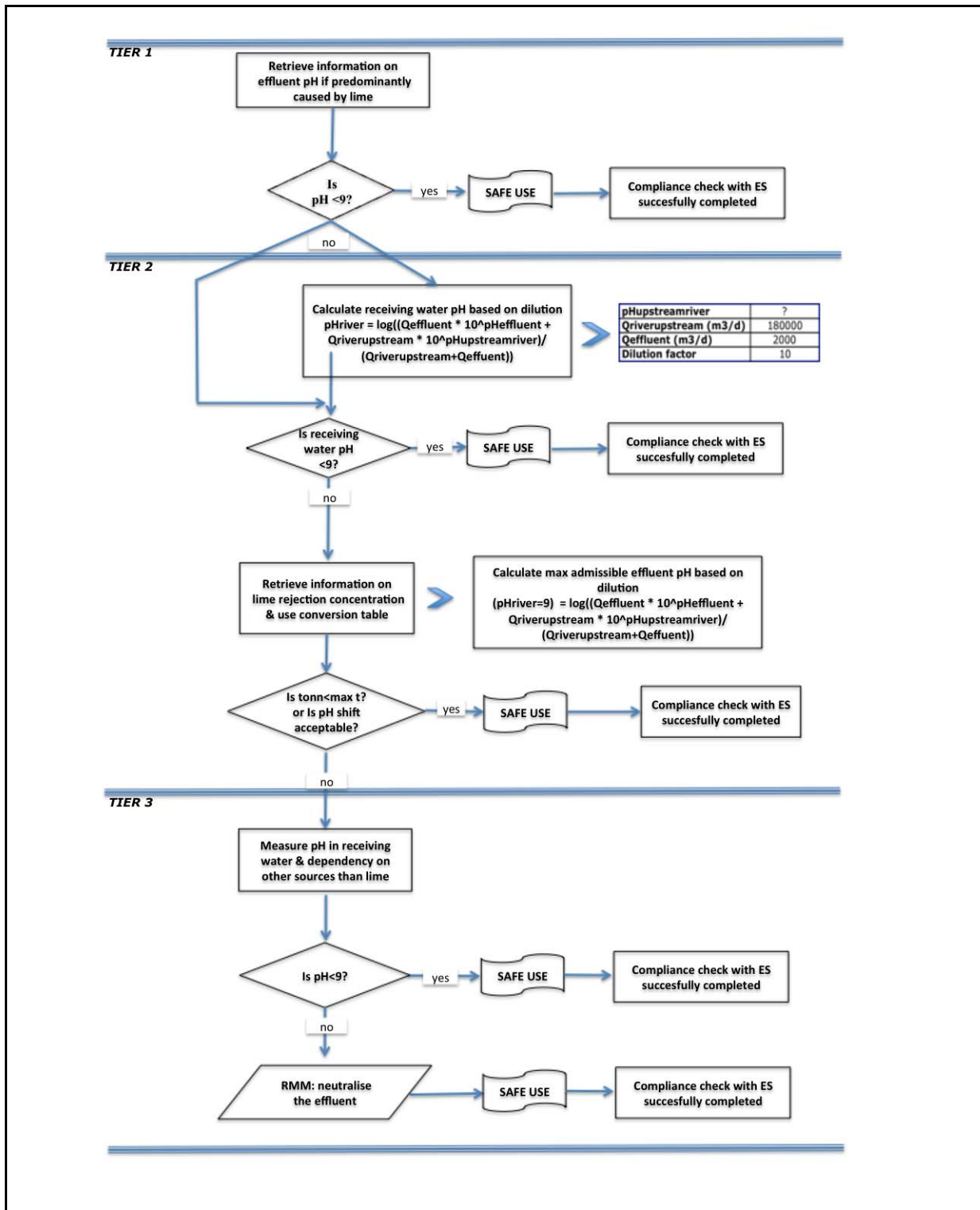
Please note that initially, default values can be used:

- Q river upstream flows: use the 10th of existing measurements distribution or use default value of 18000 m³/day
- Q effluent: use default value of 2000 m³/day
- The upstream pH is preferably a measured value. If not available, one can assume a neutral pH of 7 if this can be justified.

Such equation has to be seen as a worst case scenario, where water conditions are standard and not case specific.

Tier 2b: Equation 1 can be used to identify which effluent pH causes an acceptable pH level in the receiving body. In order to do so, pH of the river is set at value 9 and pH of the effluent is calculated accordingly (using default values as reported previously, if necessary). As temperature influences lime solubility, pH effluent might require to be adjusted on a case-by-case basis. Once the maximum admissible pH value in the effluent is established, it is assumed that the OH⁻ concentrations are all dependent on lime discharge and that there is no buffer capacity conditions to consider (this is a unrealistic worst case scenario, which can be modified where information is available). Maximum load of lime that can be annually rejected without negatively affecting the pH of the receiving water is calculated assuming chemical equilibrium. OH⁻ expressed as moles/litre are multiplied by average flow of the effluent and then divided by the molar mass of the calcium oxide.

Tier 3: measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably demonstrated and the ES ends here. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thus ensuring safe use of lime during production or use phase.



ES number 9.4: Manufacture and industrial uses of high dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers | | |
|---|---|---|
| 1. Title | | |
| Free short title | Manufacture and industrial uses of high dusty solids/powders of lime substances | |
| Systematic title based on use descriptor | SU3, SU1, SU2a, SU2b, SU4, SU5, SU6a, SU6b, SU7, SU8, SU9, SU10, SU11, SU12, SU13, SU14, SU15, SU16, SU17, SU18, SU19, SU20, SU23, SU24 PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC38, PC39, PC40 AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13 (appropriate PROCs and ERCs are given in Section 2 below) | |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. | |
| Assessment Method | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. | |
| 2. Operational conditions and risk management measures | | |
| PROC/ERC | REACH definition | Involved tasks |
| PROC 1 | Use in closed process, no likelihood of exposure | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 2 | Use in closed, continuous process with occasional controlled exposure | |
| PROC 3 | Use in closed batch process (synthesis or formulation) | |
| PROC 4 | Use in batch and other process (synthesis) where opportunity for exposure arises | |
| PROC 5 | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) | |
| PROC 7 | Industrial spraying | |
| PROC 8a | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities | |
| PROC 8b | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities | |
| PROC 9 | Transfer of substance or preparation into small containers (dedicated filling line, including weighing) | |
| PROC 10 | Roller application or brushing | |
| PROC 13 | Treatment of articles by dipping and pouring | |
| PROC 14 | Production of preparations or articles by tableting, compression, extrusion, pelletisation | |
| PROC 15 | Use as laboratory reagent | |
| PROC 16 | Using material as fuel sources, limited exposure to unburned product to be expected | |
| PROC 17 | Lubrication at high energy conditions and in partly open process | |
| PROC 18 | Greasing at high energy conditions | |
| PROC 19 | Hand-mixing with intimate contact and only PPE available | |

| | |
|--------------------|---|
| PROC 22 | Potentially closed processing operations with minerals/metals at elevated temperature Industrial setting |
| PROC 23 | Open processing and transfer operations with minerals/metals at elevated temperature |
| PROC 24 | High (mechanical) energy work-up of substances bound in materials and/or articles |
| PROC 25 | Other hot work operations with metals |
| PROC 26 | Handling of solid inorganic substances at ambient temperature |
| PROC 27a | Production of metal powders (hot processes) |
| PROC 27b | Production of metal powders (wet processes) |
| ERC 1-7, 12 | Manufacture, formulation and all types of industrial uses |
| ERC 10, 11 | Wide-dispersive outdoor and indoor use of long-life articles and materials |

2.1 Control of workers exposure

Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.

| PROC | Used in preparation? | Content in preparation | Physical form | Emission potential |
|-----------------------------------|----------------------|------------------------|----------------------|--------------------|
| PROC 22, 23, 25, 27a | not restricted | | solid/powder, molten | high |
| All other applicable PROCs | not restricted | | solid/powder | high |

Amounts used

The actual tonnage handled per shift is not considered to influence the 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

| PROC | Duration of exposure |
|-----------------------------------|------------------------------|
| PROC 7, 8a, 17, 18, 19, 22 | ≤ 240 minutes |
| All other applicable PROCs | 480 minutes (not restricted) |

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. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25.

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

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

| Technical conditions and measures to control dispersion from source towards the worker | | | | |
|--|--|---|---|--|
| PROC | Level of separation | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
| PROC 1 | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | not required | na | - |
| PROC 2, 3 | | general ventilation | 17 % | - |
| PROC 7 | | integrated local exhaust ventilation | 84 % | - |
| PROC 19 | | not applicable | na | - |
| All other applicable PROCs | | local exhaust ventilation | 78 % | - |
| Organisational measures to prevent /limit releases, dispersion and exposure | | | | |
| <p>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.</p> | | | | |
| Conditions and measures related to personal protection, hygiene and health evaluation | | | | |
| PROC | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
| PROC 1, 2, 3, 23, 25, 27b | not required | na | Since calcium oxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 4, 5, 7, 8a, 8b, 9, 17, 18, | FFP2 mask | APF=10 | | |
| PROC 10, 13, 14, 15, 16, 22, 24, 26, 27a | FFP1 mask | APF=4 | | |
| PROC 19 | FFP3 mask | APF=20 | | |
| <p>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 of communicating are reduced during the wearing of RPE.</p> <p>For reasons as 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.</p> <p>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.</p> <p>An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE.</p> | | | | |
| 2.2 Control of environmental exposure | | | | |
| Amounts used | | | | |
| The daily and annual amount per site (for point sources) is not considered to be the main determinant for environmental exposure. | | | | |

| | | | | |
|--|---|---|---|---------------------------------------|
| Frequency and duration of use | | | | |
| Intermittent (< 12 time per year) or continuous use/release | | | | |
| Environment factors not influenced by risk management | | | | |
| Flow rate of receiving surface water: 18000 m ³ /day | | | | |
| Other given operational conditions affecting environmental exposure | | | | |
| Effluent discharge rate: 2000 m ³ /day | | | | |
| 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 lime solutions into municipal wastewater 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 required. In general 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. The justification for this risk management measure can be found in the introduction section. | | | | |
| Conditions and measures related to waste | | | | |
| Solid industrial waste of lime should be reused or discharged to the industrial wastewater and further neutralized if needed. | | | | |
| 3. Exposure estimation and reference to its source | | | | |
| Occupational exposure | | | | |
| 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 for calcium oxide of 1 mg/m ³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481. | | | | |
| PROC | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
| PROC 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27a, 27b | MEASE | <1 mg/m ³ (0.01 – 0.96) | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. | |
| Environmental emissions | | | | |
| The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of calcium oxide in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH- discharges, being the toxicity of Ca ²⁺ is expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale. The high water solubility and very low vapour pressure indicate that calcium oxide will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure of calcium oxide. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario. The exposure assessment for the aquatic environment will therefore only deal with the possible pH changes in STP effluent and surface water related to the OH- discharges at the local scale. The exposure assessment is approached by assessing the resulting pH impact: the surface water pH should not increase above 9. | | | | |
| Environmental emissions | The production of calcium oxide can potentially result in an aquatic emission and locally increase the calcium oxide concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from calcium oxide production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws. | | | |
| Exposure concentration in waste water treatment plant (WWTP) | Waste water from calcium oxide production is an inorganic wastewater stream and therefore there is no biological treatment. Therefore, wastewater streams from calcium oxide production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid wastewater streams that are treated in biological WWTPs. | | | |

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|---|--|
| Exposure concentration in aquatic pelagic compartment | When calcium oxide is emitted to surface water, sorption to particulate matter and sediment will be negligible. When lime is rejected to surface water, the pH 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 | The sediment compartment is not included in this ES, because it is not considered relevant for calcium oxide: when calcium oxide is emitted to the aquatic compartment, sorption of to sediment particles is negligible. |
| Exposure concentrations in soil and groundwater | The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant. |
| Exposure concentration in atmospheric compartment | The air compartment is not included in this CSA because it is considered not relevant for calcium oxide: when emitted to air as an aerosol in water, calcium oxide is neutralised as a result of its reaction with CO ₂ (or other acids), into HCO ₃ ⁻ and Ca ²⁺ . Subsequently, the salts (e.g. calcium(bi)carbonate) are washed out from the air and thus the atmospheric emissions of neutralised calcium oxide largely end up in soil and water. |
| Exposure concentration relevant for the food chain (secondary poisoning) | Bioaccumulation in organisms is not relevant for calcium oxide: a risk assessment for secondary poisoning is therefore not required. |

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Occupational exposure

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

Environmental exposure

If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment. For that assessment, the following stepwise approach is recommended.

Tier 1: retrieve information on effluent pH and the contribution of the calcium oxide on the resulting pH. Should the pH be above 9 and be predominantly attributable to lime, then further actions are required to demonstrate safe use.

Tier 2a: retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9. If the measures are not available, the pH in the river can be calculated as follows:

$$pH_{river} = \text{Log} \left[\frac{Q_{effluent} * 10^{pH_{effluent}} + Q_{riverupstream} * 10^{pH_{upstream}}}{Q_{riverupstream} + Q_{effluent}} \right] \quad (\text{Eq 1})$$

Where:

Q effluent refers to the effluent flow (in m³/day)

Q river upstream refers to the upstream river flow (in m³/day)

pH effluent refers to the pH of the effluent

pH upstream river refers to the pH of the river upstream of the discharge point

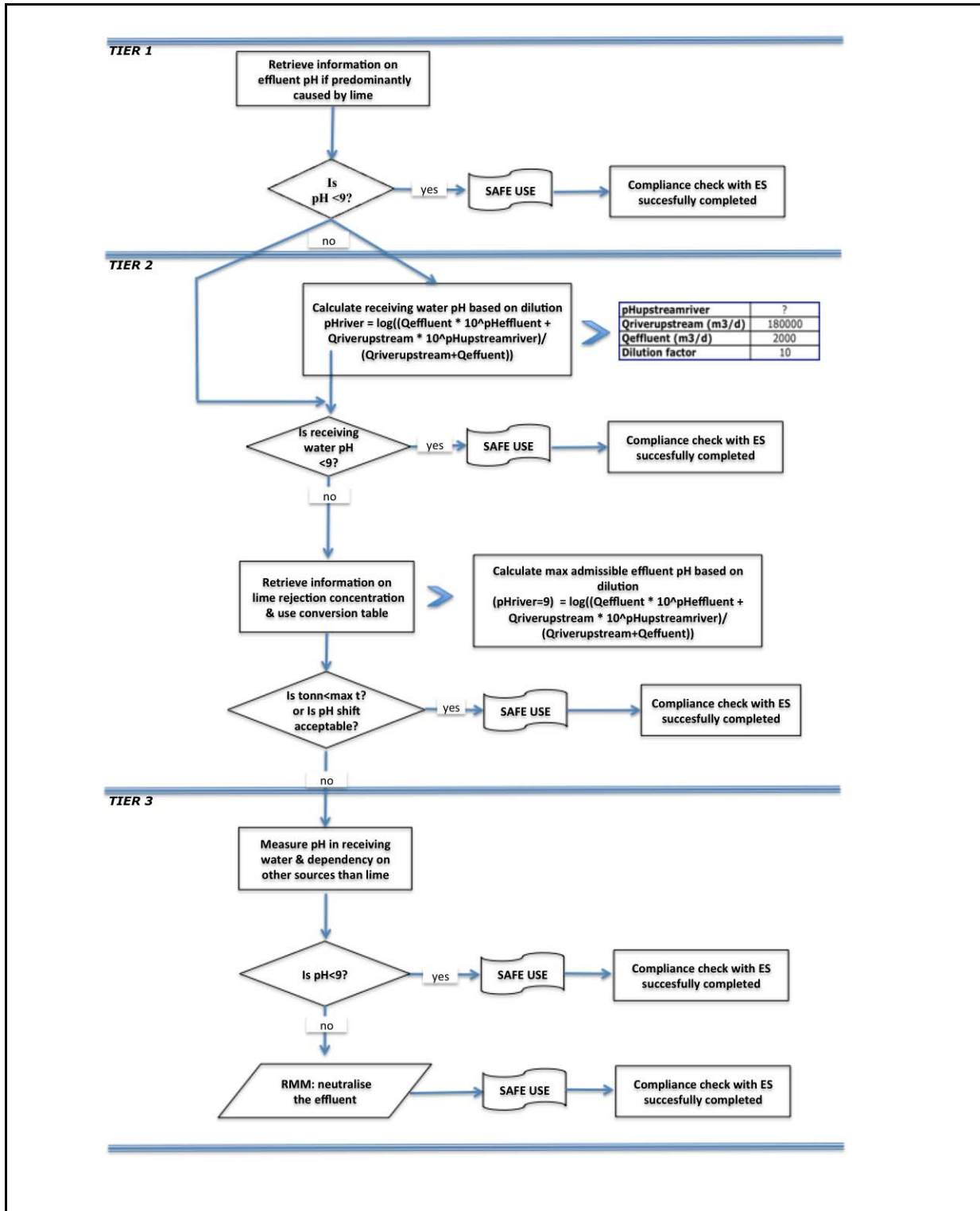
Please note that initially, default values can be used:

- Q river upstream flows: use the 10th of existing measurements distribution or use default value of 18000 m³/day
- Q effluent: use default value of 2000 m³/day
- The upstream pH is preferably a measured value. If not available, one can assume a neutral pH of 7 if this can be justified.

Such equation has to be seen as a worst case scenario, where water conditions are standard and not case specific.

Tier 2b: Equation 1 can be used to identify which effluent pH causes an acceptable pH level in the receiving body. In order to do so, pH of the river is set at value 9 and pH of the effluent is calculated accordingly (using default values as reported previously, if necessary). As temperature influences lime solubility, pH effluent might require to be adjusted on a case-by-case basis. Once the maximum admissible pH value in the effluent is established, it is assumed that the OH⁻ concentrations are all dependent on lime discharge and that there is no buffer capacity conditions to consider (this is a unrealistic worst case scenario, which can be modified where information is available). Maximum load of lime that can be annually rejected without negatively affecting the pH of the receiving water is calculated assuming chemical equilibrium. OH⁻ expressed as moles/litre are multiplied by average flow of the effluent and then divided by the molar mass of the calcium oxide.

Tier 3: measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably demonstrated and the ES ends here. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thus ensuring safe use of lime during production or use phase.



ES number 9.5: Manufacture and industrial uses of massive objects containing lime substances

Exposure Scenario Format (1) addressing uses carried out by workers

1. Title

| | |
|---|---|
| Free short title | Manufacture and industrial uses of massive objects containing lime substances |
| Systematic title based on use descriptor | SU3, SU1, SU2a, SU2b, SU4, SU5, SU6a, SU6b, SU7, SU8, SU9, SU10, SU11, SU12, SU13, SU14, SU15, SU16, SU17, SU18, SU19, SU20, SU23, SU24 PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC38, PC39, PC40 AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13 (appropriate PROCs and ERCs are given in Section 2 below) |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. |
| Assessment Method | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. |

2. Operational conditions and risk management measures

| PROC/ERC | REACH definition | Involved tasks |
|-------------|---|---|
| PROC 6 | Calendering operations | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 14 | Production of preparations or articles by tableting, compression, extrusion, pelletisation | |
| PROC 21 | Low energy manipulation of substances bound in materials and/or articles | |
| PROC 22 | Potentially closed processing operations with minerals/metals at elevated temperature Industrial setting | |
| PROC 23 | Open processing and transfer operations with minerals/metals at elevated temperature | |
| PROC 24 | High (mechanical) energy work-up of substances bound in materials and/or articles | |
| PROC 25 | Other hot work operations with metals | |
| ERC 1-7, 12 | Manufacture, formulation and all types of industrial uses | |
| ERC 10, 11 | Wide-dispersive outdoor and indoor use of long-life articles and materials | |

2.1 Control of workers exposure

Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.

| PROC | Used in preparation? | Content in preparation | Physical form | Emission potential |
|----------------------------|----------------------|------------------------|-------------------------|--------------------|
| PROC 22, 23,25 | not restricted | | massive objects, molten | high |
| PROC 24 | not restricted | | massive objects | high |
| All other applicable PROCs | not restricted | | massive objects | very low |

| Amounts used | | | | |
|--|--|--------------------------------|--|----------------------------|
| The actual tonnage handled per shift is not considered to influence the 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 | | | | |
| PROC | Duration of exposure | | | |
| PROC 22 | ≤ 240 minutes | | | |
| All other applicable PROCs | 480 minutes (not restricted) | | | |
| Human factors not influenced by risk management | | | | |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m ³ /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. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25. | | | | |
| Technical conditions and measures at process level (source) to prevent release | | | | |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes. | | | | |
| Technical conditions and measures to control dispersion from source towards the worker | | | | |
| PROC | Level of separation | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
| PROC 6, 14, 21 | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | not required | na | - |
| PROC 22, 23, 24, 25 | | 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 | | | | |
|--|--|---|---|--|
| PROC | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
| PROC 22 | FFP1 mask | APF=4 | Since calcium oxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| All other applicable PROCs | not required | na | | |
| <p>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 of communicating are reduced during the wearing of RPE.</p> <p>For reasons as 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.</p> <p>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.</p> <p>An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE.</p> | | | | |
| 2.2 Control of environmental exposure | | | | |
| Amounts used | | | | |
| The daily and annual amount per site (for point sources) is not considered to be the main determinant for environmental exposure. | | | | |
| Frequency and duration of use | | | | |
| Intermittent (< 12 time per year) or continuous use/release | | | | |
| Environment factors not influenced by risk management | | | | |
| Flow rate of receiving surface water: 18000 m ³ /day | | | | |
| Other given operational conditions affecting environmental exposure | | | | |
| Effluent discharge rate: 2000 m ³ /day | | | | |
| 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 lime solutions into municipal wastewater 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 required. In general 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. The justification for this risk management measure can be found in the introduction section. | | | | |
| Conditions and measures related to waste | | | | |
| Solid industrial waste of lime should be reused or discharged to the industrial wastewater and further neutralized if needed. | | | | |

3. Exposure estimation and reference to its source

Occupational exposure

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 for calcium oxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
|--------------------------------|--|-------------------------------------|--|---|
| PROC 6, 14, 21, 22, 23, 24, 25 | MEASE | < 1 mg/m ³ (0.01 – 0.44) | | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |

Environmental emissions

The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of calcium oxide in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH⁻ discharges, being the toxicity of Ca²⁺ is expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale. The high water solubility and very low vapour pressure indicate that calcium oxide will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure of calcium oxide. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario. The exposure assessment for the aquatic environment will therefore only deal with the possible pH changes in STP effluent and surface water related to the OH⁻ discharges at the local scale. The exposure assessment is approached by assessing the resulting pH impact: the surface water pH should not increase above 9.

| | |
|---|--|
| Environmental emissions | The production of calcium oxide can potentially result in an aquatic emission and locally increase the calcium oxide concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from calcium oxide production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws. |
| Exposure concentration in waste water treatment plant (WWTP) | Waste water from calcium oxide production is an inorganic wastewater stream and therefore there is no biological treatment. Therefore, wastewater streams from calcium oxide production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid wastewater streams that are treated in biological WWTPs. |
| Exposure concentration in aquatic pelagic compartment | When calcium oxide is emitted to surface water, sorption to particulate matter and sediment will be negligible. When lime is rejected to surface water, the pH 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 | The sediment compartment is not included in this ES, because it is not considered relevant for calcium oxide: when calcium oxide is emitted to the aquatic compartment, sorption of to sediment particles is negligible. |
| Exposure concentrations in soil and groundwater | The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant. |
| Exposure concentration in atmospheric compartment | The air compartment is not included in this CSA because it is considered not relevant for calcium oxide: when emitted to air as an aerosol in water, calcium oxide is neutralised as a result of its reaction with CO ₂ (or other acids), into HCO ₃ ⁻ and Ca ²⁺ . Subsequently, the salts (e.g. calcium(bi)carbonate) are washed out from the air and thus the atmospheric emissions of neutralised calcium oxide largely end up in soil and water. |
| Exposure concentration relevant for the food chain (secondary poisoning) | Bioaccumulation in organisms is not relevant for calcium oxide: a risk assessment for secondary poisoning is therefore not required. |

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Occupational exposure

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE

(www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥ 10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

Environmental exposure

If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment. For that assessment, the following stepwise approach is recommended.

Tier 1: retrieve information on effluent pH and the contribution of the calcium oxide on the resulting pH. Should the pH be above 9 and be predominantly attributable to lime, then further actions are required to demonstrate safe use.

Tier 2a: retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9. If the measures are not available, the pH in the river can be calculated as follows:

$$pH_{river} = \text{Log} \left[\frac{Q_{effluent} * 10^{pH_{effluent}} + Q_{riverupstream} * 10^{pH_{upstream}}}{Q_{riverupstream} + Q_{effluent}} \right] \quad (\text{Eq 1})$$

Where:

Q effluent refers to the effluent flow (in m³/day)

Q river upstream refers to the upstream river flow (in m³/day)

pH effluent refers to the pH of the effluent

pH upstream river refers to the pH of the river upstream of the discharge point

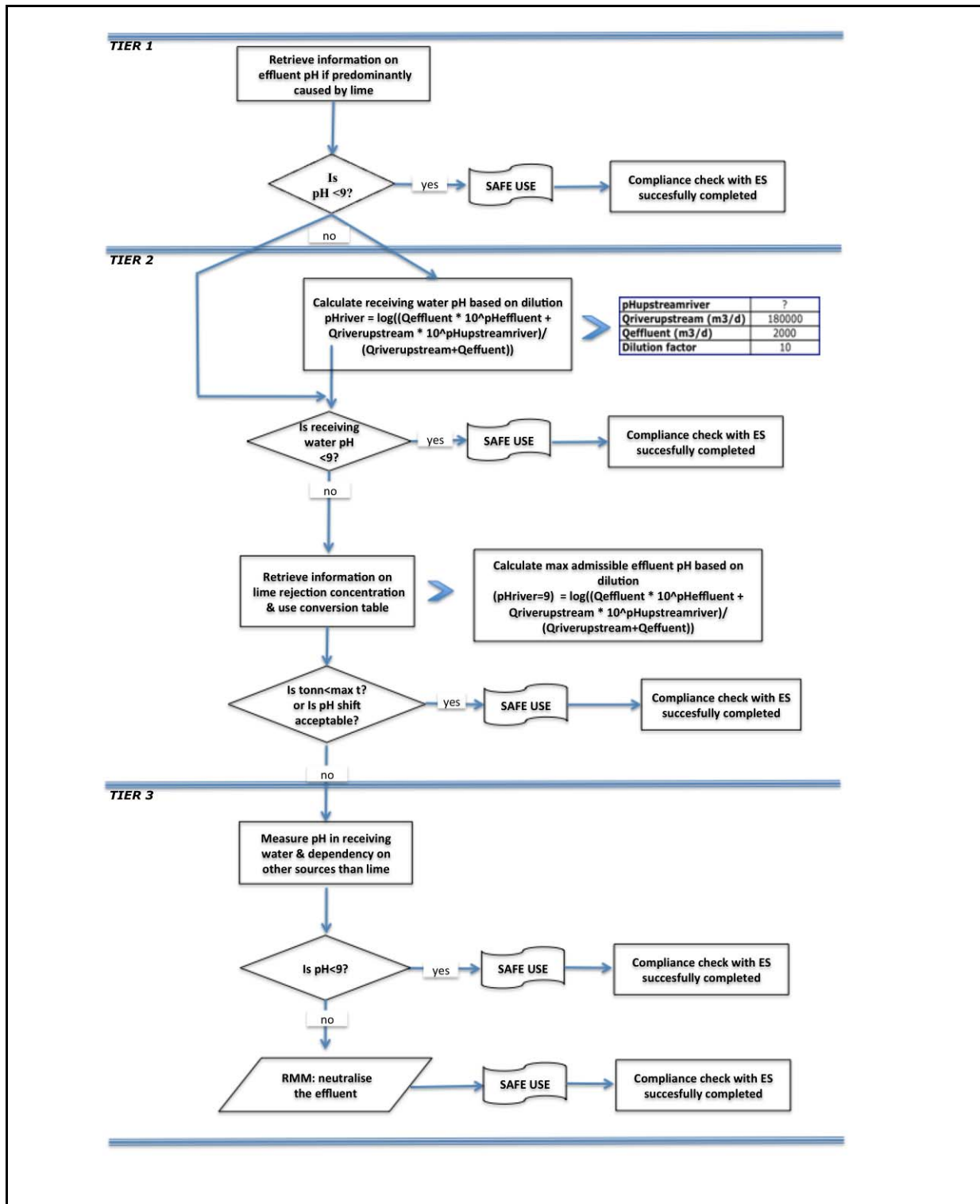
Please note that initially, default values can be used:

- Q river upstream flows: use the 10th of existing measurements distribution or use default value of 18000 m³/day
- Q effluent: use default value of 2000 m³/day
- The upstream pH is preferably a measured value. If not available, one can assume a neutral pH of 7 if this can be justified.

Such equation has to be seen as a worst case scenario, where water conditions are standard and not case specific.

Tier 2b: Equation 1 can be used to identify which effluent pH causes an acceptable pH level in the receiving body. In order to do so, pH of the river is set at value 9 and pH of the effluent is calculated accordingly (using default values as reported previously, if necessary). As temperature influences lime solubility, pH effluent might require to be adjusted on a case-by-case basis. Once the maximum admissible pH value in the effluent is established, it is assumed that the OH⁻ concentrations are all dependent on lime discharge and that there is no buffer capacity conditions to consider (this is a unrealistic worst case scenario, which can be modified where information is available). Maximum load of lime that can be annually rejected without negatively affecting the pH of the receiving water is calculated assuming chemical equilibrium. OH⁻ expressed as moles/litre are multiplied by average flow of the effluent and then divided by the molar mass of the calcium oxide.

Tier 3: measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably demonstrated and the ES ends here. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thus ensuring safe use of lime during production or use phase.



ES number 9.6: Professional uses of aqueous solutions of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers | | | |
|---|---|---|--|
| 1. Title | | | |
| Free short title | Professional uses of aqueous solutions of lime substances | | |
| Systematic title based on use descriptor | SU22, SU1, SU5, SU6a, SU6b, SU7, SU10, SU11, SU12, SU13, SU16, SU17, SU18, SU19, SU20, SU23, SU24 PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC39, PC40 AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13 (appropriate PROCs and ERCs are given in Section 2 below) | | |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. | | |
| Assessment Method | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. The environmental assessment is based on FOCUS-Exposit. | | |
| 2. Operational conditions and risk management measures | | | |
| PROC/ERC | REACH definition | Involved tasks | |
| PROC 2 | Use in closed, continuous process with occasional controlled exposure | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). | |
| PROC 3 | Use in closed batch process (synthesis or formulation) | | |
| PROC 4 | Use in batch and other process (synthesis) where opportunity for exposure arises | | |
| PROC 5 | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) | | |
| PROC 8a | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities | | |
| PROC 8b | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities | | |
| PROC 9 | Transfer of substance or preparation into small containers (dedicated filling line, including weighing) | | |
| PROC 10 | Roller application or brushing | | |
| PROC 11 | Non industrial spraying | | |
| PROC 12 | Use of blowing agents in manufacture of foam | | |
| PROC 13 | Treatment of articles by dipping and pouring | | |
| PROC 15 | Use as laboratory reagent | | |
| PROC 16 | Using material as fuel sources, limited exposure to unburned product to be expected | | |
| PROC 17 | Lubrication at high energy conditions and in partly open process | | |
| PROC 18 | Greasing at high energy conditions | | |
| PROC 19 | Hand-mixing with intimate contact and only PPE available | | |
| ERC2, ERC8a, ERC8b, ERC8c, ERC8d, | Wide dispersive indoor and outdoor use of reactive substances or processing aids in open | | Calcium oxide is applied in numerous cases of wide dispersive uses: agricultural, forestry, fish |

| | | | | |
|--|--|---|--|----------------------------|
| ERC8e, ERC8f | systems | and shrimps farming, soil treatment and environmental protection. | | |
| 2.1 Control of workers exposure | | | | |
| Product characteristic | | | | |
| According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential. The spraying of aqueous solutions (PROC7 and 11) is assumed to be involved with a medium emission. | | | | |
| PROC | Use in preparation | Content in preparation | Physical form | Emission potential |
| All applicable PROCs | not restricted | | aqueous solution | very low |
| Amounts used | | | | |
| The actual tonnage handled per shift is not considered to influence the 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 | | | | |
| PROC | Duration of exposure | | | |
| PROC 11 | ≤ 240 minutes | | | |
| All other applicable PROCs | 480 minutes (not restricted) | | | |
| Human factors not influenced by risk management | | | | |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m ³ /shift (8 hours). | | | | |
| Other given operational conditions affecting workers exposure | | | | |
| Since aqueous solutions are not used in hot-metallurgical processes, operational conditions (e.g. 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 (e.g. containment or segregation of the emission source) are generally not required in the processes. | | | | |
| Technical conditions and measures to control dispersion from source towards the worker | | | | |
| PROC | Level of separation | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
| PROC 19 | Separation of workers from the emission source is generally not required in the conducted processes. | not applicable | na | - |
| All other applicable PROCs | | not required | na | - |
| 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 | | | | |
|---|---|--|---|--|
| PROC | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
| PROC 11 | FFP3 mask | APF=20 | Since calcium oxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 17 | FFP1 mask | APF=4 | | |
| All other applicable PROCs | not required | na | | |

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 of communicating are reduced during the wearing of RPE.

For reasons as 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.

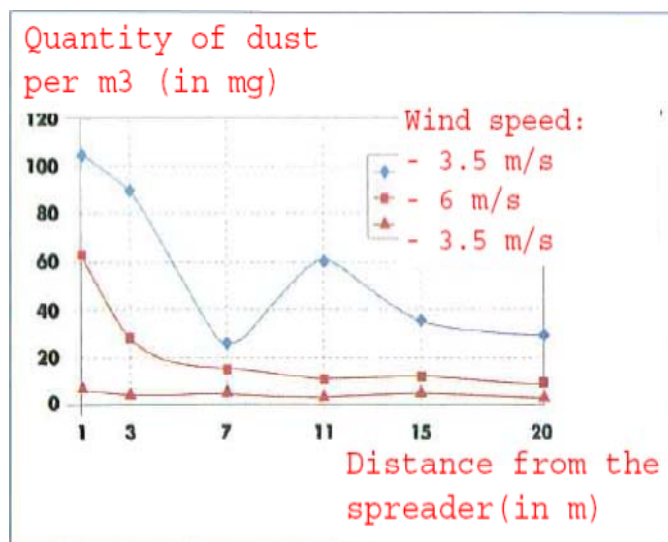
The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including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

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

2.2 Control of environmental exposure – only relevant for agricultural soil protection

Product characteristics

Drift: 1% (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

| Amounts used | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|------------------------------|----------------------------|------------------------------|----------------------------|------------------------------|---|-----|----|----|---|----|----|---|---|----|----|---|----|----|----|---|----|----|----|---|----|----|----|---|
| CaO | 1,700 kg/ha | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Frequency and duration of use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 day/year (one application per year); Multiple applications during the year are allowed, provided the total yearly amount of 1,700 kg/ha CaO is not exceeded | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Environment factors not influenced by risk management | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Volume of surface water: 300 L/m ² Field surface area: 1 ha | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Other given operational conditions affecting environmental exposure | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Outdoor use of products Soil mixing depth: 20 cm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Technical conditions and measures at process level (source) to prevent release | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| There are no direct releases to adjacent surface waters. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Drift should be minimised. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Organizational measures to prevent/limit release from site | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| In line with the requirements for good agricultural practice, agricultural soil should be analysed prior to application of lime and the application rate should be adjusted according to the results of the analysis. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 Control of environmental exposure – only relevant for urban soil treatment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Product characteristics | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Drift: 1% (very worst-case estimate based on data from dust measurements in air as a function of the distance from application) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>The graph plots 'Quantity of dust per m3 (in mg)' on the y-axis (0 to 120) against 'Distance from the spreader (in m)' on the x-axis (1, 3, 7, 11, 15, 20). Three data series are shown for wind speeds: 3.5 m/s (blue diamonds), 6 m/s (red squares), and 3.5 m/s (red triangles). The 3.5 m/s series starts at ~105 mg/m3 at 1m and drops to ~30 mg/m3 at 20m. The 6 m/s series starts at ~65 mg/m3 at 1m and drops to ~10 mg/m3 at 20m. The 3.5 m/s series starts at ~10 mg/m3 at 1m and remains low, ending at ~5 mg/m3 at 20m.</p> <table border="1"> <caption>Estimated data from the dust quantity graph</caption> <thead> <tr> <th>Distance (m)</th> <th>3.5 m/s (mg/m³)</th> <th>6 m/s (mg/m³)</th> <th>3.5 m/s (mg/m³)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>105</td> <td>65</td> <td>10</td> </tr> <tr> <td>3</td> <td>90</td> <td>30</td> <td>5</td> </tr> <tr> <td>7</td> <td>25</td> <td>15</td> <td>5</td> </tr> <tr> <td>11</td> <td>60</td> <td>10</td> <td>5</td> </tr> <tr> <td>15</td> <td>35</td> <td>10</td> <td>5</td> </tr> <tr> <td>20</td> <td>30</td> <td>10</td> <td>5</td> </tr> </tbody> </table> | | Distance (m) | 3.5 m/s (mg/m ³) | 6 m/s (mg/m ³) | 3.5 m/s (mg/m ³) | 1 | 105 | 65 | 10 | 3 | 90 | 30 | 5 | 7 | 25 | 15 | 5 | 11 | 60 | 10 | 5 | 15 | 35 | 10 | 5 | 20 | 30 | 10 | 5 |
| Distance (m) | 3.5 m/s (mg/m ³) | 6 m/s (mg/m ³) | 3.5 m/s (mg/m ³) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 105 | 65 | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 90 | 30 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 25 | 15 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | 60 | 10 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | 35 | 10 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 30 | 10 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (Figure taken from: Laudet, A. et al., 1999) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Amounts used | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CaO | 180,000 kg/ha | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Frequency and duration of use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 day/year and only once in a lifetime; Multiple applications during the year are allowed, provided the total yearly amount of 180,000 kg/ha (CaO) is not exceeded | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Environment factors not influenced by risk management | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Field surface area: 1 ha | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Other given operational conditions affecting environmental exposure

Outdoor use of products
Soil mixing depth: 20 cm

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

Lime is only applied onto the soil in the technosphere zone before road construction. There are no direct releases to adjacent surface waters.

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

Drift should be minimised.

3. Exposure estimation and reference to its source

Occupational exposure

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 for calcium oxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
|--|--|--------------------------------------|---|--------------------------------|
| PROC 2, 3, 4, 5, 8a, 8b, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19 | MEASE | < 1 mg/m ³ (<0.001 – 0.6) | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. | |

Environmental exposure for agricultural soil protection

The PEC calculation for soil and surface water was based on the FOCUS soil group (FOCUS, 1996) and on the “draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data: once applied on the soil, calcium oxide can indeed migrate then towards surface waters, via drift.

| | | | | |
|---|---|-------------------|--------------------|------------|
| Environmental emissions | See amounts used | | | |
| Exposure concentration in waste water treatment plant (WWTP) | Not relevant for agricultural soil protection | | | |
| Exposure concentration in aquatic pelagic compartment | Substance | PEC (ug/L) | PNEC (ug/L) | RCR |
| | CaO | 5.66 | 370 | 0.015 |
| Exposure concentration in sediments | As described above, no exposure of surface water nor sediment to lime is expected. Further, in natural waters the hydroxide ions react with HCO ₃ ⁻ to form water and CO ₃ ²⁻ . CO ₃ ²⁻ forms CaCO ₃ by reacting with Ca ²⁺ . The calcium carbonate precipitates and deposits on the sediment. Calcium carbonate is of low solubility and a constituent of natural soils. | | | |
| Exposure concentrations in soil and groundwater | Substance | PEC (mg/L) | PNEC (mg/L) | RCR |
| | CaO | 500 | 816 | 0.61 |
| Exposure concentration in atmospheric compartment | This point is not relevant. Calcium oxide is not volatile. The vapour pressures is below 10 ⁻⁵ Pa. | | | |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium oxides can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca ²⁺ and OH ⁻) in the environment. | | | |

Environmental exposure for urban soil treatment

The urban soil treatment scenario is based on a road border scenario. At the special road border technical meeting (Ispra, September 5, 2003), EU Member States and industry agreed on a definition for a "road technosphere". The road technosphere can be defined as "the engineered environment that carries the geotechnical functions of the road in connection with its structure, operation and maintenance including the installations to ensure road safety and manage run off. This technosphere, which includes the hard and soft shoulder at the edge of the carriageway, is vertically dictated by the groundwater watertable. The road authority has responsibility for this road technosphere including road safety, road support, prevention of pollution and water management". The road technosphere was therefore excluded as assessment endpoint for risk assessment for the purpose of the existing/new substances regulations. The target zone is the zone beyond the technosphere, to which the environmental risk assessment applies.

The PEC calculation for soil was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data.

| | | | | |
|---|--|-------------------|--------------------|------------|
| Environmental emissions | See amounts used | | | |
| Exposure concentration in waste water treatment plant (WWTP) | Not relevant for road border scenario | | | |
| Exposure concentration in aquatic pelagic compartment | Not relevant for road border scenario | | | |
| Exposure concentration in sediments | Not relevant for road border scenario | | | |
| Exposure concentrations in soil and groundwater | Substance | PEC (mg/L) | PNEC (mg/L) | RCR |
| | CaO | 529 | 816 | 0.65 |
| Exposure concentration in atmospheric compartment | This point is not relevant. Calcium oxide is not volatile. The vapour pressures is below 10^{-5} Pa. | | | |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca^{2+} and OH^-) in the environment. | | | |

Environmental exposure for other uses

For all other uses, no quantitative environmental exposure assessment is carried because

- The operational conditions and risk management measures are less stringent than those outlined for agricultural soil protection or urban soil treatment
- Lime is an ingredient and chemically bound into a matrix. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water
- Lime is specifically used to release CO₂-free breathable air, upon reaction with CO₂. Such applications only relates to the air compartment, where the lime properties are exploited
- Neutralisation/pH-shift is the intended use and there are no additional impacts beyond those desired.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE

(www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥ 10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

ES number 9.7: Professional uses of low dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers | | |
|---|---|---|
| 1. Title | | |
| Free short title | Professional uses of low dusty solids/powders of lime substances | |
| Systematic title based on use descriptor | SU22, SU1, SU5, SU6a, SU6b, SU7, SU10, SU11, SU12, SU13, SU16, SU17, SU18, SU19, SU20, SU23, SU24 PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC39, PC40 AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13 (appropriate PROCs and ERCs are given in Section 2 below) | |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. | |
| Assessment Method | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. The environmental assessment is based on FOCUS-Exposit. | |
| 2. Operational conditions and risk management measures | | |
| PROC/ERC | REACH definition | Involved tasks |
| PROC 2 | Use in closed, continuous process with occasional controlled exposure | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 3 | Use in closed batch process (synthesis or formulation) | |
| PROC 4 | Use in batch and other process (synthesis) where opportunity for exposure arises | |
| PROC 5 | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) | |
| PROC 8a | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities | |
| PROC 8b | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities | |
| PROC 9 | Transfer of substance or preparation into small containers (dedicated filling line, including weighing) | |
| PROC 10 | Roller application or brushing | |
| PROC 11 | Non industrial spraying | |
| PROC 13 | Treatment of articles by dipping and pouring | |
| PROC 15 | Use as laboratory reagent | |
| PROC 16 | Using material as fuel sources, limited exposure to unburned product to be expected | |
| PROC 17 | Lubrication at high energy conditions and in partly open process | |
| PROC 18 | Greasing at high energy conditions | |
| PROC 19 | Hand-mixing with intimate contact and only PPE available | |
| PROC 21 | Low energy manipulation of substances bound in materials and/or articles | |
| PROC 25 | Other hot work operations with metals | |

| | | | | |
|--|--|--------------------------------|--|----------------------------|
| PROC 26 | Handling of solid inorganic substances at ambient temperature | | | |
| ERC2, ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f | Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems | | | |
| 2.1 Control of workers exposure | | | | |
| Product characteristic | | | | |
| According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential. | | | | |
| PROC | Use in preparation | Content in preparation | Physical form | Emission potential |
| PROC 25 | not restricted | | solid/powder, molten | high |
| All other applicable PROCs | not restricted | | solid/powder | low |
| Amounts used | | | | |
| The actual tonnage handled per shift is not considered to influence the 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 | | | | |
| PROC | Duration of exposure | | | |
| PROC 17 | ≤ 240 minutes | | | |
| All other applicable PROCs | 480 minutes (not restricted) | | | |
| Human factors not influenced by risk management | | | | |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m ³ /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. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25. | | | | |
| Technical conditions and measures at process level (source) to prevent release | | | | |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes. | | | | |
| Technical conditions and measures to control dispersion from source towards the worker | | | | |
| PROC | Level of separation | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
| PROC 19 | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". | not applicable | na | - |
| All other applicable PROCs | A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces | not required | na | - |

| | | | | |
|--|----------------------------------|--|--|--|
| | involved with relevant exposure. | | | |
|--|----------------------------------|--|--|--|

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

| PROC | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
|----------------------------|---|--|---|--|
| PROC 4, 5, 11, 26 | FFP1 mask | APF=4 | Since calcium oxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 16, 17, 18, 25 | FFP2 mask | APF=10 | | |
| All other applicable PROCs | not required | na | | |

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 of communicating are reduced during the wearing of RPE.

For reasons as 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.

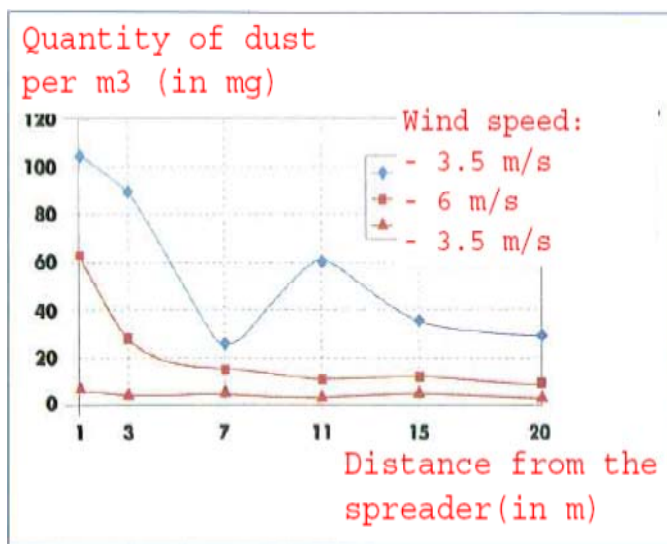
The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including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

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

2.2 Control of environmental exposure – only relevant for agricultural soil protection

Product characteristics

Drift: 1% (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

Amounts used

CaO 1,700 kg/ha

Frequency and duration of use

1 day/year (one application per year) Multiple applications during the year are allowed, provided the total yearly amount of 1,700 kg/ha is not exceeded (CaO)

Environment factors not influenced by risk management

Volume of surface water: 300 L/m²

Field surface area: 1 ha

Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

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

There are no direct releases to adjacent surface waters.

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

Drift should be minimised.

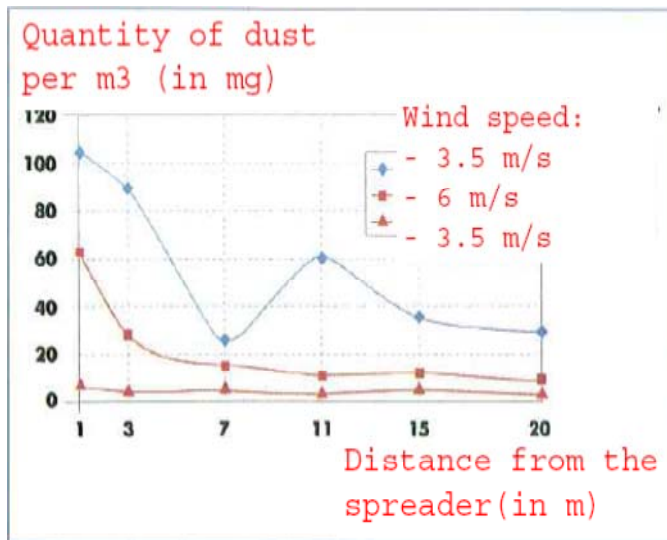
Organizational measures to prevent/limit release from site

In line with the requirements for good agricultural practice, agricultural soil should be analysed prior to application of lime and the application rate should be adjusted according to the results of the analysis.

2.2 Control of environmental exposure – only relevant for urban soil treatment

Product characteristics

Drift: 1% (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

Amounts used

CaO 180,000 kg/ha

Frequency and duration of use

1 day/year and only once in a lifetime. Multiple applications during the year are allowed, provided the total yearly amount of 180,000 kg/ha is not exceeded (CaO)

Environment factors not influenced by risk management

Field surface area: 1 ha

Other given operational conditions affecting environmental exposure

Outdoor use of products
Soil mixing depth: 20 cm

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

Lime is only applied onto the soil in the technosphere zone before road construction. There are no direct releases to adjacent surface waters.

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

Drift should be minimised.

3. Exposure estimation and reference to its source

Occupational exposure

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 for calcium oxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
|--|--|-------------------------------------|---|--------------------------------|
| PROC 2, 3, 4, 5, 8a, 8b, 9, 10, 11, 13, 15, 16, 17, 18, 19, 21, 25, 26 | MEASE | < 1 mg/m ³ (0.01 – 0.75) | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. | |

Environmental exposure for agricultural soil protection

The PEC calculation for soil and surface water was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowksi et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data: once applied on the soil, calcium oxide can indeed migrate then towards surface waters, via drift.

| Environmental emissions | See amounts used | | | |
|--|---|------------|-------------|-------|
| Exposure concentration in waste water treatment plant (WWTP) | Not relevant for agricultural soil protection | | | |
| Exposure concentration in aquatic pelagic compartment | Substance | PEC (ug/L) | PNEC (ug/L) | RCR |
| | CaO | 5.66 | 370 | 0.015 |
| Exposure concentration in sediments | As described above, no exposure of surface water nor sediment to lime is expected. Further, in natural waters the hydroxide ions react with HCO ₃ ⁻ to form water and CO ₃ ²⁻ . CO ₃ ²⁻ forms CaCO ₃ by reacting with Ca ²⁺ . The calcium carbonate precipitates and deposits on the sediment. Calcium carbonate is of low solubility and a constituent of natural soils. | | | |
| Exposure concentrations in soil and groundwater | Substance | PEC (mg/L) | PNEC (mg/L) | RCR |
| | CaO | 500 | 816 | 0.61 |
| Exposure concentration in atmospheric compartment | This point is not relevant. Calcium oxide is not volatile. The vapour pressures is below 10 ⁻⁵ Pa. | | | |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca ²⁺ and OH ⁻) in the environment. | | | |

Environmental exposure for urban soil treatment

The urban soil treatment scenario is based on a road border scenario. At the special road border technical meeting (Ispra, September 5, 2003), EU Member States and industry agreed on a definition for a "road technosphere". The road technosphere can be defined as "the engineered environment that carries the geotechnical functions of the road in connection with its structure, operation and maintenance including the installations to ensure road safety and manage run off. This technosphere, which includes the hard and soft shoulder at the edge of the carriageway, is vertically dictated by the groundwater watertable. The road authority has responsibility for this road technosphere including road safety, road support, prevention of pollution and water management". The road technosphere was therefore excluded as assessment endpoint for risk assessment for the purpose of the existing/new substances regulations. The target zone is the zone beyond the technosphere, to which the environmental risk assessment applies.

The PEC calculation for soil was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data.

| | | | | |
|---|--|-------------------|--------------------|------------|
| Environmental emissions | See amounts used | | | |
| Exposure concentration in waste water treatment plant (WWTP) | Not relevant for road border scenario | | | |
| Exposure concentration in aquatic pelagic compartment | Not relevant for road border scenario | | | |
| Exposure concentration in sediments | Not relevant for road border scenario | | | |
| Exposure concentrations in soil and groundwater | Substance | PEC (mg/L) | PNEC (mg/L) | RCR |
| | CaO | 529 | 816 | 0.65 |
| Exposure concentration in atmospheric compartment | This point is not relevant. Calcium oxide is not volatile. The vapour pressures is below 10^{-5} Pa. | | | |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca^{2+} and OH^-) in the environment. | | | |

Environmental exposure for other uses

For all other uses, no quantitative environmental exposure assessment is carried because

- The operational conditions and risk management measures are less stringent than those outlined for agricultural soil protection or urban soil treatment
- Lime is an ingredient and chemically bound into a matrix. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water
- Lime is specifically used to release CO₂-free breathable air, upon reaction with CO₂. Such applications only relates to the air compartment, where the lime properties are exploited
- Neutralisation/pH-shift is the intended use and there are no additional impacts beyond those desired.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥ 10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

ES number 9.8: Professional uses of medium dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers | | |
|---|---|---|
| 1. Title | | |
| Free short title | Professional uses of medium dusty solids/powders of lime substances | |
| Systematic title based on use descriptor | SU22, SU1, SU5, SU6a, SU6b, SU7, SU10, SU11, SU12, SU13, SU16, SU17, SU18, SU19, SU20, SU23, SU24 PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC39, PC40 AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13 (appropriate PROCs and ERCs are given in Section 2 below) | |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. | |
| Assessment Method | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. The environmental assessment is based on FOCUS-Exposit. | |
| 2. Operational conditions and risk management measures | | |
| PROC/ERC | REACH definition | Involved tasks |
| PROC 2 | Use in closed, continuous process with occasional controlled exposure | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 3 | Use in closed batch process (synthesis or formulation) | |
| PROC 4 | Use in batch and other process (synthesis) where opportunity for exposure arises | |
| PROC 5 | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) | |
| PROC 8a | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities | |
| PROC 8b | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities | |
| PROC 9 | Transfer of substance or preparation into small containers (dedicated filling line, including weighing) | |
| PROC 10 | Roller application or brushing | |
| PROC 11 | Non industrial spraying | |
| PROC 13 | Treatment of articles by dipping and pouring | |
| PROC 15 | Use as laboratory reagent | |
| PROC 16 | Using material as fuel sources, limited exposure to unburned product to be expected | |
| PROC 17 | Lubrication at high energy conditions and in partly open process | |
| PROC 18 | Greasing at high energy conditions | |
| PROC 19 | Hand-mixing with intimate contact and only PPE available | |
| PROC 25 | Other hot work operations with metals | |
| PROC 26 | Handling of solid inorganic substances at ambient temperature | |

| | |
|--|--|
| ERC2, ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f | Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems |
|--|--|

2.1 Control of workers exposure

Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.

| PROC | Use in preparation | Content in preparation | Physical form | Emission potential |
|----------------------------|--------------------|------------------------|----------------------|--------------------|
| PROC 25 | not restricted | | solid/powder, molten | high |
| All other applicable PROCs | not restricted | | solid/powder | medium |

Amounts used

The actual tonnage handled per shift is not considered to influence the 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

| PROC | Duration of exposure |
|----------------------------|------------------------------|
| PROC 11, 16, 17, 18, 19 | ≤ 240 minutes |
| All other applicable PROCs | 480 minutes (not restricted) |

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. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25.

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

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

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

| PROC | Level of separation | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
|----------------------------|---|--------------------------------------|---------------------------------------|---------------------|
| PROC 11, 16 | Any potentially required separation of workers | generic local exhaust ventilation | 72 % | - |
| PROC 17, 18 | from the emission source is indicated | integrated local exhaust ventilation | 87 % | - |
| PROC 19 | above under "Frequency and duration of exposure". | not applicable | na | - |
| All other applicable PROCs | A reduction of exposure duration can be achieved, for example, by the installation of | not required | na | - |

| | | | | |
|--|---|--|--|--|
| | ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | | | |
|--|---|--|--|--|

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

| PROC | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
|--|---|--|---|--|
| PROC 2, 3, 16, 19 | FFP1 mask | APF=4 | Since calcium oxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 4, 5, 8a, 8b, 9, 10, 13, 17, 18, 25, 26 | FFP2 mask | APF=10 | | |
| PROC 11 | FFP1 mask | APF=10 | | |
| PROC 15 | not required | na | | |

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 of communicating are reduced during the wearing of RPE.

For reasons as 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.

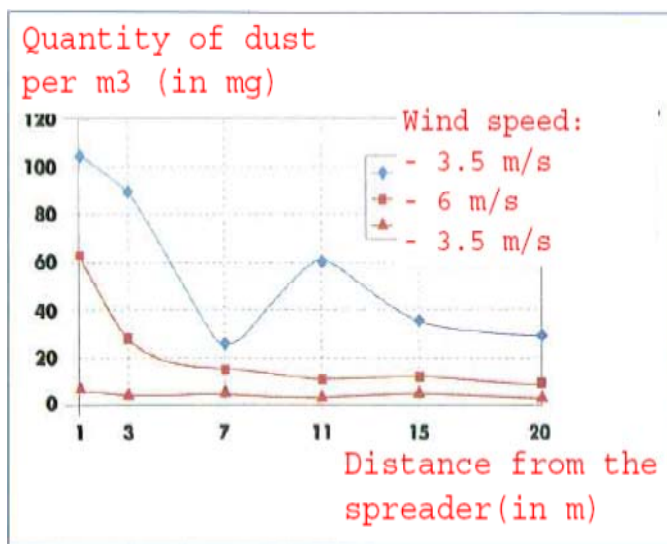
The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including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

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

2.2 Control of environmental exposure – only relevant for agricultural soil protection

Product characteristics

Drift: 1% (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

Amounts used

| | |
|-----|-------------|
| CaO | 1,700 kg/ha |
|-----|-------------|

Frequency and duration of use

1 day/year (one application per year) Multiple applications during the year are allowed, provided the total yearly amount of 1,700 kg/ha is not exceeded (CaO)

Environment factors not influenced by risk management

Volume of surface water: 300 L/m²

Field surface area: 1 ha

Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

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

There are no direct releases to adjacent surface waters.

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

Drift should be minimised.

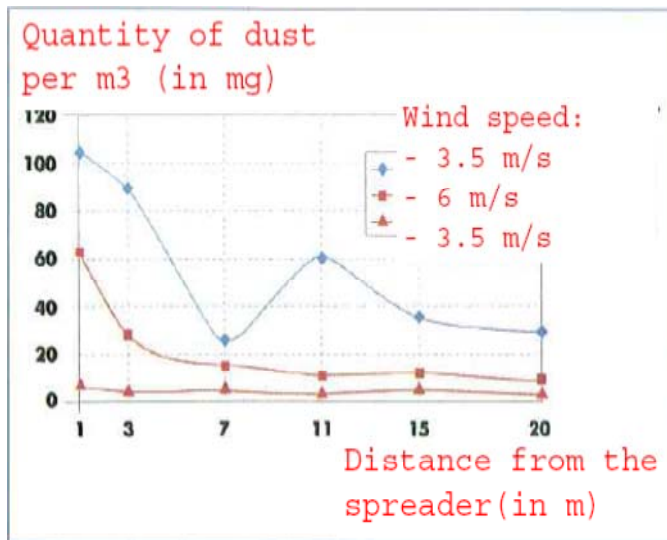
Organizational measures to prevent/limit release from site

In line with the requirements for good agricultural practice, agricultural soil should be analysed prior to application of lime and the application rate should be adjusted according to the results of the analysis.

2.2 Control of environmental exposure – only relevant for urban soil treatment

Product characteristics

Drift: 1% (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

Amounts used

CaO 180,000 kg/ha

Frequency and duration of use

1 day/year and only once in a lifetime. Multiple applications during the year are allowed, provided the total yearly amount of 180,000 kg/ha is not exceeded (CaO)

Environment factors not influenced by risk management

Field surface area: 1 ha

Other given operational conditions affecting environmental exposure

Outdoor use of products
Soil mixing depth: 20 cm

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

Lime is only applied onto the soil in the technosphere zone before road construction. There are no direct releases to adjacent surface waters.

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

Drift should be minimised.

3. Exposure estimation and reference to its source

Occupational exposure

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 for calcium oxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
|--|--|--------------------------------------|---|--------------------------------|
| PROC 2, 3, 4, 5, 8a, 8b, 9, 10, 11, 13, 15, 16, 17, 18, 19, 25, 26 | MEASE | < 1 mg/m ³ (0.25 – 0.825) | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. | |

Environmental exposure for agricultural soil protection

The PEC calculation for soil and surface water was based on the FOCUS soil group (FOCUS, 1996) and on the “draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowksi et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data: once applied on the soil, calcium oxide can indeed migrate then towards surface waters, via drift.

| | | | | |
|--|---|------------|-------------|-------|
| Environmental emissions | See amounts used | | | |
| Exposure concentration in waste water treatment plant (WWTP) | Not relevant for agricultural soil protection | | | |
| Exposure concentration in aquatic pelagic compartment | Substance | PEC (ug/L) | PNEC (ug/L) | RCR |
| | CaO | 5.66 | 370 | 0.015 |
| Exposure concentration in sediments | As described above, no exposure of surface water nor sediment to lime is expected. Further, in natural waters the hydroxide ions react with HCO ₃ ⁻ to form water and CO ₃ ²⁻ . CO ₃ ²⁻ forms CaCO ₃ by reacting with Ca ²⁺ . The calcium carbonate precipitates and deposits on the sediment. Calcium carbonate is of low solubility and a constituent of natural soils. | | | |
| Exposure concentrations in soil and groundwater | Substance | PEC (mg/L) | PNEC (mg/L) | RCR |
| | CaO | 500 | 816 | 0.61 |
| Exposure concentration in atmospheric compartment | This point is not relevant. Calcium oxide is not volatile. The vapour pressures is below 10 ⁻⁵ Pa. | | | |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca ²⁺ and OH ⁻) in the environment. | | | |

Environmental exposure for urban soil treatment

The urban soil treatment scenario is based on a road border scenario. At the special road border technical meeting (Ispra, September 5, 2003), EU Member States and industry agreed on a definition for a "road technosphere". The road technosphere can be defined as "the engineered environment that carries the geotechnical functions of the road in connection with its structure, operation and maintenance including the installations to ensure road safety and manage run off. This technosphere, which includes the hard and soft shoulder at the edge of the carriageway, is vertically dictated by the groundwater watertable. The road authority has responsibility for this road technosphere including road safety, road support, prevention of pollution and water management". The road technosphere was therefore excluded as assessment endpoint for risk assessment for the purpose of the existing/new substances regulations. The target zone is the zone beyond the technosphere, to which the environmental risk assessment applies.

The PEC calculation for soil was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data.

| | | | | |
|---|---|-------------------|--------------------|------------|
| Environmental emissions | See amounts used | | | |
| Exposure concentration in waste water treatment plant (WWTP) | Not relevant for road border scenario | | | |
| Exposure concentration in aquatic pelagic compartment | Not relevant for road border scenario | | | |
| Exposure concentration in sediments | Not relevant for road border scenario | | | |
| Exposure concentrations in soil and groundwater | Substance | PEC (mg/L) | PNEC (mg/L) | RCR |
| | CaO | 529 | 816 | 0.65 |
| Exposure concentration in atmospheric compartment | This point is not relevant. Calcium oxide is not volatile. The vapour pressures is below 10 ⁻⁵ Pa. | | | |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca ²⁺ and OH ⁻) in the environment. | | | |

Environmental exposure for other uses

For all other uses, no quantitative environmental exposure assessment is carried because

- The operational conditions and risk management measures are less stringent than those outlined for agricultural soil protection or urban soil treatment
- Lime is an ingredient and chemically bound into a matrix. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water
- Lime is specifically used to release CO₂-free breathable air, upon reaction with CO₂. Such applications only relates to the air compartment, where the lime properties are exploited
- Neutralisation/pH-shift is the intended use and there are no additional impacts beyond those desired.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥ 10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

ES number 9.9: Professional uses of high dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers | |
|---|---|
| 1. Title | |
| Free short title | Professional uses of high dusty solids/powders of lime substances |
| Systematic title based on use descriptor | SU22, SU1, SU5, SU6a, SU6b, SU7, SU10, SU11, SU12, SU13, SU16, SU17, SU18, SU19, SU20, SU23, SU24 PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC39, PC40 AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13 (appropriate PROCs and ERCs are given in Section 2 below) |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. |
| Assessment Method | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. The environmental assessment is based on FOCUS-Exposit. |

2. Operational conditions and risk management measures

| PROC/ERC | REACH definition | Involved tasks |
|--|--|---|
| PROC 2 | Use in closed, continuous process with occasional controlled exposure | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 3 | Use in closed batch process (synthesis or formulation) | |
| PROC 4 | Use in batch and other process (synthesis) where opportunity for exposure arises | |
| PROC 5 | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) | |
| PROC 8a | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities | |
| PROC 8b | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities | |
| PROC 9 | Transfer of substance or preparation into small containers (dedicated filling line, including weighing) | |
| PROC 10 | Roller application or brushing | |
| PROC 11 | Non industrial spraying | |
| PROC 13 | Treatment of articles by dipping and pouring | |
| PROC 15 | Use as laboratory reagent | |
| PROC 16 | Using material as fuel sources, limited exposure to unburned product to be expected | |
| PROC 17 | Lubrication at high energy conditions and in partly open process | |
| PROC 18 | Greasing at high energy conditions | |
| PROC 19 | Hand-mixing with intimate contact and only PPE available | |
| PROC 25 | Other hot work operations with metals | |
| PROC 26 | Handling of solid inorganic substances at ambient temperature | |
| ERC2, ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f | Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems | |

2.1 Control of workers exposure

Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.

| PROC | Use in preparation | Content in preparation | Physical form | Emission potential |
|----------------------|--------------------|------------------------|---------------|--------------------|
| All applicable PROCs | not restricted | | solid/powder | high |

| Amounts used | | | | |
|--|--|---|---|--|
| The actual tonnage handled per shift is not considered to influence the 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 | | | | |
| PROC | Duration of exposure | | | |
| PROC 4, 5, 8a, 8b, 9, 10, 16, 17, 18, 19, 26 | ≤ 240 minutes | | | |
| PROC 11 | ≤ 60 minutes | | | |
| All other applicable PROCs | 480 minutes (not restricted) | | | |
| Human factors not influenced by risk management | | | | |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m ³ /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. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25. | | | | |
| Technical conditions and measures at process level (source) to prevent release | | | | |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes. | | | | |
| Technical conditions and measures to control dispersion from source towards the worker | | | | |
| PROC | Level of separation | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
| PROC 4, 5, 8a, 8b, 9, 11, 16, 26 | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | generic local exhaust ventilation | 72 % | - |
| PROC 17, 18 | | integrated local exhaust ventilation | 87 % | - |
| PROC 19 | | not applicable | na | only in well ventilated rooms or outdoors (efficiency 50 %)- |
| All other applicable PROCs | | not required | na | - |
| 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 | | | | |
| PROC | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
| PROC 9, 26 | FFP1 mask | APF=4 | Since calcium oxide is classified as irritating to skin, the use of | Eye protection equipment (e.g. goggles or visors) must |
| PROC 11, 17, 18, 19 | FFP3 mask | APF=20 | | |

| | | | | |
|-----------------------------------|-----------|--------|---|---|
| PROC 25 | FFP2 mask | APF=10 | protective gloves is mandatory for all process steps. | be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| All other applicable PROCs | FFP2 mask | APF=10 | | |

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 of communicating are reduced during the wearing of RPE.

For reasons as 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.

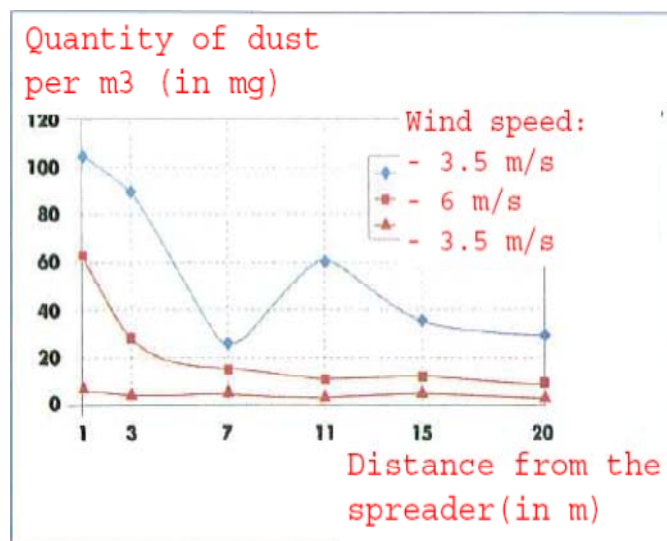
The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including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

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

2.2 Control of environmental exposure – only relevant for agricultural soil protection

Product characteristics

Drift: 1% (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

Amounts used

CaO 1,700 kg/ha

Frequency and duration of use

1 day/year (one application per year). Multiple applications during the year are allowed, provided the total yearly amount of 1,700 kg/ha is not exceeded (CaO)

Environment factors not influenced by risk management

Volume of surface water: 300 L/m²

Field surface area: 1 ha

Other given operational conditions affecting environmental exposure

Outdoor use of products
Soil mixing depth: 20 cm

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

There are no direct releases to adjacent surface waters.

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

Drift should be minimised.

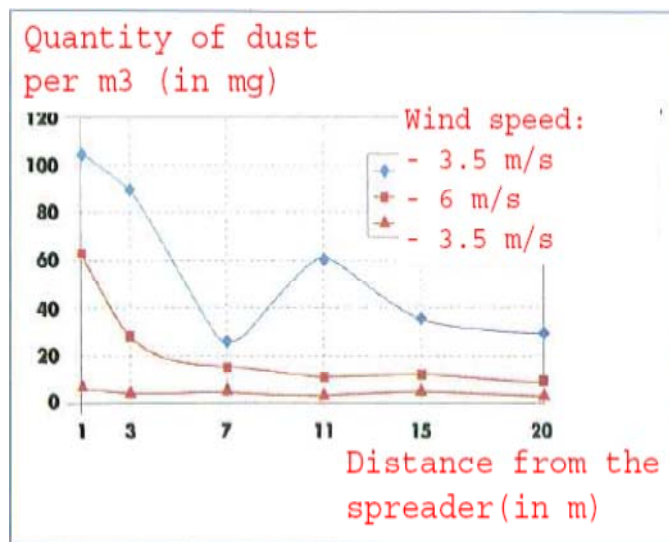
Organizational measures to prevent/limit release from site

In line with the requirements for good agricultural practice, agricultural soil should be analysed prior to application of lime and the application rate should be adjusted according to the results of the analysis.

2.2 Control of environmental exposure – only relevant for urban soil treatment

Product characteristics

Drift: 1% (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

Amounts used

| | |
|-----|---------------|
| CaO | 180,000 kg/ha |
|-----|---------------|

Frequency and duration of use

1 day/year and only once in a lifetime. Multiple applications during the year are allowed, provided the total yearly amount of 180,000 kg/ha is not exceeded (CaO)

Environment factors not influenced by risk management

Field surface area: 1 ha

Other given operational conditions affecting environmental exposure

Outdoor use of products
Soil mixing depth: 20 cm

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

Lime is only applied onto the soil in the technosphere zone before road construction. There are no direct releases to adjacent surface waters.

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

Drift should be minimised.

3. Exposure estimation and reference to its source

Occupational exposure

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 for calcium oxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
|--|--|------------------------------------|--|---|
| PROC 2, 3, 4, 5, 8a, 8b, 9, 10, 11, 13, 15, 16, 17, 18, 19, 25, 26 | MEASE | <1 mg/m ³ (0.5 – 0.825) | | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |

Environmental exposure for agricultural soil protection

The PEC calculation for soil and surface water was based on the FOCUS soil group (FOCUS, 1996) and on the “draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowksi et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data: once applied on the soil, calcium oxide can indeed migrate then towards surface waters, via drift.

| | | | | |
|---|---|-------------------|--------------------|------------|
| Environmental emissions | See amounts used | | | |
| Exposure concentration in waste water treatment plant (WWTP) | Not relevant for agricultural soil protection | | | |
| Exposure concentration in aquatic pelagic compartment | Substance | PEC (ug/L) | PNEC (ug/L) | RCR |
| | CaO | 5.66 | 370 | 0.015 |
| Exposure concentration in sediments | As described above, no exposure of surface water nor sediment to lime is expected. Further, in natural waters the hydroxide ions react with HCO ₃ ⁻ to form water and CO ₃ ²⁻ . CO ₃ ²⁻ forms CaCO ₃ by reacting with Ca ²⁺ . The calcium carbonate precipitates and deposits on the sediment. Calcium carbonate is of low solubility and a constituent of natural soils. | | | |
| Exposure concentrations in soil and groundwater | Substance | PEC (mg/L) | PNEC (mg/L) | RCR |
| | CaO | 500 | 816 | 0.61 |
| Exposure concentration in atmospheric compartment | This point is not relevant. Calcium oxide is not volatile. The vapour pressures is below 10 ⁻⁵ Pa. | | | |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca ²⁺ and OH ⁻) in the environment. | | | |

Environmental exposure for urban soil treatment

The urban soil treatment scenario is based on a road border scenario. At the special road border technical meeting (Ispra, September 5, 2003), EU Member States and industry agreed on a definition for a "road technosphere". The road technosphere can be defined as "the engineered environment that carries the geotechnical functions of the road in connection with its structure, operation and maintenance including the installations to ensure road safety and manage run off. This technosphere, which includes the hard and soft shoulder at the edge of the carriageway, is vertically dictated by the groundwater watertable. The road authority has responsibility for this road technosphere including road safety, road support, prevention of pollution and water management". The road technosphere was therefore excluded as assessment endpoint for risk assessment for the purpose of the existing/new substances regulations. The target zone is the zone beyond the technosphere, to which the environmental risk assessment applies.

The PEC calculation for soil was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data.

| | | | | |
|---|--|-------------------|--------------------|------------|
| Environmental emissions | See amounts used | | | |
| Exposure concentration in waste water treatment plant (WWTP) | Not relevant for road border scenario | | | |
| Exposure concentration in aquatic pelagic compartment | Not relevant for road border scenario | | | |
| Exposure concentration in sediments | Not relevant for road border scenario | | | |
| Exposure concentrations in soil and groundwater | Substance | PEC (mg/L) | PNEC (mg/L) | RCR |
| | CaO | 529 | 816 | 0.65 |
| Exposure concentration in atmospheric compartment | This point is not relevant. Calcium oxide is not volatile. The vapour pressures is below 10^{-5} Pa. | | | |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca^{2+} and OH^-) in the environment. | | | |

Environmental exposure for other uses

For all other uses, no quantitative environmental exposure assessment is carried because

- The operational conditions and risk management measures are less stringent than those outlined for agricultural soil protection or urban soil treatment
- Lime is an ingredient and chemically bound into a matrix. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water
- Lime is specifically used to release CO₂-free breathable air, upon reaction with CO₂. Such applications only relates to the air compartment, where the lime properties are exploited
- Neutralisation/pH-shift is the intended use and there are no additional impacts beyond those desired.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE

(www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥ 10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

ES number 9.10: Professional use of lime substances in soil treatment

| Exposure Scenario Format (1) addressing uses carried out by workers | |
|---|---|
| 1. Title | |
| Free short title | Professional use of lime substances in soil treatment |
| Systematic title based on use descriptor | SU22 (appropriate PROCs and ERCs are given in Section 2 below) |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. |
| Assessment Method | The assessment of inhalation exposure is based on measured data and on the exposure estimation tool MEASE. The environmental assessment is based on FOCUS-Exposit. |

2. Operational conditions and risk management measures

| Task/ERC | REACH definition | Involved tasks |
|--|--|--|
| Milling | PROC 5 | Preparation and use of calcium oxides for soil treatment. |
| Loading of spreader | PROC 8b, PROC 26 | |
| Application to soil (spreading) | PROC 11 | |
| ERC2, ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f | Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems | Calcium oxide is applied in numerous cases of wide dispersive uses: agricultural, forestry, fish and shrimps farming, soil treatment and environmental protection. |

2.1 Control of workers exposure

Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.

| Task | Use in preparation | Content in preparation | Physical form | Emission potential |
|---------------------------------|--------------------|------------------------|---------------|--------------------|
| Milling | not restricted | | solid/powder | high |
| Loading of spreader | not restricted | | solid/powder | high |
| Application to soil (spreading) | not restricted | | solid/powder | high |

Amounts used

The actual tonnage handled per shift is not considered to influence the 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

| Task | Duration of exposure |
|---------------------------------|------------------------------|
| Milling | 240 minutes |
| Loading of spreader | 240 minutes |
| Application to soil (spreading) | 480 minutes (not restricted) |

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 (e.g. 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

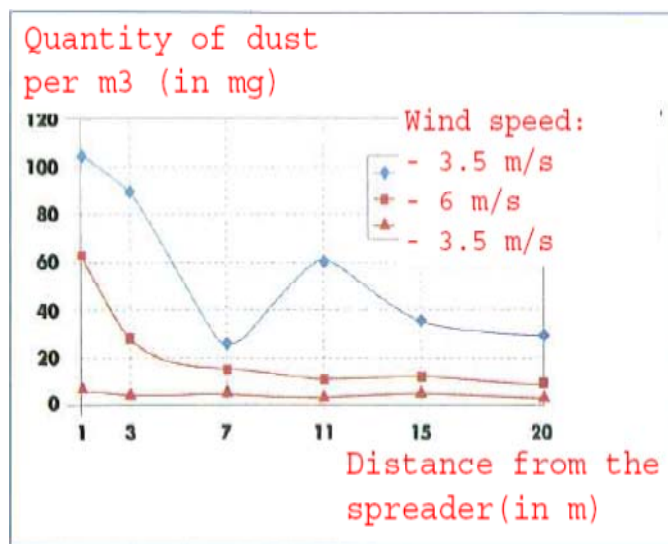
Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

| Technical conditions and measures to control dispersion from source towards the worker | | | | |
|--|---|--|---|--|
| Task | Level of separation | Localised controls (LC) | Efficiency of LC | Further information |
| Milling | Separation of workers is generally not required in the conducted processes. | not required | na | - |
| Loading of spreader | | not required | na | - |
| Application to soil (spreading) | During application the worker is sitting in the cabin of the spreader | Cabin with filtered air supply | 99% | - |
| Organisational measures to prevent /limit releases, dispersion and exposure | | | | |
| <p>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.</p> | | | | |
| Conditions and measures related to personal protection, hygiene and health evaluation | | | | |
| Task | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
| Milling | FFP3 mask | APF=20 | Since calcium oxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| Loading of spreader | FFP3 mask | APF=20 | | |
| Application to soil (spreading) | not required | na | | |
| <p>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 of communicating are reduced during the wearing of RPE.</p> <p>For reasons as 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.</p> <p>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.</p> <p>An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE.</p> | | | | |

2.2 Control of environmental exposure – only relevant for agricultural soil protection

Product characteristics

Drift: 1% (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

Amounts used

CaO 1,700 kg/ha

Frequency and duration of use

1 day/year (one application per year). Multiple applications during the year are allowed, provided the total yearly amount of 1,700 kg/ha (CaO) is not exceeded

Environment factors not influenced by risk management

Volume of surface water: 300 L/m²

Field surface area: 1 ha

Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

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

There are no direct releases to adjacent surface waters.

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

Drift should be minimised.

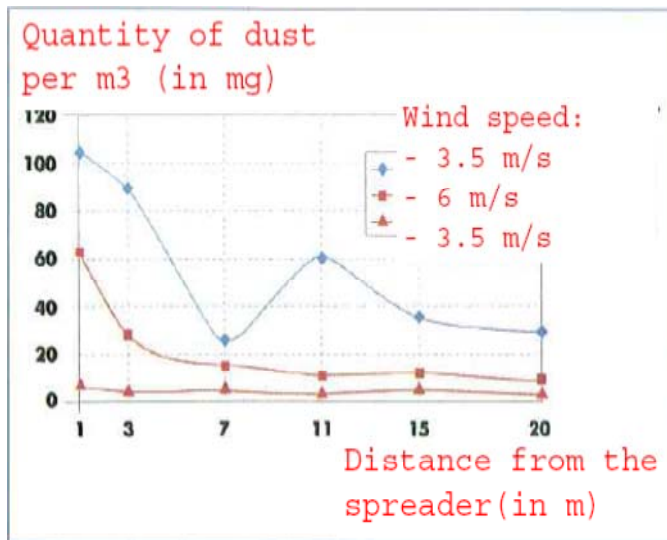
Organizational measures to prevent/limit release from site

In line with the requirements for good agricultural practice, agricultural soil should be analysed prior to application of lime and the application rate should be adjusted according to the results of the analysis.

2.2 Control of environmental exposure – only relevant for urban soil treatment

Product characteristics

Drift: 1% (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

Amounts used

CaO 180,000 kg/ha

Frequency and duration of use

1 day/year and only once in a lifetime. Multiple applications during the year are allowed, provided the total yearly amount of 180,000 kg/ha is not exceeded (CaO)

Environment factors not influenced by risk management

Field surface area: 1 ha

Other given operational conditions affecting environmental exposure

Outdoor use of products
Soil mixing depth: 20 cm

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

Lime is only applied onto the soil in the technosphere zone before road construction. There are no direct releases to adjacent surface waters.

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

Drift should be minimised.

3. Exposure estimation and reference to its source

Occupational exposure

Measured data and modelled exposure estimates (MEASE) were 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 for calcium oxide of 1 mg/m³ (as respirable dust).

| Task | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
|---------------------------------|--|------------------------------------|---|--------------------------------|
| Milling | MEASE | 0.488 mg/m ³ (0.48) | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. | |
| Loading of spreader | MEASE (PROC 8b) | 0.488 mg/m ³ (0.48) | | |
| Application to soil (spreading) | measured data | 0.880 mg/m ³ (0.88) | | |

Environmental exposure for agricultural soil protection

The PEC calculation for soil and surface water was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data: once applied on the soil, calcium oxide can indeed migrate then towards surface waters, via drift.

| Environmental emissions | See amounts used | | | |
|--|---|------------|-------------|-------|
| Exposure concentration in waste water treatment plant (WWTP) | Not relevant for agricultural soil protection | | | |
| Exposure concentration in aquatic pelagic compartment | Substance | PEC (ug/L) | PNEC (ug/L) | RCR |
| | CaO | 5.66 | 370 | 0.015 |
| Exposure concentration in sediments | As described above, no exposure of surface water nor sediment to lime is expected. Further, in natural waters the hydroxide ions react with HCO ₃ ⁻ to form water and CO ₃ ²⁻ . CO ₃ ²⁻ forms CaCO ₃ by reacting with Ca ²⁺ . The calcium carbonate precipitates and deposits on the sediment. Calcium carbonate is of low solubility and a constituent of natural soils. | | | |
| Exposure concentrations in soil and groundwater | Substance | PEC (mg/L) | PNEC (mg/L) | RCR |
| | CaO | 500 | 816 | 0.61 |
| Exposure concentration in atmospheric compartment | This point is not relevant. Calcium oxide is not volatile. The vapour pressures is below 10 ⁻⁵ Pa. | | | |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca ²⁺ and OH ⁻) in the environment. | | | |

Environmental exposure for urban soil treatment

The urban soil treatment scenario is based on a road border scenario. At the special road border technical meeting (Ispra, September 5, 2003), EU Member States and industry agreed on a definition for a "road technosphere". The road technosphere can be defined as "the engineered environment that carries the geotechnical functions of the road in connection with its structure, operation and maintenance including the installations to ensure road safety and manage run off. This technosphere, which includes the hard and soft shoulder at the edge of the carriageway, is vertically dictated by the groundwater watertable. The road authority has responsibility for this road technosphere including road safety, road support, prevention of pollution and water management". The road technosphere was therefore excluded as assessment endpoint for risk assessment for the purpose of the existing/new substances regulations. The target zone is the zone beyond the technosphere, to which the environmental risk assessment applies.

The PEC calculation for soil was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data.

| | | | | |
|---|--|-------------------|--------------------|------------|
| Environmental emissions | See amounts used | | | |
| Exposure concentration in waste water treatment plant (WWTP) | Not relevant for road border scenario | | | |
| Exposure concentration in aquatic pelagic compartment | Not relevant for road border scenario | | | |
| Exposure concentration in sediments | Not relevant for road border scenario | | | |
| Exposure concentrations in soil and groundwater | Substance | PEC (mg/L) | PNEC (mg/L) | RCR |
| | CaO | 529 | 816 | 0.65 |
| Exposure concentration in atmospheric compartment | This point is not relevant. Calcium oxide is not volatile. The vapour pressures is below 10^{-5} Pa. | | | |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca^{2+} and OH^-) in the environment. | | | |

Environmental exposure for other uses

For all other uses, no quantitative environmental exposure assessment is carried because

- The operational conditions and risk management measures are less stringent than those outlined for agricultural soil protection or urban soil treatment
- Lime is an ingredient and chemically bound into a matrix. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water
- Lime is specifically used to release CO₂-free breathable air, upon reaction with CO₂. Such applications only relates to the air compartment, where the lime properties are exploited
- Neutralisation/pH-shift is the intended use and there are no additional impacts beyond those desired.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE

(www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥ 10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

ES number 9.11: Professional uses of articles/containers containing lime substances

Exposure Scenario Format (1) addressing uses carried out by workers

1. Title

| | |
|---|--|
| Free short title | Professional uses of articles/containers containing lime substances |
| Systematic title based on use descriptor | SU22, SU1, SU5, SU6a, SU6b, SU7, SU10, SU11, SU12, SU13, SU16, SU17, SU18, SU19, SU20, SU23, SU24 AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13 (appropriate PROCs and ERCs are given in Section 2 below) |
| Processes, tasks and/or activities covered | Processes, tasks and/or activities covered are described in Section 2 below. |
| Assessment Method | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. |

2. Operational conditions and risk management measures

| PROC/ERC | REACH definition | Involved tasks |
|-----------------------------|---|---|
| PROC 0 | Other process (PROC 21 (low emission potential) as proxy for exposure estimation) | Use of containers containing calcium oxide/preparations as CO ₂ absorbents (e.g. breathing apparatus) |
| PROC 21 | Low energy manipulation of substances bound in materials and/or articles | Handling of substances bound in materials and/or articles |
| PROC 24 | High (mechanical) energy work-up of substances bound in materials and/or articles | Grinding, mechanical cutting |
| PROC 25 | Other hot work operations with metals | Welding, soldering |
| ERC10, ERC11, ERC 12 | Wide dispersive indoor and outdoor use of long-life articles and materials with low release | Calcium oxide bound into or onto articles and materials such as: wooden and plastic construction and building materials (e.g. gutters, drains), flooring, furniture, toys, leather products, paper and cardboard products (magazines, books, news paper and packaging paper), electronic equipment (casing) |

2.1 Control of workers exposure

Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.

| PROC | Used in preparation? | Content in preparation | Physical form | Emission potential |
|--------------------|----------------------|------------------------|---|---|
| PROC 0 | not restricted | | massive objects (pellets), low potential for dust formation due to abrasion during previous filling and handling activities of pellets, not during use of breathing apparatus | low (worst case assumption as no inhalation exposure is assumed during the use of the breathing apparatus due to the very low abrasive potential) |
| PROC 21 | not restricted | | massive objects | very low |
| PROC 24, 25 | not restricted | | massive objects | high |

| Amounts used | | | | |
|--|--|--------------------------------|--|----------------------------|
| The actual tonnage handled per shift is not considered to influence the 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 | | | | |
| PROC | Duration of exposure | | | |
| PROC 0 | 480 minutes (not restricted as far as occupational exposure to calcium oxide is concerned, the actual wearing duration may be restricted due the user instructions of the actual breathing apparatus) | | | |
| PROC 21 | 480 minutes (not restricted) | | | |
| PROC 24, 25 | ≤ 240 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 m ³ /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. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25. | | | | |
| Technical conditions and measures at process level (source) to prevent release | | | | |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes. | | | | |
| Technical conditions and measures to control dispersion from source towards the worker | | | | |
| PROC | Level of separation | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
| PROC 0, 21, 24, 25 | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | not required | na | - |
| 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

| PROC | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves | Further personal protective equipment (PPE) |
|-------------|---|--|---|--|
| PROC 0, 21 | not required | na | Since calcium oxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 24, 25 | FFP1 mask | APF=4 | | |

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 of communicating are reduced during the wearing of RPE.

For reasons as 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.

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

2.2 Control of environmental exposure

Product characteristics

Lime is chemically bound into/onto a matrix with very low release potential

3. Exposure estimation and reference to its source

Occupational exposure

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 for calcium oxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment | Dermal exposure estimate (RCR) |
|---------|--|------------------------------------|---|--------------------------------|
| PROC 0 | MEASE (PROC 21) | 0.5 mg/m ³ (0.5) | Since calcium oxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. | |
| PROC 21 | MEASE | 0.05 mg/m ³ (0.05) | | |
| PROC 24 | MEASE | 0.825 mg/m ³ (0.825) | | |
| PROC 25 | MEASE | 0.6 mg/m ³ (0.6) | | |

Environmental exposure

Lime is an ingredient and is chemically bound into a matrix: there is no intended release of lime during normal and reasonable foreseeable conditions of use. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The 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 own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness ≥ 10 % are defined as "high dusty".

DNEL_{inhalation}: 1 mg/m³ (as respirable dust)

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). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

ES number 9.12: Consumer use of building and construction material (DIY – do it yourself)

| Exposure Scenario Format (2) addressing uses carried out by consumers | | | | |
|---|---|-------------------------------------|---|------------------------------|
| 1. Title | | | | |
| Free short title | Consumer use of building and construction material | | | |
| Systematic title based on use descriptor | SU21, PC9a, PC9b, ERC8c, ERC8d, ERC8e, ERC8f | | | |
| Processes, tasks activities covered | Handling (mixing and filling) of powder formulations Application of liquid, pasty lime preparations. | | | |
| Assessment Method* | Human health: A qualitative assessment has been performed for oral and dermal exposure as well as exposure to the eye. Inhalation exposure to dust has been assessed by the Dutch model (van Hemmen, 1992). Environment: A qualitative justification assessment is provided. | | | |
| 2. Operational conditions and risk management measures | | | | |
| RMM | No product integrated risk management measures are in place. | | | |
| PC/ERC | Description of activity referring to article categories (AC) and environmental release categories (ERC) | | | |
| PC 9a, 9b | Mixing and loading of powder containing lime substances. Application of lime plaster, putty or slurry to the walls or ceiling. Post-application exposure. | | | |
| ERC 8c, 8d, 8e, 8f | Wide dispersive indoor use resulting in inclusion into or onto a matrix Wide dispersive outdoor use of processing aids in open systems Wide dispersive outdoor use of reactive substances in open systems Wide dispersive outdoor use resulting in inclusion into or onto a matrix | | | |
| 2.1 Control of consumers exposure | | | | |
| Product characteristic | | | | |
| Description of the preparation | Concentration of the substance in the preparation | Physical state of the preparation | Dustiness (if relevant) | Packaging design |
| Lime substance | 100 % | Solid, powder | High, medium and low, depending on the kind of lime substance (indicative value from DIY ¹ fact sheet see section 9.0.3) | Bulk in bags of up to 35 kg. |
| Plaster, Mortar | 20-40% | Solid, powder | | |
| Plaster, Mortar | 20-40% | Pasty | - | - |
| Putty, filler | 30-55% | Pasty, highly viscous, thick liquid | - | In tubes or buckets |
| Pre-mixed lime wash paint | ~30% | Solid, powder | High - low (indicative value from DIY ¹ fact sheet see section 9.0.3) | Bulk in bags of up to 35 kg. |
| Lime wash paint/milk of lime preparation | ~ 30 % | Milk of lime preparation | - | - |
| Amounts used | | | | |
| Description of the preparation | Amount used per event | | | |
| Filler, putty | 250 g – 1 kg powder (2:1 powder water) Difficult to determine, because the amount is heavily dependent on the depth and size of the holes to be filled. | | | |
| Plaster/lime wash paint | ~ 25 kg depending on the size of the room, wall to be treated. | | | |

| | | | | |
|--|--|---|---|---|
| Floor/wall equalizer | ~ 25 kg depending on the size of the room, wall to be equalized. | | | |
| Frequency and duration of use/exposure | | | | |
| Description of task | Duration of exposure per event | | frequency of events | |
| Mixing and loading of lime containing powder. | 1.33 min (DIY ¹ -fact sheet, RIVM, Chapter 2.4.2 Mixing and loading of powders) | | 2/year (DIY ¹ fact sheet) | |
| Application of lime plaster, putty or slurry to the walls or ceiling | Several minutes - hours | | 2/year (DIY ¹ fact sheet) | |
| Human factors not influenced by risk management | | | | |
| Description of the task | Population exposed | Breathing rate | Exposed body part | Corresponding skin area [cm²] |
| Handling of powder | Adult | 1.25 m ³ /hr | Half of both hands | 430 (DIY ¹ fact sheet) |
| Application of liquid, pasty lime preparations. | Adult | NR | Hands and forearms | 1900 (DIY ¹ fact sheet) |
| Other given operational conditions affecting consumers exposure | | | | |
| Description of the task | Indoor/outdoor | Room volume | Air exchange rate | |
| Handling of powder | indoor | 1 m ³ (personal space, small area around the user) | 0.6 hr ⁻¹ (unspecified room) | |
| Application of liquid, pasty lime preparations. | indoor | NR | NR | |
| Conditions and measures related to information and behavioural advice to consumers | | | | |
| In order to avoid health damage DIYers should comply with the same strict protective measures which apply to professional workplaces: | | | | |
| <ul style="list-style-type: none"> • Change wet clothing, shoes and gloves immediately. • Protect uncovered areas of skin (arms, legs, face): there are various effective skin protection products which should be used in accordance with a skin protection plan (skin protection, cleansing and care). Cleanse the skin thoroughly after the work and apply a care product. | | | | |
| Conditions and measures related to personal protection and hygiene | | | | |
| In order to avoid health damage DIYers should comply with the same strict protective measures which apply to professional workplaces: | | | | |
| <ul style="list-style-type: none"> • When preparing or mixing building materials, during demolition or caulking and, above all, during overhead work, wear protective goggles as well as face masks during dusty work. • Choose work gloves carefully. Leather gloves become wet and can facilitate burns. When working in a wet environment, cotton gloves with plastic covering (nitrile) are better. Wear gauntlet gloves during overhead work because they can considerably reduce the amount of humidity which permeates the working clothes. | | | | |
| 2.2 Control of environmental exposure | | | | |
| Product characteristics | | | | |
| Not relevant for exposure assessment | | | | |
| Amounts used* | | | | |
| Not relevant for exposure assessment | | | | |
| Frequency and duration of use | | | | |
| Not relevant for exposure assessment | | | | |
| Environment factors not influenced by risk management | | | | |
| Default river flow and dilution | | | | |
| Other given operational conditions affecting environmental exposure | | | | |
| Indoor | | | | |
| Direct discharge to the wastewater is avoided. | | | | |
| Conditions and measures related to municipal sewage treatment plant | | | | |
| Default size of municipal sewage system/treatment plant and sludge treatment technique | | | | |
| Conditions and measures related to external treatment of waste for disposal | | | | |
| Not relevant for exposure assessment | | | | |
| Conditions and measures related to external recovery of waste | | | | |
| Not relevant for exposure assessment | | | | |
| 3. Exposure estimation and reference to its source | | | | |

The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and is given in parentheses below. For inhalation exposure, the RCR is based on the acute DNEL for lime substances of 4 mg/m³ (as respirable dust) and the respective inhalation exposure estimate (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction is a sub-fraction of the inhalable fraction according to EN 481. Since limes are classified as irritating to skin and eyes a qualitative assessment has been performed for dermal exposure and exposure to the eye.

Human exposure

Handling of powder

| Route of exposure | Exposure estimate | Method used, comments |
|-------------------|--|---|
| Oral | - | Qualitative assessment Oral exposure does not occur as part of the intended product use. |
| Dermal | small task: 0.1 µg/cm ² (-) large task: 1 µg/cm ² (-) | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. However, dermal contact to dust from loading of lime substances or direct contact to the lime cannot be excluded if no protective gloves are worn during application. This may occasionally result in mild irritation easily avoided by prompt rinsing with water. Quantitative assessment The constant rate model of ConsExpo has been used. The contact rate to dust formed while pouring powder has been taken from the DIY ¹ -fact sheet (RIVM report 320104007). |
| Eye | Dust | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. Dust from loading of the lime substances cannot be excluded if no protective goggles are used. Prompt rinsing with water and seeking medical advice after accidental exposure is advisable. |
| Inhalation | Small task: 12 µg/m ³ (0.003) Large task: 120 µg/m ³ (0.03) | Quantitative assessment Dust formation while pouring the powder is addressed by using the dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above). |

Application of liquid, pasty lime preparations.

| Route of exposure | Exposure estimate | Method used, comments |
|-------------------|-------------------|---|
| Oral | - | Qualitative assessment Oral exposure does not occur as part of the intended product use. |
| Dermal | Splashes | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. However, splashes on the skin cannot be excluded if no protective gloves are worn during the application. Splashes may occasionally result in mild irritation easily avoided by immediate rinsing of the hands with water. |
| Eye | Splashes | Qualitative assessment If appropriate goggles are worn no exposure to the eyes needs to be expected. However, splashes into the eyes cannot be excluded if no protective goggles are worn during the application of liquid or pasty lime preparations, especially during overhead work. Prompt rinsing with water and seeking medical advice after accidental exposure is advisable. |
| Inhalation | - | Qualitative assessment Not expected, as the vapour pressure of limes in water is low and generation of mists or aerosols does not take place. |

Post-application exposure

No relevant exposure will be assumed as the aqueous lime preparation will quickly convert to calcium carbonate with carbon dioxide from the atmosphere.

Environmental exposure

Referring to the OC/RMMs related to the environment to avoid discharging lime solutions directly into municipal wastewater, the pH of the influent of a municipal wastewater treatment plant is circum-neutral and therefore, there is no exposure to the biological activity. The influent of a municipal wastewater treatment plant is often neutralized anyway and lime may even be used beneficially for pH control of acid wastewater streams that are treated in biological WWTPs. Since the pH of the influent of the municipal treatment plant is circum neutral, the pH impact is negligible on the receiving environmental compartments, such as surface water, sediment and terrestrial compartment.

ES number 9.13: Consumer use of CO₂ absorbent in breathing apparatuses

| Exposure Scenario Format (2) addressing uses carried out by consumers | | | | |
|---|---|--|---|-------------------------------|
| 1. Title | | | | |
| Free short title | | Consumer use of CO ₂ absorbent in breathing apparatuses | | |
| Systematic title based on use descriptor | | SU21, PC2, ERC8b | | |
| Processes, tasks activities covered | | Filling of the formulation into the cartridge Use of closed circuit breathing apparatuses Cleaning of equipment | | |
| Assessment Method* | | Human health A qualitative assessment has been performed for oral and dermal exposure. The inhalation exposure has been assessed by the Dutch model (van Hemmen, 1992). Environment A qualitative justification assessment is provided. | | |
| 2. Operational conditions and risk management measures | | | | |
| RMM | The soda lime is available in granular form. Furthermore, a defined amount of water (14-18%) is added which will further reduce the dustiness of the absorbent. During the breathing cycle calcium dihydroxide will be quickly reacting with CO ₂ to form the carbonate. | | | |
| PC/ERC | Description of activity referring to article categories (AC) and environmental release categories (ERC) | | | |
| PC 2 | Use of closed circuit breathing apparatus for e.g. recreational diving containing soda lime as CO ₂ absorbent. The breathed air will flow through the absorbent and CO ₂ will quickly react (catalysed by water and sodium hydroxide) with the calcium dihydroxide to form the carbonate. The CO ₂ -free air can be re-breathed again, after addition of oxygen. Handling of the absorbent: The absorbent will be discarded after each use and refilled before each dive. | | | |
| ERC 8b | Wide dispersive indoor use resulting in inclusion into or onto a matrix | | | |
| 2.1 Control of consumers exposure | | | | |
| Product characteristic | | | | |
| Description of the preparation | Concentration of the substance in the preparation | Physical state of the preparation | Dustiness (if relevant) | Packaging design |
| CO ₂ absorbent | 78 - 84% Depending on the application the main component has different additives. A specific amount of water is always added (14-18%). | Solid, granular | Very low dustiness (reduction by 10 % compared to powder) Dust formation cannot be ruled out during the filling of the scrubber cartridge. | 4.5, 18 kg canister |
| "Used" CO ₂ absorbent | ~ 20% | Solid, granular | Very low dustiness (reduction by 10 % compared to powder) | 1-3 kg in breathing apparatus |
| Amounts used | | | | |
| CO ₂ -Absorbent used in breathing apparatus | | 1-3 kg depending on the kind of breathing apparatus | | |
| Frequency and duration of use/exposure | | | | |
| Description of the task | Duration of exposure per event | frequency of events | | |
| Filling of the formulation into the cartridge | Ca. 1.33 min per filling, in sum < 15 min | Before each dive (up to 4 times) | | |
| Use of closed circuit breathing apparatus | 1-2 h | Up to 4 dives a day | | |
| Cleaning and emptying of equipment | < 15 min | After each dive (up to 4 times) | | |

| Human factors not influenced by risk management | | | | |
|---|---------------------------|--|--------------------------|---|
| Description of the task | Population exposed | Breathing rate | Exposed body part | Corresponding skin area [cm²] |
| Filling of the formulation into the cartridge | adult | 1.25 m ³ /hr (light working activity) | hands | 840 (REACH guidance R.15, men) |
| Use of closed circuit breathing apparatus | | | - | - |
| Cleaning and emptying of equipment | | | hands | 840 (REACH guidance R.15, men) |
| Other given operational conditions affecting consumers exposure | | | | |
| Description of the task | Indoor/outdoor | Room volume | Air exchange rate | |
| Filling of the formulation into the cartridge | NR | NR | NR | |
| Use of closed circuit breathing apparatus | - | - | - | |
| Cleaning and emptying of equipment | NR | NR | NR | |
| Conditions and measures related to information and behavioural advice to consumers | | | | |
| <p>Do not get in eyes, on skin, or on clothing. Do not breathe dust Keep container tightly closed as to avoid the soda lime to dry out. Keep out of reach of children. Wash thoroughly after handling. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Do not mix with acids. Carefully read the instructions of the breathing apparatus to assure a proper use of the breathing apparatus.</p> | | | | |
| Conditions and measures related to personal protection and hygiene | | | | |
| Wear suitable gloves, goggles and protective clothes during handling. Use a filtering half mask (mask type FFP2 acc. to EN 149). | | | | |
| 2.2 Control of environmental exposure | | | | |
| Product characteristics | | | | |
| Not relevant for exposure assessment | | | | |
| Amounts used* | | | | |
| Not relevant for exposure assessment | | | | |
| Frequency and duration of use | | | | |
| Not relevant for exposure assessment | | | | |
| Environment factors not influenced by risk management | | | | |
| Default river flow and dilution | | | | |
| Other given operational conditions affecting environmental exposure | | | | |
| Indoor | | | | |
| Conditions and measures related to municipal sewage treatment plant | | | | |
| Default size of municipal sewage system/treatment plant and sludge treatment technique | | | | |
| Conditions and measures related to external treatment of waste for disposal | | | | |
| Not relevant for exposure assessment | | | | |
| Conditions and measures related to external recovery of waste | | | | |
| Not relevant for exposure assessment | | | | |
| 3. Exposure estimation and reference to its source | | | | |

The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and is given in parentheses below. For inhalation exposure, the RCR is based on the acute DNEL for lime substances of 4 mg/m³ (as respirable dust) and the respective inhalation exposure estimate (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction is a sub-fraction of the inhalable fraction according to EN 481. Since lime substances are classified as irritating to skin, and eyes a qualitative assessment has been performed for dermal exposure and exposure to the eye.

Due to the very specialised kind of consumers (divers filling their own CO₂ scrubber) it can be assumed that instructions will be taken into account to reduce exposure

Human exposure

Filling of the formulation into the cartridge

| Route of exposure | Exposure estimate | Method used, comments |
|-------------------|---|--|
| Oral | - | Qualitative assessment Oral exposure does not occur as part of the intended product use. |
| Dermal | - | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. However, dermal contact to dust from loading of granular soda lime or direct contact to the granules cannot be excluded if no protective gloves are worn during application. This may occasionally result in mild irritation easily avoided by prompt rinsing with water. |
| Eye | Dust | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. Dust from loading of the granular soda lime is expected to be minimal, therefore eye exposure will be minimal even without protective goggles. Nevertheless, prompt rinsing with water and seeking medical advice after accidental exposure is advisable. |
| Inhalation | Small task: 1.2 µg/m ³ (3 × 10 ⁻⁴) Large task: 12 µg/m ³ (0.003) | Quantitative assessment Dust formation while pouring the powder is addressed by using the dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above) and applying a dust reduction factor of 10 for the granular form. |

Use of closed circuit breathing apparatus

| Route of exposure | Exposure estimate | Method used, comments |
|-------------------|-------------------|---|
| Oral | - | Qualitative assessment Oral exposure does not occur as part of the intended product use. |
| Dermal | - | Qualitative assessment Due to the product characteristics, it can be concluded that dermal exposure to the absorbent in breathing apparatuses is non-existent. |
| Eye | - | Qualitative assessment Due to the product characteristics, it can be concluded that eye exposure to the absorbent in breathing apparatuses is non-existent. |
| Inhalation | negligible | Qualitative assessment Instructional advice is provided to remove any dust before finishing the assembly of the scrubber. Divers filling their own CO ₂ scrubber represent a specific subpopulation within consumers. Proper use of equipment and materials is in their own interest; hence it can be assumed that instructions will be taken into account. Due to the product characteristics and the instructional advices given, it can be concluded that inhalation exposure to the absorbent during the use of the breathing apparatus is negligible. |

| Cleaning and emptying of equipment | | |
|--|--|--|
| Route of exposure | Exposure estimate | Method used, comments |
| Oral | - | Qualitative assessment Oral exposure does not occur as part of the intended product use. |
| Dermal | Dust and splashes | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. However, dermal contact to dust from emptying granular soda lime or direct contact to the granules cannot be excluded if no protective gloves are worn during cleaning. Furthermore, during the cleaning of the cartridge with water contact to moistened soda lime may occur. This may occasionally result in mild irritation easily avoided by immediate rinsing of with water. |
| Eye | Dust and splashes | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. However, contact to dust from emptying granular soda limes or during the cleaning of the cartridge with water contact to moisten soda limes may occur in very rare occasions. Prompt rinsing with water and seeking medical advice after accidental exposure is advisable. |
| Inhalation | Small task: $0.3 \mu\text{g}/\text{m}^3$ (7.5×10^{-5}) Large task: $3 \mu\text{g}/\text{m}^3$ (7.5×10^{-4}) | Quantitative assessment Dust formation while pouring the powder is addressed by using the Dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above) and applying a dust reduction factor of 10 for the granular form and a factor of 4 to account for the reduced amount of lime in the "used" absorbent. |
| Environmental exposure | | |
| The pH impact due to use of lime in breathing apparatuses is expected to be negligible. The influent of a municipal wastewater treatment plant is often neutralized anyway and lime may even be used beneficially for pH control of acid wastewater streams that are treated in biological WWTPs. Since the pH of the influent of the municipal treatment plant is circum neutral, the pH impact is negligible on the receiving environmental compartments, such as surface water, sediment and terrestrial compartment. | | |

ES number 9.14: Consumer use of garden lime/fertilizer

| Exposure Scenario Format (2) addressing uses carried out by consumers | | | | |
|---|---|---|---|---|
| 1. Title | | | | |
| Free short title | | Consumer use of garden lime/fertilizer | | |
| Systematic title based on use descriptor | | SU21, PC20, PC12, ERC8e | | |
| Processes, tasks activities covered | | Manual application of garden lime, fertilizer Post-application exposure | | |
| Assessment Method* | | Human health A qualitative assessment has been performed for oral and dermal exposure as well as for the exposure to the eye. The dust exposure has been assessed by the Dutch model (van Hemmen, 1992). Environment A qualitative justification assessment is provided. | | |
| 2. Operational conditions and risk management measures | | | | |
| RMM | | No product integrated risk management measures are in place. | | |
| PC/ERC | | Description of activity referring to article categories (AC) and environmental release categories (ERC) | | |
| PC 20 | | Surface spreading of the garden lime by shovel/hand (worst case) and soil incorporation. Post-application exposure to playing children. | | |
| PC 12 | | Surface spreading of the garden lime by shovel/ hand (worst case) and soil incorporation. Post-application exposure to playing children. | | |
| ERC 8e | | Wide dispersive outdoor use of reactive substances in open systems | | |
| 2.1 Control of consumers exposure | | | | |
| Product characteristic | | | | |
| Description of the preparation | Concentration of the substance in the preparation | Physical state of the preparation | Dustiness (if relevant) | Packaging design |
| Garden lime | 100 % | Solid, powder | High dusty | Bulk in bags or containers of 5, 10 and 25 kg |
| Fertilizer | Up to 20 % | Solid, granular | Low dusty | Bulk in bags or containers of 5, 10 and 25 kg |
| Amounts used | | | | |
| Description of the preparation | | Amount used per event | Source of information | |
| Garden lime | | 100g /m ² (up to 200g/m ²) | Information and direction of use | |
| Fertilizer | | 100g /m ² (up to 1kg/m ² (compost)) | Information and direction of use | |
| Frequency and duration of use/exposure | | | | |
| Description of the task | Duration of exposure per event | | frequency of events | |
| Manual application | Minutes-hours Depending on the size of the treated area | | 1 tasks per year | |
| Post-application | 2 h (toddlers playing on grass (EPA exposure factors handbook)) | | Relevant for up to 7 days after application | |
| Human factors not influenced by risk management | | | | |
| Description of the task | Population exposed | Breathing rate | Exposed body part | Corresponding skin area [cm ²] |
| Manual application | Adult | 1.25 m ³ /hr | Hands and forearms | 1900 (DIY fact sheet) |
| Post-application | Child/Toddlers | NR | NR | NR |
| Other given operational conditions affecting consumers exposure | | | | |
| Description of the task | Indoor/outdoor | Room volume | Air exchange rate | |

| | | | |
|--|--|---|---|
| Manual application | outdoor | 1 m ³ (personal space, small area around the user) | NR |
| Post-application | outdoor | NR | NR |
| Conditions and measures related to information and behavioural advice to consumers | | | |
| Do not get in eyes, on skin, or on clothing. Do not breathe dust. Use a filtering half mask (mask type FFP2 acc. to EN 149). Keep container closed and out of reach of children. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wash thoroughly after handling. Do not mix with acids and always add limes to water and not water to limes. Incorporation of the garden lime or fertilizer into the soil with subsequent watering will facilitate the effect. | | | |
| Conditions and measures related to personal protection and hygiene | | | |
| Wear suitable gloves, goggles and protection clothes. | | | |
| 2.2 Control of environmental exposure | | | |
| Product characteristics | | | |
| Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application) | | | |
| Amounts used | | | |
| Amount used | Ca(OH) ₂ | 2,244 kg/ha | In professional agricultural soil protection, it is recommended not to exceed 1700 kg CaO/ha or the corresponding amount of 2244 kg Ca(OH) ₂ /ha. This rate is three times the amount needed to compensate the annual losses of lime by leaching. For this reason, the value of 1700 kg CaO/ha or the corresponding amount of 2244 kg Ca(OH) ₂ /ha is used in this dossier as the basis for the risk assessment. The amount used for the other lime variants can be calculated based on their composition and the molecular weight. |
| | CaO | 1,700 kg/ha | |
| | CaO.MgO | 1,478 kg/ha | |
| | Ca(OH) ₂ .Mg(OH) ₂ | 2,030 kg/ha | |
| | CaCO ₃ .MgO | 2,149 kg/ha | |
| | Ca(OH) ₂ .MgO | 1,774 kg/ha | |
| | Natural hydraulic lime | 2,420 kg/ha | |
| Frequency and duration of use | | | |
| 1 day/year (one application per year); Multiple applications during the year are allowed, provided the total yearly amount of 1,700 kg/ha is not exceeded (CaO) | | | |
| Environment factors not influenced by risk management | | | |
| Not relevant for exposure assessment | | | |
| Other given operational conditions affecting environmental exposure | | | |
| Outdoor use of products Soil mixing depth: 20 cm | | | |
| Technical conditions and measures at process level (source) to prevent release | | | |
| There are no direct releases to adjacent surface waters. | | | |
| Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil | | | |
| Drift should be minimised. | | | |
| Conditions and measures related to municipal sewage treatment plant | | | |
| Not relevant for exposure assessment | | | |
| Conditions and measures related to external treatment of waste for disposal | | | |
| Not relevant for exposure assessment | | | |
| Conditions and measures related to external recovery of waste | | | |
| Not relevant for exposure assessment | | | |
| 3. Exposure estimation and reference to its source | | | |
| The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and is given in parentheses below. For inhalation exposure, the RCR is based on the long-term DNEL for lime substances of 1 mg/m ³ (as respirable dust) and the respective inhalation exposure estimate (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction is a sub-fraction of the inhalable fraction according to EN 481. Since lime substances are classified as irritating to skin and eyes a qualitative assessment has been performed for dermal exposure and exposure to the eye. | | | |
| Human exposure | | | |
| Manual application | | | |

| Route of exposure | Exposure estimate | Method used, comments |
|--|--|--|
| Oral | - | Qualitative assessment Oral exposure does not occur as part of the intended product use. |
| Dermal | Dust, powder | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. However, dermal contact to dust from application of lime substances or by direct contact to the limes cannot be excluded if no protective gloves are worn during application. Due to the relatively long application time, skin irritation would be expected. This can easily be avoided by immediate rinsing with water. It would be assumed that consumers who had experience of skin irritation will protect themselves. Therefore, any occurring skin irritation, which will be reversible, can be assumed to be non-recurring. |
| Eye | Dust | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. Dust from surfacing with lime cannot be excluded if no protective goggles are used. Prompt rinsing with water and seeking medical advice after accidental exposure is advisable. |
| Inhalation (garden lime) | Small task: 12 µg/m ³ (0.0012) Large task: 120 µg/m ³ (0.012) | Quantitative assessment No model describing the application of powders by shovel/hand is available, therefore, read-across from the dust formation model while pouring powders has been used as a worst case. Dust formation while pouring the powder is addressed by using the dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above). |
| Inhalation (fertilizer) | Small task: 0.24 µg/m ³ (2.4 * 10 ⁻⁴) Large task: 2.4 µg/m ³ (0.0024) | Quantitative assessment No model describing the application of powders by shovel/hand is available, therefore, read across from the dust formation model while pouring powders has been used as a worst case. Dust formation while pouring the powder is addressed by using the dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above) and applying a dust reduction factor of 10 for the granular form and a factor of 5 to account for the reduced amount of limes in fertilizer. |
| Post-application | | |
| <p>According to the PSD (UK Pesticide Safety Directorate, now called CRD) post-application exposure need to be addressed for products which are applied in parks or amateur products used to treat lawns and plants grown in private gardens. In this case exposure of children, who may have access to these areas soon after treatment, needs to be assessed. The US EPA model predicts the post-application exposure to products used in private gardens (e.g. lawns) by toddlers crawling on the treated area and also via the oral route through hand-to-mouth activities.</p> <p>Garden lime or fertilizer including lime is used to treat acidic soil. Therefore, after application to the soil and subsequent watering the hazard driving effect of lime (alkalinity) will be quickly neutralized. Exposure to lime substances will be negligible within a short time after application.</p> | | |
| Environmental exposure | | |
| <p>No quantitative environmental exposure assessment is carried out because the operational conditions and risk management measures for consumer use are less stringent than those outlined for professional agricultural soil protection. Moreover, the neutralisation/pH-effect is the intended and desired effect in the soil compartment. Releases to wastewater are not expected.</p> | | |

ES number 9.15: Consumer use of lime substances as water treatment chemicals

| Exposure Scenario Format (2) addressing uses carried out by consumers | | | | |
|--|---|---|---|--|
| 1. Title | | | | |
| Free short title | Consumer use of lime substances as water treatment chemicals | | | |
| Systematic title based on use descriptor | SU21, PC20, PC37, ERC8b | | | |
| Processes, tasks activities covered | Loading, filling or re-filling of solid formulations into container/preparation of lime milk Application of lime milk to water | | | |
| Assessment Method* | Human health: A qualitative assessment has been performed for oral and dermal exposure as well as for exposure of the eye. Dust exposure has been assessed by the Dutch model (van Hemmen, 1992). Environment: A qualitative justification assessment is provided. | | | |
| 2. Operational conditions and risk management measures | | | | |
| RMM | No further product integrated risk management measures are in place. | | | |
| PC/ERC | Description of activity referring to article categories (AC) and environmental release categories (ERC) | | | |
| PC 20/37 | Filling and re-filling (transfer of lime substances (solid)) of lime reactor for water treatment. Transfer of lime substances (solid) into container for further application. Dropwise application of lime milk to water. | | | |
| ERC 8b | Wide dispersive indoor use of reactive substances in open systems | | | |
| 2.1 Control of consumers exposure | | | | |
| Product characteristic | | | | |
| Description of the preparation | Concentration of the substance in the preparation | Physical state of the preparation | Dustiness (if relevant) | Packaging design |
| Water treatment chemical | Up to 100 % | Solid, fine powder | high dustiness (indicative value from DIY fact sheet see section 9.0.3) | Bulk in bags or buckets/containers. |
| Water treatment chemical | Up to 99 % | Solid, granular of different size (D50 value 0.7 D50 value 1.75 D50 value 3.08) | low dustiness (reduction by 10% compared to powder) | Bulk-tank lorry or in „Big Bags“ or in sacks |
| Amounts used | | | | |
| Description of the preparation | Amount used per event | | | |
| Water treatment chemical in lime reactor for aquaria | depending on the size of the water reactor to be filled (~ 100g /L) | | | |
| Water treatment chemical in lime reactor for drinking water | depending on the size of the water reactor to be filled (~up to 1.2 kg/L) | | | |
| Lime milk for further application | ~ 20 g / 5L | | | |
| Frequency and duration of use/exposure | | | | |
| Description of task | Duration of exposure per event | frequency of events | | |
| Preparation of lime milk (loading, filling and refilling) | 1.33 min (DIY-fact sheet, RIVM, Chapter 2.4.2 Mixing and loading of powders) | 1 task/month 1task/week | | |
| Dropwise application of lime milk to water | Several minutes - hours | 1 tasks/ month | | |

| Human factors not influenced by risk management | | | | |
|---|---------------------------|---|--|---|
| Description of the task | Population exposed | Breathing rate | Exposed body part | Corresponding skin area [cm²] |
| Preparation of lime milk (loading, filling and refilling) | adult | 1.25 m ³ /hr | Half of both hands | 430 (RIVM report 320104007) |
| Dropwise application of lime milk to water | adult | NR | Hands | 860 (RIVM report 320104007) |
| Other given operational conditions affecting consumers exposure | | | | |
| Description of the task | Indoor/outdoor | Room volume | Air exchange rate | |
| Preparation of lime milk (loading, filling and refilling) | Indoor/outdoor | 1 m ³ (personal space, small area around the user) | 0.6 hr ⁻¹ (unspecified room indoor) | |
| Dropwise application of lime milk to water | indoor | NR | NR | |
| Conditions and measures related to information and behavioural advice to consumers | | | | |
| Do not get in eyes, on skin, or on clothing. Do not breathe dust Keep container closed and out of reach of children. Use only with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wash thoroughly after handling. Do not mix with acids and always add limes to water and not water to limes. | | | | |
| Conditions and measures related to personal protection and hygiene | | | | |
| Wear suitable gloves, goggles and protective clothes. Use a filtering half mask (mask type FFP2 acc. to EN 149). | | | | |
| 2.2 Control of environmental exposure | | | | |
| Product characteristics | | | | |
| Not relevant for exposure assessment | | | | |
| Amounts used* | | | | |
| Not relevant for exposure assessment | | | | |
| Frequency and duration of use | | | | |
| Not relevant for exposure assessment | | | | |
| Environment factors not influenced by risk management | | | | |
| Default river flow and dilution | | | | |
| Other given operational conditions affecting environmental exposure | | | | |
| Indoor | | | | |
| Conditions and measures related to municipal sewage treatment plant | | | | |
| Default size of municipal sewage system/treatment plant and sludge treatment technique | | | | |
| Conditions and measures related to external treatment of waste for disposal | | | | |
| Not relevant for exposure assessment | | | | |
| Conditions and measures related to external recovery of waste | | | | |
| Not relevant for exposure assessment | | | | |

3. Exposure estimation and reference to its source

The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and is given in parentheses below. For inhalation exposure, the RCR is based on the acute DNEL for lime substances of 4 mg/m³ (as respirable dust) and the respective inhalation exposure estimate (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction is a sub-fraction of the inhalable fraction according to EN 481. Since lime substances are classified as irritating to skin and eyes a qualitative assessment has been performed for dermal exposure and exposure to the eye.

Human exposure

Preparation of lime milk (loading)

| Route of exposure | Exposure estimate | Method used, comments |
|-----------------------|--|--|
| Oral | - | Qualitative assessment Oral exposure does not occur as part of the intended product use. |
| Dermal (powder) | small task: 0.1 µg/cm ² (-) large task: 1 µg/cm ² (-) | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. However, dermal contact to dust from loading of limes or direct contact to the lime cannot be excluded if no protective gloves are worn during application. This may occasionally result in mild irritation easily avoided by prompt rinsing with water. Quantitative assessment The constant rate model of ConsExpo has been used. The contact rate to dust formed while pouring powder has been taken from the DIY-fact sheet (RIVM report 320104007). For granules the exposure estimate will be even lower. |
| Eye | Dust | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. Dust from loading of the limes cannot be excluded if no protective goggles are used. Prompt rinsing with water and seeking medical advice after accidental exposure is advisable. |
| Inhalation (powder) | Small task: 12 µg/m ³ (0.003) Large task: 120 µg/m ³ (0.03) | Quantitative assessment Dust formation while pouring the powder is addressed by using the Dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above). |
| Inhalation (granules) | Small task: 1.2 µg/m ³ (0.0003) Large task: 12 µg/m ³ (0.003) | Quantitative assessment Dust formation while pouring the powder is addressed by using the Dutch model (van Hemmen, 1992 as described in section 9.0.3.1 above) and applying a dust reduction factor of 10 for the granular form. |

Dropwise application of lime milk to water

| Route of exposure | Exposure estimate | Method used, comments |
|-------------------|----------------------|---|
| Oral | - | Qualitative assessment Oral exposure does not occur as part of the intended product use. |
| Dermal | Droplets or splashes | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. However, splashes on the skin cannot be excluded if no protective gloves are worn during application. Splashes may occasionally result in mild irritation easily avoided by immediate rinsing of the hands in water. |
| Eye | Droplets or splashes | Qualitative assessment If risk reduction measures are taken into account no human exposure is expected. However, splashes into the eyes cannot be excluded if no protective goggles are worn during the application. However, it is rare for eye irritation to occur as a result of exposure to a clear solution of calcium hydroxide (lime water) and mild irritation can easily be avoided by immediate rinsing of the eyes with water. |

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|--|---|--|
| Inhalation | - | Qualitative assessment Not expected, as the vapour pressure of limes in water is low and generation of mists or aerosols does not take place. |
| Environmental exposure | | |
| The pH impact due to use of lime in cosmetics is expected to be negligible. The influent of a municipal wastewater treatment plant is often neutralized anyway and lime may even be used beneficially for pH control of acid wastewater streams that are treated in biological WWTPs. Since the pH of the influent of the municipal treatment plant is circum neutral, the pH impact is negligible on the receiving environmental compartments, such as surface water, sediment and terrestrial compartment. | | |

ES number 9.15: Consumer use of cosmetics containing lime substances

| Exposure Scenario Format (2) addressing uses carried out by consumers | |
|---|---|
| 1. Title | |
| Free short title | Consumer use of cosmetics containing limes |
| Systematic title based on use descriptor | SU21, PC39 , ERC8a |
| Processes, tasks activities covered | - |
| Assessment Method* | Human health: According to Article 14(5) (b) of regulation (EC) 1907/2006 risks to human health need not be considered for substances included in cosmetic products within the scope of Directive 76/768/EC. Environment A qualitative justification assessment is provided. |
| 2. Operational conditions and risk management measures | |
| ERC 8a | Wide dispersive indoor use of processing aids in open systems |
| 2.1 Control of consumers exposure | |
| Product characteristic | |
| Not relevant, as the risk to human health from this use does not need to be considered. | |
| Amounts used | |
| Not relevant, as the risk to human health from this use does not need to be considered. | |
| Frequency and duration of use/exposure | |
| Not relevant, as the risk to human health from this use does not need to be considered. | |
| Human factors not influenced by risk management | |
| Not relevant, as the risk to human health from this use does not need to be considered. | |
| Other given operational conditions affecting consumers exposure | |
| Not relevant, as the risk to human health from this use does not need to be considered. | |
| Conditions and measures related to information and behavioural advice to consumers | |
| Not relevant, as the risk to human health from this use does not need to be considered. | |
| Conditions and measures related to personal protection and hygiene | |
| Not relevant, as the risk to human health from this use does not need to be considered. | |
| 2.2 Control of environmental exposure | |
| Product characteristics | |
| Not relevant for exposure assessment | |
| Amounts used* | |
| Not relevant for exposure assessment | |
| Frequency and duration of use | |
| Not relevant for exposure assessment | |
| Environment factors not influenced by risk management | |
| Default river flow and dilution | |
| Other given operational conditions affecting environmental exposure | |
| Indoor | |
| Conditions and measures related to municipal sewage treatment plant | |
| Default size of municipal sewage system/treatment plant and sludge treatment technique | |
| Conditions and measures related to external treatment of waste for disposal | |
| Not relevant for exposure assessment | |
| Conditions and measures related to external recovery of waste | |
| Not relevant for exposure assessment | |

3. Exposure estimation and reference to its source

Human exposure

Human exposure to cosmetics will be addressed by other legislation and therefore need not be addressed under regulation (EC) 1907/2006 according to Article 14(5) (b) of this regulation.

Environmental exposure

The pH impact due to use of lime in cosmetics is expected to be negligible. The influent of a municipal wastewater treatment plant is often neutralized anyway and lime may even be used beneficially for pH control of acid wastewater streams that are treated in biological WWTPs. Since the pH of the influent of the municipal treatment plant is circum neutral, the pH impact is negligible on the receiving environmental compartments, such as surface water, sediment and terrestrial compartment.

End of the Safety Data Sheet