

FORTISCHEM a. s., M. R. Štefánika 1, 972 71 Nováky, Slovenská republika

*Elaborate according to COMMISSION REGULATION (EU) 2015/830  
amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration,  
Evaluation, Authorisation and Restriction of Chemicals (REACH)*

Date of issue: 30.11.2010

Replaces the version of 05.05.2021

Revision date: 12.11.2021

<b>SECTION 1: Identification of the substance/mixture and of the company/undertaking</b>	
<b>1.1 Product identifier</b>	
Trade name:	CALCIUM CARBIDE (CAREX)
REACH registration number:	01-2119494719-18-0001
CAS:	75-20-7
EINECS:	200-848-3
Chemical name (IUCRID):	calcium acetylide
Index number:	006-004-00-9
Molecular formula:	CaC <sub>2</sub>
Synonyms:	calcium carbide, carburo de calcio, calcium acetylide, acetylenogen, calcium dicarbide, ethyne calcium deriv.
Chemical characterisation:	inorganic single-component substance
<b>1.2 Relevant identified uses of the substance or mixture and uses advised against</b>	
Calcium carbide is used as a material or intermediate product for acetylene and calcium cyanamide production. It is used in metallurgical industry to desulphurize hot metals in blast furnaces, and iron and steel foundries.	
<b>Use requiring attention:</b>	
The past use advancing the ripeness of fruits and the use in carbide lamps (acetylene formed from calcium carbide in both cases). These uses require attention and have not been assessed.	
<b>1.3 Details of the supplier of the safety data sheet</b>	
Producers name:	FORTISCHEM a. s.
Address:	M.R. Štefánika 1, 972 71 NOVÁKY, Slovenská republika
Phone:	+421/46/568 1111
Contact to a responsible person for the SDS:	<a href="mailto:khu@fortischem.sk">khu@fortischem.sk</a>
<b>1.4 Emergency telephone number</b>	
National Poisons Information Service City Hospital, Birmingham B187QH, United Kingdom	
Tel.:	+44 121 507 4123
E-mail:	<a href="mailto:allistervale@npis.org">allistervale@npis.org</a> , <a href="mailto:sallybradberryy@npis.org">sallybradberryy@npis.org</a>

<b>SECTION 2: Hazards identification</b>
<b>2.1 Classification of the substance or preparation</b>
<b>2.1.1 Classification according to Regulation of the EP and of the Council No. 1272/2008/ES (CLP):</b>
Signal word: <b>Danger</b>
<b>Classification:</b>
Water react Flam.Gas 1, H260
Skin. Irrit 2, H315
Eye damage 1, H318
STOT Single Exp. 3, H335
<b>Hazard statements:</b>
H260 In contact with water releases flammable gases which may ignite spontaneously.
H315 Causes skin irritation.
H335 May cause respiratory irritation.

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H318 Causes serious eye damage.

**2.2 Labelling**

2.2.1 Labelling according to Regulation of the EP and of the Council No. 1272/2008/ES (CLP):

Signal word: **Danger**

Warning pictograms, codes and symbols:



**Hazard statements:**

H315 Causes skin irritation.

H335 May cause respiratory irritation.

H318 Causes serious eye damage.

H260 In contact with water releases flammable gases which may ignite spontaneously.

**Precautionary statements:**

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

P223 Keep away from any possible contact with water, because of violent reaction and possible flash fire.

P312 Call a POISON CENTER or doctor/physician if you feel unwell.

P302+P352 IF ON SKIN: Wash with plenty of soap and water.

P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P370+P378 In case of fire: use sand or dry powder for extinction. It is not advisable to stop the fire completely if there is a still a source of moisture as the fire could flare up again.

P402+P404 Store in a dry place. Store in a closed container.

2.3. Other hazards: -

**SECTION 3: Composition/information on ingredients**

Component	CAS	ES	Classification	H statements	Concentration w/w%
Calcium carbide REACH registration No. 01-2119494719-18-0001	200-848-3	75-20-7	Water react Flam.Gas 1 Skin. Irrit 2 Eye damage 1 STOT Single Exp. 3	H260 H315 H318 H335	75 - 80
Calcium monoxide	215-138-9	1305-78-8	Skin. Irrit 2 Eye damage 1 STOT Single Exp. 3	H315 H318 H335	15 - 20
Carbon	231-153-3	7440-44-0	-	-	0,3 - 8

**SECTION 4: First aid measures**

4.1 First aid measures description:

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**4.1.1 General principles of first aid provision:**

If any health issues or any doubts occur seek medical attention.

If any life-endangering conditions occur resuscitation is required:

- If the person shows no signs of breathing mouth-to-mouth respiration must be provided
- If the person suffered cardiac arrest indirect cardiac massage must be initiated immediately.
- If the person is unconscious place him/her in a stable position on his/her side.

**4.1.2 Following inhalation:**

If the person inhaled the substance remove him/her to fresh air and avoid any active movement. If the person experiences breathing difficulties provide mouth-to-mouth resuscitation or oxygen. Call a doctor/physician. Provide him/her with all product information.

**4.1.3 Following skin contact:**

Rinse the affected areas with water for at least 15 minutes and apply a layer of suitable protective cream. Seek medical attention. If burnt with the molten product cool the skin down with cold water for as long as possible. Do not remove contaminated clothes if stuck to skin. Seek medical attention immediately.

**4.1.4 Following eye contact:**

Rinse immediately with a large volume of water for at least 15 minutes. Further treatment by eye doctor is absolutely essential.

**4.2 The most critical symptoms and effects:**

Sore eyes, nose, throat and skin. Irritable cough, shortness of breath. Toxic effects not expected. When in contact with water, the product forms acetylene or calcium hydroxide. Make sure that all burns caused by calcium hydroxide (burnt mucosa or wet skin areas) are noticed. Particular attention should be paid to cornea. Dust may be irritating to eyes and airways and may form skin lesions. When in contact with water and moisture, the product forms acetylene, which is toxic. Here the level of poisoning is derived from technical product impurities.

**4.3. Indication of any immediate medical attention and special treatment needed: -****SECTION 5: Firefighting measures****5.1 Suitable extinguishing media:**

Dry chemical powder, dry sand, dry soil

Extinguishing media that shall not be used for safety reasons: water, carbon dioxide, foam.

**5.2 Special fire hazard:**

Formation of hazardous decomposition products. The product itself is inflammable but when in contact with water or when in humid environment it easily releases flammable gaseous acetylene and forms explosive mixtures when mixed with the air. When extinguishing, weather conditions should be monitored (wind direction and wind rate). Explosive limits and safety measures to take in protective confined areas must be strictly followed. Fire can only be put out from far distance.

**5.3 Advice for fire-fighters:**

Self-contained breathing apparatus (SCBA) and chemical resistant clothes required.

**SECTION 6: Accidental release measures****6.1 Personal precautions, protective equipment and emergency procedures:****6.1.1 For non-emergency personnel:**

Close the accident area. Then put out the fire and eliminate all potential ignition sources.

No entry to the accident area to unauthorised persons. Use non-explosive design light sources and non-sparking equipment. Use skin, airways and eye protecting equipment. Wear twilled impermeable dust clothing and safety goggles.

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6.1.2 For emergency personnel: Use full protection - protective clothing, breathing apparatus.

**6.2 Environmental precautions:**

Prevent any release to the environment. If discharged in sewer systems or in the form of waste water the substance might explode or explosive toxic mixtures can be formed.

**6.3 Methods and material for containment and cleaning up:**

Stop product leakage if possible. Try to eliminate the leakage using any method possible. If contaminating a water stream or a sewer system, report to the relevant body. The leaked material must be collected and taken away in closed vessels. Once in contact with water gaseous acetylene is formed easily. Therefore it is necessary to take into account large gas amounts formed in such vessels.

**6.4 Reference to other sections:**

For further information on exposure control and personal protection refer to section 8 and for further information on disposal measures to section 13.

**SECTION 7: Handling and storage****7.1 Precautions for safe handling:**

Prevent product contact with moisture and any potential water source as violent reactions and ignition might occur. The product shall be processed in inert atmosphere only. No eating, drinking, smoking while working with the product. Prescribed protective aids must be worn. Recommended protective equipment must be used (see section 8).

**7.2 Conditions for safe storage, including any incompatibilities:**

Store in dry and tight vessels (metal barrels, steel containers). Vessels must be hermetically sealed so as to prevent any air moisture from getting into contact with the carbide. Store on a dry, well vented location. Storage temperature max. +100°C

7.3 Specific end use(s): no data available

**SECTION 8: Exposure controls/personal protection****8.1 Control parameters:****8.1.1 National occupational exposure limit values:**

(Regulation of the Government of the Slovak Republic No. 355/2006 of Coll.):

No Slovak exposure limit values for calcium carbide available.

Average NPEL for calcium monoxide: 2 mg/m<sup>3</sup>  
for solid aerosol: 10 mg/m<sup>3</sup>

Limit NPEL: not available

**8.2 Exposure controls:****8.2.1 Technical measures:**

Dust contained in the air must be eliminated or minimized by venting and extraction. Prevent any skin or mucosa contact.

**8.2.2 Personal protection equipment:**

Use closed systems, local ventilation or other engineering controls to keep atmosphere concentrations below the limit value.

a) **Eye protection:** safety glasses - tight glasses preventing ingress of dust into the eyes.

b) **Skin protection:** protective gloves and work clothes; at work requires the use of protective gloves, protective standard working clothes entirely with covered skin, with adjacent to the arms and legs, defending the penetration of dust, and safety shoes S3.

Use protective gloves. The glove material must be sufficiently impermeable and resistant to the substance.

Check the tightness before wear. Gloves should be well cleaned before being removed, then stored in a well

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ventilated location. Pay attention to skin care.  
 Skin protection cremes do not protect sufficiently against the substance.  
 The following materials are suitable for protective gloves:  
 Nitrile rubber/Nitrile latex - NBR  
 Minimum layer thickness: 0,11 mm; Break through time: 480 min  
**c) Respiratory protection:** Respirator with dust filter with a protection factor min. 10

**SECTION 9: Physical and chemical properties**

**9.1 Information on basic physical and chemical properties:**

Appearance:	Powder or irregular-shape pieces
Colour:	grey to deep violet
Odour:	garlicky after acetylene
pH:	basic
Boiling temperature:	2,300°C (101.3 kPa)
Melting point:	2,300°C (101.3 kPa)
Decomposition temperature:	Not determined
Flash point:	Not determined
Flammability:	Non-flammable (the substance forms flammable gas when in contact with moisture)
Auto-ignition temperature:	None
Explosion hazard:	Not determined (the substance forms flammable gas when in contact with moisture)
Explosive properties:	Not determined
a) Lower explosive limit:	-
b) Upper explosive limit:	-
Oxidising properties:	Not determined
Vapour pressure:	0.1kPa (20°C)
Relative density:	2.2-2.7 g/cm <sup>3</sup>
Solubility:	Not determined (the product reacts with water)
Partition coefficient:	Not determined (inorganic substance)
Viscosity:	Not determined
Other information:	When in contact with moisture calcium carbide reacts and forms acetylene.
<b>Acetylene data:</b>	
Flash point:	- 17.8
Ignition temperature:	321°C
Explosive properties:	
a) Lower explosive limit:	1.5 w/w % acetylene
b) Upper explosive limit:	82 w/w % acetylene

**SECTION 10: Stability and reactivity**

**10.1 Reactivity:** Violent reaction when in contact with water, forming easily combustible gaseous acetylene and large heat amount. A kg of calcium carbide forms approximately 300 l of gaseous acetylene when in contact with water. Acetylene becomes unstable at the ambient temperature. When in contact with the air acetylene easily forms explosive mixtures. Its ignition is caused by hot surfaces, sparkles and open fire.

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Highly liable to explosion is the reaction caused by calcium carbide added to silver nitrate. When heated up the mixture of hydrogen peroxide and calcium carbide explodes.

When reacting with copper and brass, the substance forms explosive compounds. When reacting with potassium fluoride, metal potassium is formed. When combined with salts of some heavy metals the product of reaction, namely acetylene, forms highly explosive compounds. It also reacts violently with acids.

**10.2 Chemical stability:** Stable in dry environment. It reacts with air moisture and forms flammable acetylene.

**10.3 Possibility of hazardous reactions:** -

**10.4 Conditions to avoid:** Its contact with water and humid environment must be prevented.

**10.5 Incompatible materials:**

Water, silver nitrate, sodium peroxide, copper, brass, potassium fluoride - explosion hazard

**10.6 Hazardous decomposition products:**

explosive gaseous acetylene C<sub>2</sub>H<sub>2</sub> and highly poisonous flammable gases, phosphane PH<sub>3</sub> and sulphane H<sub>2</sub>S.

**SECTION 11: Toxicological information**

**11.1 Information on toxicological effects:**

**Acute toxicity:** No information on product acute toxicity available.

**Irritation:** The pH of 1% of calcium carbide dissolved in water is 12.48.  
 Skin irritation (in vivo, rabbit): Irritant to skin  
 Eye irritation (in vivo, rabbit): Irreversible eye lesions  
 Based on results of the carbide pH evaluation the substance should be classified as irritable.

**Chronic toxicity:** No information on repeated dose toxicity available.

**Mutagenicity:** No conclusive mutagenicity evidence available

**Carcinogenicity:** No conclusive carcinogenicity evidence available.

**Toxicity for reproduction:** No conclusive reproductive toxicity, developmental toxicity and teratogenicity evidence available.

**DNEL:** As the data for DNEL calculation is insufficient, indicative occupational exposure limits for calcium hydroxide are used to assess the hazard. TWA 5mg/m<sup>3</sup> (8 hours). Maximum dust exposure is 4 hours, which allows the change of the value to 10 mg/m<sup>3</sup>.

**SECTION 12: Ecological information**

**12.1 Toxicity**

**Environmental impacts information:**

When in contact with moisture calcium carbide decomposes easily forming acetylene and calcium hydroxide. Moreover, calcium carbide contains the impurity calcium monoxide, which also hydrolyses calcium hydroxide. Calcium hydroxide is alkaline and can influence pH as such. Organisms of water ecosystem are able to adapt to pH changes. The pH of aquatic environment can range from 6 pH, in soft water, to 9 pH, in hard water. The buffer capacity of the environment will neutralise calcium hydroxide formed from calcium carbide. Acetylene is highly volatile. Therefore its relationship to eco-toxicity does not have to be considered. The rest of impurities are present in irrelevant quantities and thus do not influence the product eco-toxicity.

Toxicity for fish: No data on calcium carbide toxicity for fish available.

**12.2 Toxicity for vertebrates and invertebrates:**

No data on calcium carbide toxicity for fish available.

**12.3 Persistence and degradability:**

Bioaccumulation factor: Calcium carbide does not contain any ingredients with potential bioaccumulation.

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Therefore it does not have any PBT and vPvB properties.

Degradation: Abiotic-type - Acetylene and calcium hydroxide are formed by hydrolysis.

**12.4 Mobility in soil:** Once present in the environment, it reacts with water or air moisture and forms gaseous acetylene and calcium hydroxide.

**SECTION 13: Disposal considerations**

**13.1 Waste treatment methods**

Recommended waste-treatment method: Excess material must be stored in a closed vessel. All the applicable waste-related laws and regulations must be observed. Excess material cannot be discharged into sewer systems or water streams. It must be taken away in closed vessels. When in contact with moisture, gaseous acetylene is formed easily. If this is the case ignition sources must be eliminated and the formation of large gas volume in the vessels must be considered for transport purposes.

**Recommended method of contaminated packaging waste treatment:**

Only completely emptied packaging can be recycled. Any product left in packaging can react with air moisture and form gaseous acetylene. If this is the case all ignition sources must be eliminated.

**SECTION 14: Transport information**

**Land transport (ADR/RID)**

UN number:	1402
ADR/RID class:	4.3
Classification code:	W2
Warning plate Hazard-no.:	X423
Hazard label:	4.3



ADR/RID packing group:	I
Limited quantity:	0 kg/l
Tunnel restriction code:	(B/E)
Description of the goods:	Calcium carbide
Exempt amount:	EO
Transport category:	1
Customs Tariff Number (NHM):	284910

**Marine transport IMDG**

UN number:	1402
IMDG code:	4.3
Marine pollutant:	no
Hazard label:	4.3



IMDG packing group:	I
EmS:	F-G, S-N
Limited quantity:	0 kg/l
Description of the goods:	Calcium carbide
Exempt amount:	EO

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Air transport IATA	
UN/ID number:	1402
ICAO/IATA-DGR:	4.3
Hazard label:	4.3
	
ICAO packing group:	1
Limited quantity passenger:	prohibited
IATA packing instructions passenger:	prohibited
IATA - max. quantity passenger:	prohibited
IATA- packaging instructions - Cargo:	487
IATA - max.quantity - Cargo:	15 kg
Description of the goods:	Calcium carbide

**SECTION 15: Regulatory information**

**15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:**  
 Regulation of the Slovak Government No. 355/2006 of Coll. on Employees Protection Against Risks Related to their Occupational Exposure to Chemical Factors as amended;  
 Decree No.365/2015 of Coll. stipulating Waste Catalogue  
 Regulation of the European Parliament and of the Council (EC) No.1907/2006 concerning Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).  
 Regulation of the European Parliament and of the Council (EC) No.1272/2008 concerning Classification, Labelling and Packing of Substances and Mixtures (CLP).  
 Water hazard class: WGK 1 – small water hazard.

**15.2 Chemical safety assessment:** Chemical safety assessment was carried out as a part of the substance registration according to the REACH regulation.

**SECTION 16: Other information**

Legend to abbreviations:	
Skin Irrit 2	Skin irritation, category 2
Eye Damage 1	Eye damage, category 1
STOT Sing. Exp.3	Specific Target Organ Toxicity – exposure 3
DNEL	Derived No Effect Level (derived concentration of a substance that no adverse effect)
PEL	Permissible Exposure Limit, long-term (8 hours)
CLP	CLP Regulation 1272/2008/EC
REACH	REACH Regulation 1907/2006/EC
PBT	persistent, bioaccumulative and toxic substance
vPvB	very persistent and very bioaccumulative substance
CSR	Chemical Safety Report
number ES	EINECS „European Inventory of Existing Commercial Substances“ included certain complex substances in a single entry
number CAS	unique numerical identifiers assigned by the Chemical Abstracts Service to every chemical substance described in the open scientific literature, including organic and inorganic compounds, minerals, isotopes, alloys and nonstructurable materials.

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**Full text of H-Statements referred to under sections 2 and 3:**

H260	In contact with water releases flammable gases which may ignite spontaneously.
H315	Causes skin irritation.
H318	Causes serious eye damage.
H335	May cause respiratory irritation.

**SDS revision:** The revision was performed in accordance with Regulation of the EP and of the Council (EC) No.1907/2006 (REACH) and its amending published in COMMISSION REGULATION (EU) 2015/830. Changes in Material Safety Data Sheet - Section 1; 15; 16.

**Important reference to literature and information sources at formation of Safety Data Sheet:**

Registration documentation of the substance under the Regulation No.1907/2006 REACH, national legislation, literature, CSR, ECHA.

**Instructions for training:**

For employee have to be available safety regulations under the Act 596/2002 Z. z., consulted with authorities of public health protection. Persons in contact with the product have to be provable informed about its hazardous properties, the principles of health protection, the environment, with its harmful effect and the principles of first-aid treatment.

**Access to informations:**

Every employer have to allow the access to information in Safety Data Sheet under the Regulation 1907/2006 REACH (article 35) to all workers, who use this product or they are exhibit its effects during work and also to all the substitutes of these workers.

**Other informations:**

The classification is based on the test results of product, which are performed according to registration of the substance under the REACH Regulation.

**Attachment EXPOSURE SCENARIOS / MSDS/ CALCIUM CARBIDE/**

Exposure scenarios are presented for the production of calcium carbide and the two identified uses described in Section 2:

- A) Use of calcium carbide in the production of acetylene and calcium cyanide.

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Any tonnages discussed in this document are generic and should not be taken as relating to any specific site. The scenarios and releases described in this chapter are written in accordance with the REACH Guidance and are taken mainly from or based on the following sources:

- Reference Document on Best Available Techniques (BAT) for the Manufacture of Large Volume Inorganic Chemicals.
- Information provided by calcium carbide consortium members.
- Site visits to a calcium carbide production plant and industries making use of calcium carbide.

The uses and relevant descriptor codes for each identified exposure scenario are summarised in Table 1.1.

Exposure Scenario 1 describes the production of calcium carbide.

Exposure Scenario 2 describes the milling/formulation of calcium carbide products.

Exposure Scenario 3 describes the industrial use of calcium carbide as a process material or intermediate in the production of acetylene and calcium cyanide.

Exposure Scenario 4 describes use of calcium carbide in metallurgy (use as a blast furnace hot metal desulfuriser, use as a foundry iron desulfuriser and use during steelmaking).

It should be noted that all concentrations in the soil compartment are upper limits; the significance of this is discussed in Section 10.1.

No calculation of regional releases is required, for reasons explained in Section 9.5.

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Table1.1, Overview on exposure scenarios and coverage of substance life cycle

ES number	Volume (tonnes)	Manufacture	Identified uses			Resulting life cycle stage		Linked to Identified Use	Sector of Use (SU)	Preparation Category (PC)	Process category (PROC)	Article category (AC)
			Formulation	End use	Consumer use	Service life (for articles)	Waste stage					
ES 1	300 000	X							SU 3 (main user group), SU 8 (end-use)	-	PROC 2, 8b	-
ES 2	<i>Confidential</i>		X						SU 3 (main user group), SU 10 (end-use)	PC 20	PROC 5, 8b	-
ES 3	<i>Confidential</i>			X					SU 3 (main user group), SU 8 (end-use)	PC 19	PROC 2, 8b	N/A
ES 4	<i>Confidential</i>			X					SU 3 (main user group), SU 14 (end-use)	PC 20	PROC 22 <sup>1</sup>	N/A

Notes: <sup>1</sup>Transfer of substance from/to vessels/large containers at dedicated facilities (PROC8b) is not applicable because high levels of containment are used in automated systems.

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**ES 1: Production of calcium carbide**

*Exposure scenario*

**Description of activities and processes covered in the exposure scenario**

This scenario covers the production of calcium carbide based on information provided by members of the calcium carbide consortium. It also includes information about risk management measures (RMM) in place during production.

A site visit to a calcium carbide production facility showed that in some respects it is a typical chemical production plant with a roof covering an essentially open area. The electrothermal process is not typical of the chemical industry, with very high electrical power consumption as a means of performing the required process. Production takes place on not less than 300 days per year, and each furnace can produce several hundred tonnes of calcium carbide per day. Once the continuous process has started, production continues until essential maintenance is required.

Due to the nature of the reaction and the hazards associated with acetylene, no water is used in the facility apart from a cooling jacket around the furnace crucible. There is no generation of wastewater in the production area. Signs saying “No water” are present throughout the facility.

**Operational conditions related to frequency, duration and amount of use**

Table 1.2. Duration, frequency and amount

Information type	Data field	Explanation
Used amount of substance per day	500 tonnes/day	Assumption used in the exposure assessment
Duration of exposure per day at workplace [for one worker]	>4 hours	Information provided by members of the calcium carbide consortium
Frequency of exposure at workplace [for one worker]	Once per day	
Annual amount used per site	150 000 tonnes/year	Assumption used in the exposure assessment
Emission days per site	300 days/year	Information provided by members of the calcium carbide consortium

**Operational conditions and risk management measures related to product<sup>1</sup> characteristics**

Table 1.3 shows the product characteristics. Manufacture of calcium carbide is a closed, controlled process with occasional controlled exposure. Transfer of calcium carbide to vessels or large containers takes place at dedicated facilities. Milling of calcium carbide is either carried out at a separate site or at the production sites.

– <sup>1</sup> “Product” includes substances, preparations and articles

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Table 1.3: Characteristics of the substance

Information type	Data field	Explanation
Physical state	Solid	Formed in the liquid state at high temperature, then allowed to cool and solidify
For solids: Categorisation of dust grades	Low, medium, high	The actual size of calcium carbide supplied depends on the processing requirements of the downstream use
Purity of industrial-grade calcium carbide	80%	Industrial-grade calcium carbide contains about 80% CaC <sub>2</sub> , 15% CaO and 5% other impurities in the raw material
Risk management measures related to the design of product		See text.

**Operational conditions related to available dilution capacity and characteristics of exposed humans**

Table 1.4 shows the characteristics of exposed humans that are assumed for the exposure assessment.

Table 1.4. Operational conditions related to respiration and skin contact

Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default worker respiration rate for light activity
Room size and ventilation rate	m <sup>3</sup> ; exchange per hour	
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC TRA model default: PROC2 non-dispersive use, no direct handling, palms of both hands. PROC8b: wide-dispersive use, direct handling, palms of both hands.
Body weight	70 kg	Default for workers

Environmental surroundings characteristics

A dilution factor of 40 has been used, because calcium carbide production takes place at large industrial sites. This is taken from the Emission Scenario Document in part IV of the risk assessment guidance for new and existing substances. This scenario has a standard waste water treatment plant flow rate of 10 000 m<sup>3</sup>/day.

**Other operational conditions of use**

Releases to air

Emissions of dust can be encountered at various stages over the whole production process. The main source of dust emissions is the dust-laden furnace gas. Depending on the de-dusting system, dust emissions from the use of furnace gas are between <5 and 15 mg/Nm<sup>3</sup>. Diffuse emissions arising from

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the tapping of liquid CaC<sub>2</sub> can be reduced by a fume extraction system and waste gas treatment to a large extent.

The EU IPPC BREF document on Large Volume Inorganic Chemicals (EU BREF 2007) gives the emission factor to air, in furnace and tapping gas after the de-dusting process as <110 g/t CaC<sub>2</sub> and <3 mg/Nm<sup>3</sup> respectively (common de-dusting system for tapping and furnace gas). Based on information from consortium members, a worst-case value for emissions to air is <166 g/t.

Releases of calcium carbide dust or particulates to air during manufacturing would also occur at the crushing, sieving, screening and storage stages of production. Air pollution control devices such as fabric filters and scrubbers are usually in place during these operations. The EU IPPC BREF document on Large Volume Inorganic Chemicals (EU BREF 2007) gives the emission factor to air, during the crushing of calcium carbide (after dust abatement with fabric filter) as 1 g/t calcium carbide, which is 1E-4%. Dust content and emissions is largely dependent on the method of block crushing. Final dust content of <30 g/t calcium carbide and <1 mg/m<sup>3</sup> for crushing and packaging of calcium carbide (in drums and containers) respectively, are reported for calcium carbide production in Slovenia (EU BREF 2007).

The REACH default environmental release estimates as given in Table R.16-23 in Chapter R.16 (environmental exposure estimation) of the REACH guidance are very conservative. The estimated default release to air for production of chemicals (ERC1) is given as 5%. Such a default is not applicable to calcium carbide production, as evidenced by the BREF and the site visit made by one of the authors.

It cannot be excluded that some dust will react with water vapour resulting in acetylene losses to air. For the purpose of this assessment the worst-case emission of 166 g/tonne of dust to air has been used to estimate emissions. This is assumed to include emissions from crushing, sieving, screening and storing where these are carried out on the production site.

#### Releases to water

Water is primarily used for the indirect cooling of the furnace and other devices during calcium carbide manufacturing. The cooling water is not contaminated during this use (EU BREF 2007). Fabric filters are generally used for dust abatement during crushing of block calcium carbide<sup>2</sup>.

Most of the calcium carbide dust generated during production and collected from off-gas, local exhaust ventilation and plant cleaning processes is reused or recycled. Some of the dust may however find its way to the wastewater stream during neutralisation in the drain. The main constituent (the carbide itself) will, however, react there therefore calcium hydroxide and acetylene could be present at low levels. The non-volatile impurities would remain and exposure to these impurities cannot be excluded. Table R.16-23 in Chapter R.16 (environmental exposure estimation) of the REACH guidance gives the default release estimate to wastewater for production of chemicals (ERC1) as 6%. This high default release estimate is not expected to be applicable to calcium carbide production, where no water is used during the actual production, apart from a cooling jacket around the reactor vessel.

As a reasonable estimate perhaps 1% of the dust emissions reach water as fugitive loss. However, this will ultimately generate acetylene and the volatility of acetylene produced is such that all of it would evaporate before the waste stream reaches a wastewater treatment plant. Release of the impurities in commercial CaC<sub>2</sub> could occur and the exposure of wastewater to these has been accounted for.

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– <sup>2</sup> It might be important to consider the release route for CaC<sub>2</sub> during cleaning of fabric filters.

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Emission to soil

No direct emissions to soil, although losses of dust to air followed by redeposition are included in the modelling.

**Risk management measures**

Table 1.5 summarises the risk management measures in place during production of calcium carbide.

Table 1.5. Risk management measures for industrial site

Information type	Data field	Explanation
<b>Containment and local exhaust ventilation</b>		
Containment plus good work practice required		
Local exhaust ventilation required plus good work practise	No	
<b>Personal protective equipment (PPE)</b>		
Skin protection	Protective gloves and clothing are used	Information from production sites
Eye protection	Goggles are used	Information from production sites
Respiratory protection	Respirators are used	Information from production sites
Others	Skin protection creams	Information from production sites
<b>Other risk management measures related to workers</b>		
<b>Risk management measures related to environmental emissions from industrial sites</b>		
Onsite pre-treatment of wastewater	No measured data	
Resulting fraction of initially applied amount in wastewater released from site to the external sewage system	1.7x10 <sup>-6</sup> kg/kg	
Air emission abatement	Scrubbers, Fabric filters	Information from production sites
Resulting fraction of applied amount in waste gas released to environment	1.7x10 <sup>-4</sup> kg/kg	Value is fraction of tonnage produced, expressed as calcium carbide, in the form of dust.
Onsite waste treatment	No measured data.	
Fraction of initially applied amount sent to external waste treatment. This is the sum of direct losses from processes to waste, and the residues from onsite wastewater and waste gas treatment.	1.7x10 <sup>-4</sup> kg/kg	

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Information type	Data field	Explanation
Municipal or other type of external wastewater treatment	Yes	Generic environmental surrounding characteristics considered covers both on-site wastewater and municipal or external wastewater treatment
Effluent (of the wastewater treatment plant) discharge rate	10 000 m <sup>3</sup> /day discharged to wastewater treatment plant	Standard size wastewater treatment plant for highly industrial sites.
Recovery of sludge for agriculture or horticulture	Yes	The spreading of sludge is assumed in accordance with the default models, but is not believed to occur at every location.

### Waste related measures

Waste generated from calcium carbide production is mainly ferrosilicon (FeSi) with CaC<sub>2</sub> and calcium carbide dust. CaC<sub>2</sub> is separated from ferrosilicon and is reused, recycled or neutralised.

Calcium Carbide dust from air emission abatement devices and cleaning operations is also reused, recycled or neutralised.

Solid waste is handled differently across production sites. Some production sites recover dust into other production streams or convert it to hydrated lime in an acetylene generator.

Solid waste from the furnace off-gas scrubbing system is sent to an approved on-site settling lagoon at some production sites, while substances from filters are treated with small amounts of water to decompose carbide and then deposited in dedicated landfills.

### Exposure estimation

#### Workers exposure

##### Acute/Short term exposure

Workers at industrial sites are routinely involved with the same tasks; therefore it is more appropriate to consider long-term exposure.

##### Long-term exposure

Human exposure from production and industrial use, based on the known work pattern, has been estimated using the ECETOC TRA screening tool and measured data. Table 1.1 shows the REACH process categories important for human exposure assessment for the life cycle and identified uses of calcium carbide. Predictions are retained for reference.

In a typical calcium carbide production plant, molten calcium carbide from the reaction furnace is allowed to pour into iron trucks, which take around 300 kg each. These are placed under the reactor one after another on an automated rail system, and after filling they are moved into a storage area to cool, which takes around 24 hours. Due to the intense heat, workers are at least 20 m away behind



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screens, in full protective clothing and helmets. Additionally there is ventilation for dust and furnace gas to prevent workers from being exposed.

Deposits of powder of calcium oxide /carbide are found on the floor in the production area. These vary from 1 mm on general floor areas to 5 cm in depth around less accessible areas. Exhaust systems are used to reduce the amount of dust in the air. Worker exposure to dust can occur and is monitored. It is estimated that around 166 g of dust are generated for each tonne of carbide produced. This is a consequence of the large scale handling of solids under conditions which are open at some stages in the processing.

Measurements from a typical production site

Maximum exposure levels occur in the vicinity of the silo automatic loading. The average exposure is 5.5 mg/m<sup>3</sup>. The maximum exposure occurs when depositions of dust are swirled up during operating mode, with a measured value of 54.7 mg/m<sup>3</sup>. This operation mode works three times a day for 30 minutes and workers' exposure time is approximately 10 minutes per 30 minutes' operation.

These values are above the UK Workplace Exposure Limits (WELs) for calcium oxide therefore PPE in the form of respiratory protective equipment such as the mask FFP3 is required. Qualitative assessment indicates that use of PPE is sufficient to reduce exposure to an acceptable level. The UK WEL for calcium oxide is 2 mg/m<sup>3</sup> and for calcium hydroxide the UK WEL is 5 mg/m<sup>3</sup>. These values are based on an 8-hour TWA reference period.

#### Oral exposure

Eating and drinking at the workplace is forbidden across production sites. Hence, workers' exposure via ingestion of calcium carbide is not expected.

#### Dermal exposure

Risk management measures used to prevent dermal exposures at most production sites include gloves, protective clothing, goggles and skin protection creams (used during crushing operations). Inappropriate use of PPE can result in skin irritation and burns.

Tier 1 dermal exposure estimates based on the ECETOC TRA workers' model have been estimated for the production of calcium carbide (PROC 2 and 8b) and milling/formulation of calcium carbide products (PROC 5). According to the ECETOC assumptions for these process categories, the exposed skin surface area (palms of both hands) is 480 cm<sup>2</sup> and LEV is assumed to be present. For PROC 2 (use in closed, continuous process with occasional controlled exposure), non-dispersive use and no direct handling is assumed. For PROC 8b (transfer from/to large dedicated vessels), wide-dispersive use, direct handling and intermittent exposure is assumed.

No modifying factor (e.g. use of personal protective equipments) has been applied, except the use of local exhaust ventilation. Human health exposures during production and industrial uses of calcium carbide have been considered for the neat substance. In cases where calcium carbide is formulated during milling and formulated products are used in metallurgy, it is important to consider exposure to calcium carbide preparations and the concentration of calcium carbide in such preparation.

#### Inhalation exposure

A limited amount of dust is always prevalent during production. Exposure of workers via inhalation is prevented by use of respirators. Dust concentration in the work place has been measured to be in the range 1 to 5 mg/m<sup>3</sup>, with calcium carbide content of 20 to 50%, in the areas of highest dust in the plant. Duration of workers exposure to dust is reported to be for 1-4 hours per shift.

Tier 1 inhalation exposure estimates based on the ECETOC TRA workers' model have been estimated for the production of calcium carbide (PROC 2 and 8b) and milling/formulation of calcium carbide products (PROC 5).

Based on the use pattern information and fugacity banding of the ECETOC model, the availability of calcium carbide for inhalation exposures has been assumed to fall in the 'medium' fugacity band i.e. slightly dusty during production and industrial use in acetylene production; and the 'high' fugacity band i.e. highly dusty during milling; and industrial use in metallurgy and calcium cyanamide production.

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No modifying factor (e.g. use of respiratory protective equipments) has been applied, except the use of local exhaust ventilation. Human health inhalation exposures during production and industrial uses of calcium carbide have been considered for the whole substance. The inhalation exposure estimate of 2.5 mg/m<sup>3</sup> from the ECETOC TRA model for the milling process falls in the range of measured workplace dust concentrations (1 to 5 mg/m<sup>3</sup>, with 20 to 50% calcium carbide concentration) specified by members of the calcium carbide consortium.

An exposure time of 1-4 hours is should be assumed.

In cases where calcium carbide is formulated during milling and formulated products are used in metallurgy, it is important to consider exposure to calcium carbide preparations and the concentration of calcium carbide in such preparation will be required.

Table 1.6. Long-term exposure concentrations to workers

Routes of exposure	Estimated exposure concentrations		Estimated exposure concentrations		Explanation / source of measured data
	value	unit	Value	unit	
Dermal exposure	0.14	mg/kg/day	-	-	ECETOC TRA model prediction for PROC 2 (production)
	0.69	mg/kg/day	-	-	ECETOC TRA model prediction for PROC 8b (production)
	0.07	mg/kg/day	-	-	ECETOC TRA model prediction for PROC 5 (milling)
Inhalation exposure	0.05	mg/m <sup>3</sup>	0.007 <sup>a</sup>	mg/kg/day	ECETOC TRA model prediction for PROC 2 (production)
	0.25	mg/m <sup>3</sup>	0.036 <sup>a</sup>	mg/kg/day	ECETOC TRA model prediction for PROC 8b (production)
	2.5	mg/m <sup>3</sup>	0.36	mg/kg/day	ECETOC TRA model prediction for PROC 5 (milling)

Notes:<sup>a</sup> Calculated assuming a default bodyweight of 70 kg for workers and a default respiratory volume of 10 m<sup>3</sup>, light activity, for an 8 hour work shift.

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Table 1.7. Summary of long-term exposure concentration to workers

<b>Routes of exposure</b>	<b>Concentrations</b>	<b>Justification</b>
Dermal local exposure (in mg/cm <sup>2</sup> )		
Dermal systemic exposure (in mg/kg bw/d)	0.69	Worst case ECETOC TRA model prediction for PROC 8b (production)
Inhalation exposure (in mg/m <sup>3</sup> )/8h workday <sup>3</sup>	2.5	Worst case ECETOC TRA model prediction for PROC 5 (milling)

### Consumer exposure

There is no consumer exposure from the production of calcium carbide.

### Indirect exposure of humans via the environment (oral)

There is no oral exposure of humans via the environment.

### Environmental exposure

Predicted Environmental Calculations (PECs) have been determined using EUSES 2.1.1. The EUSES program implements the environmental exposure models described in REACH Technical Guidance Chapter R16. Default model parameters have been used with the following exceptions:

Lowest daily flow rate to WWTP – 10 000 m<sup>3</sup>/day

Dilution factor – 40 (EU TGD Part IV, EC 2003)

Local tonnage – 500 tonnes per day

Number of days – 300 days

There is only one site in the Region.

### Environmental releases

The release fractions are discussed in Section 1.1.1.5. From this, emissions to air as dust are 166 g/tonne, as calcium carbide. As discussed in Section 7 for the environment the assessment is considering the two impurities calcium cyanamide (as cyanamide) and calcium sulfide. The maximum content of calcium cyanamide in calcium carbide is 5% by weight (see Section 1.2), hence the emission factor is 8.3 g/tonne. For calcium sulfide, the maximum content is 1.3% by weight (see Section 1.2), hence the emission factor is 2.2 g/tonne.

– <sup>3</sup> air concentration at the workplace

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For water, the emissions are 1% of those to air, or 1.7 g/tonne as calcium carbide. The corresponding emission factors for the two impurities are 83 mg/tonne for calcium cyanamide and 22 mg/tonne for calcium sulfide.

These factors are applied to a site producing 500 tonnes of calcium carbide per day.

No measured values for released amounts are available, so the calculated values are used in the exposure estimation. These are summarised in Table 1.8 and 1.9.

Table 1.8. Summary of the releases to the environment - cyanamide

Compartments	Release <sup>1</sup> from point source (kg/d) (local exposure estimation)	Justification
Aquatic (without STP)	0.022	Release calculated based on local tonnage
Aquatic (after STP)	2.8E-03	
Air (direct + STP)	2.2	Point source release rate, direct only.
Soil (direct releases only)		None

Notes: <sup>1</sup> Releases converted to cyanamide basis.

Table 1.9. Summary of the releases to the environment – calcium sulfide

Compartments	Release from point source (kg/d) (local exposure estimation)	Justification
Aquatic (without STP)	0.011	Release calculated based on local tonnage
Aquatic (after STP)	0.011	No removal in STP
Air (direct + STP)	1.1	Point source release rate, direct only.
Soil (direct releases only)		None

**Exposure concentrations in the environment**

Table 1.10 summarises the exposure concentrations for cyanamide calculated using EUSES 2.1.1.

Table 1.10. Summary of exposure concentrations from production – cyanamide

STP OUTPUT	Value	Unit
Fraction of emission directed to air by STP	5.14E-06	[%]

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Fraction of emission directed to water by STP	12.7	[%]
Fraction of emission directed to sludge by STP	0.037	[%]
Fraction of the emission degraded in STP	87.3	[%]
Total of fractions	100	[%]
Local indirect emission to air from STP during episode	1.13E-09	[kg.d-1]
Concentration in untreated wastewater	2.20E-03	[mg.l-1]
Concentration of chemical (total) in the STP-effluent	2.78E-04	[mg.l-1]
Concentration in effluent exceeds solubility	No	
Concentration in dry sewage sludge	2.06E-03	[mg.kg-1]
PEC for micro-organisms in the STP	2.78E-04	[mg.l-1]
<b>LOCAL CONCENTRATIONS AND DEPOSITIONS</b>		
<b>AIR</b>		
Concentration in air during emission episode	6.12E-04	[mg.m-3]
Annual average concentration in air, 100 m from point source	5.03E-04	[mg.m-3]
Total deposition flux during emission episode	1.10E-03	[mg.m-2.d-1]
Annual average total deposition flux	9.08E-04	[mg.m-2.d-1]
<b>WATER, SEDIMENT</b>		
Concentration in surface water during emission episode (dissolved)	6.96E-06	[mg.l-1]
Concentration in surface water exceeds solubility	No	
Annual average concentration in surface water (dissolved)	5.72E-06	[mg.l-1]
Concentration in seawater during emission episode (dissolved)	2.20E-05	[mg.l-1]
Annual average concentration in seawater (dissolved)	1.81E-05	[mg.l-1]
<b>SOIL, GROUNDWATER</b>		
Concentration in agric. soil averaged over 30 days	8.91E-05	[mg.kgwwt-1]
Concentration in agric. soil averaged over 180 days	8.76E-05	[mg.kgwwt-1]
Concentration in grassland averaged over 180 days	1.40E-04	[mg.kgwwt-1]
Fraction of steady-state (agricultural soil)	1	[-]
Fraction of steady-state (grassland soil)	1	[-]
<b>LOCAL PECS [PRODUCTION]</b>		
<b>AIR</b>		
Annual average local PEC in air (total)	5.03E-04	[mg.m-3]
<b>WATER, SEDIMENT</b>		
Local PEC in surface water during emission episode (dissolved)	6.96E-06	[mg.l-1]
Qualitative assessment might be needed (TGD Part II, 5.6)	No	

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Annual average local PEC in surface water (dissolved)	5.72E-06	[mg.l-1]
Local PEC in fresh-water sediment during emission episode	6.04E-06	[mg.kgwwt-1]
Local PEC in seawater during emission episode (dissolved)	2.20E-05	[mg.l-1]
Qualitative assessment might be needed (TGD Part II, 5.6)	No	
Annual average local PEC in seawater (dissolved)	1.81E-05	[mg.l-1]
Local PEC in marine sediment during emission episode	1.91E-05	[mg.kgwwt-1]
<b>SOIL, GROUNDWATER</b>		
Local PEC in agric. soil (total) averaged over 30 days	8.91E-05	[mg.kgwwt-1]
Local PEC in agric. soil (total) averaged over 180 days	8.76E-05	[mg.kgwwt-1]
Local PEC in grassland (total) averaged over 180 days	1.40E-04	[mg.kgwwt-1]
Local PEC in pore water of agricultural soil	4.69E-04	[mg.l-1]
Local PEC in pore water of grassland	7.49E-04	[mg.l-1]
Local PEC in groundwater under agricultural soil	4.69E-04	[mg.l-1]

Table 1.11. summarises the exposure concentrations for calcium sulfide calculated using EUSES 2.1.1.

Table 1. 11. Summary of exposure concentrations from production – calcium sulfide

<b>STP OUTPUT</b>	<b>Value</b>	<b>Unit</b>
Fraction of emission directed to air by STP	4.33E-10	[%]
Fraction of emission directed to water by STP	6.51	[%]
Fraction of emission directed to sludge by STP	0.0292	[%]
Fraction of the emission degraded in STP	93.5	[%]
Total of fractions	100	[%]
Local indirect emission to air from STP during episode	4.77E-14	[kg.d-1]
Concentration in untreated wastewater	1.10E-03	[mg.l-1]
Concentration of chemical (total) in the STP-effluent	7.16E-05	[mg.l-1]
Concentration in effluent exceeds solubility	No	
Concentration in dry sewage sludge	8.12E-04	[mg.kg-1]
PEC for micro-organisms in the STP	7.16E-05	[mg.l-1]
<b>LOCAL CONCENTRATIONS AND DEPOSITIONS</b>		
<b>AIR</b>		
Concentration in air during emission episode	3.06E-04	[mg.m-3]
Annual average concentration in air, 100 m from point source	2.51E-04	[mg.m-3]
Total deposition flux during emission episode	0.011	[mg.m-2.d-1]
Annual average total deposition flux	9.01E-03	[mg.m-2.d-1]
<b>WATER, SEDIMENT</b>		
Concentration in surface water during emission episode (dissolved)	1.79E-06	[mg.l-1]

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Concentration in surface water exceeds solubility	No	
Annual average concentration in surface water (dissolved)	1.47E-06	[mg.l-1]
Concentration in seawater during emission episode (dissolved)	1.10E-05	[mg.l-1]
Annual average concentration in seawater (dissolved)	9.04E-06	[mg.l-1]
<b>SOIL, GROUNDWATER</b>		
Concentration in agric. soil averaged over 30 days	3.78E-05	[mg.kgwwt-1]
Concentration in agric. soil averaged over 180 days	3.78E-05	[mg.kgwwt-1]
Concentration in grassland averaged over 180 days	7.47E-05	[mg.kgwwt-1]
Fraction of steady-state (agricultural soil)	1	[-]
Fraction of steady-state (grassland soil)	1	[-]
<b>LOCAL PECS [PRODUCTION]</b>		
	<b>Value</b>	<b>Unit</b>
<b>AIR</b>		
Annual average local PEC in air (total)	2.51E-04	[mg.m-3]
<b>WATER, SEDIMENT</b>		
Local PEC in surface water during emission episode (dissolved)	1.79E-06	[mg.l-1]
Qualitative assessment might be needed (TGD Part II, 5.6)	No	
Annual average local PEC in surface water (dissolved)	1.47E-06	[mg.l-1]
Local PEC in fresh-water sediment during emission episode	1.52E-06	[mg.kgwwt-1]
Local PEC in seawater during emission episode (dissolved)	1.10E-05	[mg.l-1]
Qualitative assessment might be needed (TGD Part II, 5.6)	No	
Annual average local PEC in seawater (dissolved)	9.04E-06	[mg.l-1]
Local PEC in marine sediment during emission episode	9.36E-06	[mg.kgwwt-1]
<b>SOIL, GROUNDWATER</b>		
Local PEC in agric. soil (total) averaged over 30 days	3.78E-05	[mg.kgwwt-1]
Local PEC in agric. soil (total) averaged over 180 days	3.78E-05	[mg.kgwwt-1]
Local PEC in grassland (total) averaged over 180 days	7.47E-05	[mg.kgwwt-1]
Local PEC in pore water of agricultural soil	2.18E-04	[mg.l-1]
Local PEC in pore water of grassland	4.31E-04	[mg.l-1]
Local PEC in groundwater under agricultural soil	2.18E-04	[mg.l-1]

**Exposure concentration relevant for the food chain (Secondary poisoning)**

Neither of the two impurities being considered accumulates in the food chain, so the assessment of secondary poisoning is not considered further.

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**ES 2: Milling/formulation of calcium carbide products**

**Description of activities and processes covered in the exposure scenario**

This scenario covers the milling of calcium carbide based on information provided by members of the calcium carbide consortium.

Due to the hazards associated with acetylene, no water is used in the facility.

**Operational conditions related to frequency, duration and amount of use**

Table 1.12. Duration, frequency and amount

Information type	Data field	Explanation
Used amount of substance per day	500 tonnes/day	Assumption used in the exposure assessment
Duration of exposure per day at workplace [for one worker]	>4 hours	Information provided by members of the calcium carbide consortium
Frequency of exposure at workplace [for one worker]	Once per day	
Annual amount used per site	150 000 tonnes/year	Assumption used in the exposure assessment
Emission days per site	300 days/year	Information provided by members of the calcium carbide consortium

**Operational conditions and risk management measures related to product<sup>4</sup> characteristics**

Table 1.13. shows the product characteristics. Milling or formulation of calcium carbide is either carried out at a separate site or at the production sites (mixing of blending in batch process).

Table 1.13. Characteristics of the substance

Information type	Data field	Explanation
Physical state	Solid	Formed in the liquid state at high temperature, then allowed to cool and solidify
For solids: Categorisation of dust grades	Low, medium, high	The actual size of calcium carbide supplied depends on the processing requirements of the downstream use
Purity of industrial-grade calcium carbide	80%	Industrial-grade calcium carbide contains about 80% CaC <sub>2</sub> , 15% CaO and 5% other impurities in the raw material
Risk management measures related to the design of product		See text.

– <sup>4</sup> “Product” includes substances, preparations and articles



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**Operational conditions related to available dilution capacity and characteristics of exposed humans**

Table 1.64. Operational conditions related to respiration and skin contact

Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default worker respiration rate for light activity
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC TRA model default: PROC2 non-dispersive use, no direct handling, palms of both hands. PROC8b: wide-dispersive use, direct handling, palms of both hands.
Body weight	70 kg	Default for workers

Environmental surroundings characteristics  
Standard environment assumed.

**Other operational conditions of use**

Releases to air

Releases of calcium carbide dust or particulates to air will occur at the crushing, sieving, screening and storage stages. Air pollution control devices such as fabric filters and scrubbers are usually in place during these operations. The EU IPPC BREF document on Large Volume Inorganic Chemicals (EU BREF 2007) gives the emission factor to air, during the crushing of calcium carbide (after dust abatement with fabric filter) as 1 g/t calcium carbide, which is 1E-4%. Dust content and emissions is largely dependent on the method of block crushing.

The REACH default environmental release estimates as given in Table R.16-23 in Chapter R.16 (environmental exposure estimation) of the REACH guidance are very conservative. The estimated default release to air for formulation of preparations (ERC2) is given as 2.5%.

For the purpose of this assessment the worst-case emission of 1 g/tonne of dust to air has been used to estimate emissions. This is assumed to include emissions from crushing, sieving, screening and storing.

Releases to water

Table R.16-23 in Chapter R.16 (environmental exposure estimation) of the REACH guidance gives the default release estimate to wastewater for formulation of preparations (ERC2) as 2%. As the substance reacts with water to produce acetylene, the use of water on such sites is avoided and therefore the default factor is an over-estimate. It has been assumed that the factor for production sites (1% of the dust emissions) is also reasonable here.

Emission to soil

**Risk management measures**

Table 1.15 summarises the risk management measures in place during the milling/formulation of calcium carbide.

Table 1.75. Risk management measures for industrial site

Information type	Data field	Explanation
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Information type	Data field	Explanation
<b>Containment and local exhaust ventilation</b>		
Containment plus good work practice required	No measured data	
Local exhaust ventilation required plus good work practise		
<b>Personal protective equipment (PPE)</b>		
Skin protection	Protective gloves and clothing are used	Company information
Eye protection	Goggles are used	Company information
Respiratory protection	Respirators are used	Company specific information
Others	Skin protection creams	Company specific information
<b>Other risk management measures related to workers</b>		
<b>Risk management measures related to environmental emissions from industrial sites</b>		
Onsite pre-treatment of wastewater	No measured data.	
Resulting fraction of initially applied amount in wastewater released from site to the external sewage system	1x10 <sup>-8</sup> kg/kg	
Air emission abatement	No measured data.	
Resulting fraction of applied amount in waste gas released to environment	1x10 <sup>-6</sup> kg/kg	
Onsite waste treatment	No measured data.	
Fraction of initially applied amount sent to external waste treatment. This is the sum of direct losses from processes to waste, and the residues from onsite wastewater and waste gas treatment.	1x10 <sup>-6</sup> kg/kg	
Municipal or other type of external wastewater treatment	Yes	Generic environmental surrounding characteristics considered covers both on-site wastewater and municipal or external wastewater treatment.
Effluent (of the wastewater treatment plant) discharge rate	2 000 m <sup>3</sup> /d discharged to wastewater treatment plant	Default.
Recovery of sludge for agriculture or horticulture	Yes	The spreading of sludge is assumed a worst-case scenario.

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### *Exposure estimation*

## **Workers exposure**

### Acute/Short term exposure

Workers at industrial sites are routinely involved with the same tasks; therefore it is more appropriate to consider long-term exposure.

### Long-term exposure

Human exposure from milling/formulation, based on the known work pattern has been estimated using the ECETOC TRA screening tool. Exposures as measured for the production scenario may also be relevant. Therefore personal protective equipment as described for ES 1 will also be needed if the limits are exceeded locally.

An important consideration for human health exposure assessment is exposure to the impurities in calcium carbide that have been classified as harmful to human health Table 1.1 shows the REACH process categories, important for human exposure assessment, for the life cycle and identified uses of calcium carbide.

#### Oral exposure

Eating and drinking at the workplace is forbidden across sites. Hence, workers' exposure via ingestion of calcium carbide is not expected.

#### Dermal exposure

Risk management measures used to prevent dermal exposures at most sites include gloves, protective clothing, goggles and skin protection creams (used during crushing operations). Inappropriate use of PPE can result in skin irritation and burns.

Tier 1 dermal exposure estimates based on the ECETOC TRA workers' model have been estimated for the milling/formulation of calcium carbide (PROC 5; mixing or blending in batch process). According to the ECETOC assumptions for this process category, the exposed skin surface area (palms of both hands) is 480 cm<sup>2</sup> and LEV is assumed to be present.

No modifying factor (e.g. use of personal protective equipments) has been applied, except the use of local exhaust ventilation. Human health exposures during milling/formulation of calcium carbide have been considered for the neat substance.

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Inhalation exposure

Tier 1 inhalation exposure estimates based on the ECETOC TRA workers' model have been estimated for the milling/formulation of calcium carbide (PROC 5).

In cases where calcium carbide is formulated during milling, it is important to consider exposure to calcium carbide preparations and the concentration of calcium carbide in such preparation is required.

Table 1.16. Long-term exposure concentrations to workers

Routes of exposure	Estimated exposure concentrations		Measured exposure concentrations		Explanation / source of measured data
	Value	Unit	Value	Unit	
Dermal exposure <sup>a</sup>	0.07	mg/kg/day	-	-	ECETOC TRA model prediction for PROC 5 (milling)
Inhalation exposure	2.5	mg/m <sup>3</sup>	3.8	-	Maximum value from industrial measurement

Notes: <sup>a</sup> Calculated assuming a default bodyweight of 70 kg for workers and a default respiratory volume of 10 m<sup>3</sup>, light activity, for an 8 hour work shift.

Table 1.8: Summary of long-term exposure concentration to workers

Routes of exposure	Concentrations	Justification
Dermal local exposure (in mg/cm <sup>2</sup> )	0.01	ECETOC TRA model prediction for PROC 5 (milling)
Dermal systemic exposure <sup>a</sup> (in mg/kg bw/d)	0.07	ECETOC TRA model prediction for PROC 5 (milling)
Inhalation exposure <sup>a</sup> (in mg/m <sup>3</sup> )/8h workday <sup>5</sup>	0.36	ECETOC TRA model prediction for PROC 5 (milling)

Notes: <sup>a</sup> Calculated assuming a default bodyweight of 70 kg for workers and a default respiratory volume of 10 m<sup>3</sup>, light activity, for an 8 hour work shift.

**Consumer exposure**

There is no consumer exposure from the milling/formulation of calcium carbide.

**Indirect exposure of humans via the environment (oral)**

There is no oral exposure of humans via the environment.

– <sup>5</sup> air concentration at the workplace

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**Environmental exposure**

Predicted Environmental Calculations (PECs) have been determined using EUSES 2.1.1. The EUSES program implements the environmental exposure models described in REACH Technical Guidance Chapter R16. Default model parameters have been used.

Local tonnage – 500 tonnes per day

Number of days – 300 days.

**Environmental releases**

The release fractions are discussed in Section 1.2.1.5. From this, emissions to air as dust are 1 g/tonne, as calcium carbide. As discussed in Section 7 for the environment the assessment is considering the two impurities calcium cyanamide (as cyanamide) and calcium sulfide. The maximum content of calcium cyanamide in calcium cyanamide is 5% by weight (see Section 1.2), hence the emission factor is 0.05 g/tonne. For calcium sulfide, the maximum content is 1.3% by weight (see Section 1.2), hence the emission factor is 0.013 g/tonne.

For water, the emissions are 1% of those to air, or 0.01 g/tonne as calcium carbide. The corresponding emission factors for the two impurities are 0.5 mg/tonne for calcium cyanamide and 0.13 mg/tonne for calcium sulfide.

These factors are applied to a site handling 500 tonnes of calcium carbide per day.

No measured values for released amounts are available, so the calculated values are used in the exposure estimation. These are summarised in **Chyba! Nenašiel sa žiaden zdroj odkazov.** and Table 1.19.

Table 1.18. Summary of the releases to the environment - cyanamide

Compartments	Release <sup>1</sup> from point source (kg/d) (local exposure estimation)	Justification
Aquatic (without STP)	1.3E-04	Release calculated based on local tonnage
Aquatic (after STP)	1.7E-05	
Air (direct + STP)	0.013	Point source release rate, direct only.
Soil (direct releases only)		None

Note: <sup>1</sup> releases converted to cyanamide basis

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Table 1.19. Summary of the releases to the environment – calcium sulfide

Compartments	Release from point source (kg/d) (local exposure estimation)	Justification
Aquatic (without STP)	6.5E-05	Release calculated based on local tonnage
Aquatic (after STP)	6.5E-05	No removal in STP
Air (direct + STP)	6.6E-03	Point source release rate, direct only.
Soil (direct releases only)		None

Exposure concentration in the environment

Table 1.20. Summary of exposure concentrations from milling/formulation – cyanamide

OUTPUT	Value	Unit
Fraction of emission directed to air by STP	5.16E-06	[%]
Fraction of emission directed to water by STP	12.7	[%]
Fraction of emission directed to sludge by STP	0.037	[%]
Fraction of the emission degraded in STP	87.3	[%]
Total of fractions	100	[%]
Local indirect emission to air from STP during episode	6.70E-12	[kg.d-1]
Concentration in untreated wastewater	6.50E-05	[mg.l-1]
Concentration of chemical (total) in the STP-effluent	8.23E-06	[mg.l-1]
Concentration in effluent exceeds solubility	No	
Concentration in dry sewage sludge	6.09E-05	[mg.kg-1]
PEC for micro-organisms in the STP	8.23E-06	[mg.l-1]
LOCAL CONCENTRATIONS AND DEPOSITIONS	Value	Unit
AIR		
Concentration in air during emission episode	3.61E-06	[mg.m-3]
Annual average concentration in air, 100 m from point source	2.97E-06	[mg.m-3]
Total deposition flux during emission episode	6.53E-06	[mg.m-2.d-1]
Annual average total deposition flux	5.37E-06	[mg.m-2.d-1]
WATER, SEDIMENT		
Concentration in surface water during emission episode (dissolved)	8.23E-07	[mg.l-1]
Concentration in surface water exceeds solubility	No	
Annual average concentration in surface water (dissolved)	6.76E-07	[mg.l-1]

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Concentration in seawater during emission episode (dissolved)	6.50E-07	[mg.l-1]
Annual average concentration in seawater (dissolved)	5.34E-07	[mg.l-1]
<b>SOIL, GROUNDWATER</b>		
Concentration in agric. soil averaged over 30 days	5.73E-07	[mg.kgwwt-1]
Concentration in agric. soil averaged over 180 days	5.31E-07	[mg.kgwwt-1]
Concentration in grassland averaged over 180 days	8.31E-07	[mg.kgwwt-1]
Fraction of steady-state (agricultural soil)	1	[-]
Fraction of steady-state (grassland soil)	1	[-]
<b>LOCAL PECS [INDUSTRIAL USE]</b>		
	<b>Value</b>	<b>Unit</b>
<b>AIR</b>		
Annual average local PEC in air (total)	2.97E-06	[mg.m-3]
<b>WATER, SEDIMENT</b>		
Local PEC in surface water during emission episode (dissolved)	8.23E-07	[mg.l-1]
Qualitative assessment might be needed (TGD Part II, 5.6)	No	
Annual average local PEC in surface water (dissolved)	6.76E-07	[mg.l-1]
Local PEC in fresh-water sediment during emission episode	7.14E-07	[mg.kgwwt-1]
Local PEC in seawater during emission episode (dissolved)	6.50E-07	[mg.l-1]
Qualitative assessment might be needed (TGD Part II, 5.6)	No	
Annual average local PEC in seawater (dissolved)	5.34E-07	[mg.l-1]
Local PEC in marine sediment during emission episode	5.64E-07	[mg.kgwwt-1]
<b>SOIL, GROUNDWATER</b>		
Local PEC in agric. soil (total) averaged over 30 days	5.73E-07	[mg.kgwwt-1]
Local PEC in agric. soil (total) averaged over 180 days	5.31E-07	[mg.kgwwt-1]
Local PEC in grassland (total) averaged over 180 days	8.31E-07	[mg.kgwwt-1]
Local PEC in pore water of agricultural soil	2.84E-06	[mg.l-1]
Local PEC in pore water of grassland	4.45E-06	[mg.l-1]
Local PEC in groundwater under agricultural soil	2.84E-06	[mg.l-1]

Table 1.21 summarises the exposure concentrations for calcium sulfide calculated using EUSES 2.1.1.

Table 1.21. **Summary of exposure concentrations from milling/formulation – calcium sulfide**

<b>OUTPUT</b>	<b>Value</b>	<b>Unit</b>
Fraction of emission directed to air by STP	1.25E-10	[%]
Fraction of emission directed to water by STP	6.51	[%]
Fraction of emission directed to sludge by STP	0.0292	[%]
Fraction of the emission degraded in STP	93.5	[%]

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Total of fractions	100	[%]
Local indirect emission to air from STP during episode	8.15E-17	[kg.d-1]
Concentration in untreated wastewater	3.25E-05	[mg.l-1]
Concentration of chemical (total) in the STP-effluent	2.11E-06	[mg.l-1]
Concentration in effluent exceeds solubility	No	
Concentration in dry sewage sludge	2.40E-05	[mg.kg-1]
PEC for micro-organisms in the STP	2.11E-06	[mg.l-1]
<b>LOCAL CONCENTRATIONS AND DEPOSITIONS</b>	<b>Value</b>	<b>Unit</b>
<b>AIR</b>		
Concentration in air during emission episode	1.83E-06	[mg.m-3]
Annual average concentration in air, 100 m from point source	1.51E-06	[mg.m-3]
Total deposition flux during emission episode	6.58E-05	[mg.m-2.d-1]
Annual average total deposition flux	5.40E-05	[mg.m-2.d-1]
<b>WATER, SEDIMENT</b>		
Concentration in surface water during emission episode (dissolved)	2.11E-07	[mg.l-1]
Concentration in surface water exceeds solubility	No	
Annual average concentration in surface water (dissolved)	1.74E-07	[mg.l-1]
Concentration in seawater during emission episode (dissolved)	3.25E-07	[mg.l-1]
Annual average concentration in seawater (dissolved)	2.67E-07	[mg.l-1]
<b>SOIL, GROUNDWATER</b>		
Concentration in agric. soil averaged over 30 days	2.28E-07	[mg.kgwwt-1]
Concentration in agric. soil averaged over 180 days	2.27E-07	[mg.kgwwt-1]
Concentration in grassland averaged over 180 days	4.48E-07	[mg.kgwwt-1]
Fraction of steady-state (agricultural soil)	1	[-]
Fraction of steady-state (grassland soil)	1	[-]
<b>LOCAL PECS [INDUSTRIAL USE]</b>	<b>Value</b>	<b>Unit</b>
<b>AIR</b>		
Annual average local PEC in air (total)	1.51E-06	[mg.m-3]
<b>WATER, SEDIMENT</b>		
Local PEC in surface water during emission episode (dissolved)	2.11E-07	[mg.l-1]
Qualitative assessment might be needed (TGD Part II, 5.6)	No	
Annual average local PEC in surface water (dissolved)	1.74E-07	[mg.l-1]
Local PEC in fresh-water sediment during emission episode	1.80E-07	[mg.kgwwt-1]
Local PEC in seawater during emission episode (dissolved)	3.25E-07	[mg.l-1]



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Qualitative assessment might be needed (TGD Part II, 5.6)	No	
Annual average local PEC in seawater (dissolved)	2.67E-07	[mg.l-1]
Local PEC in marine sediment during emission episode	2.77E-07	[mg.kgwwt-1]
<b>SOIL, GROUNDWATER</b>		
Local PEC in agric. soil (total) averaged over 30 days	2.28E-07	[mg.kgwwt-1]
Local PEC in agric. soil (total) averaged over 180 days	2.27E-07	[mg.kgwwt-1]
Local PEC in grassland (total) averaged over 180 days	4.48E-07	[mg.kgwwt-1]
Local PEC in pore water of agricultural soil	1.31E-06	[mg.l-1]
Local PEC in pore water of grassland	2.58E-06	[mg.l-1]
Local PEC in groundwater under agricultural soil	1.31E-06	[mg.l-1]

Exposure concentration relevant for the food chain (Secondary poisoning)

Neither of the two impurities being considered accumulates in the food chain, so the assessment of secondary poisoning is not considered further.

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**ES 3: Use as an intermediate in the production of acetylene and calcium cyanamide**

*Exposure scenario*

**Description of activities and processes covered in the exposure scenario**

This scenario covers the use of calcium carbide in the production of acetylene, based on information provided by members of the calcium carbide consortium.  
 Calcium carbide is used as a process material or intermediate in the production of acetylene and calcium cyanamide. Releases can be estimated using the REACH or standard TGD defaults, once the tonnage in this use is known.  
 Essentially, calcium carbide is transformed to other products during industrial use. However, exposure of soil and water (via raw material, process and product handling) to the impurities in commercial CaC<sub>2</sub> would be expected during this use. Emissions to the environment of calcium carbide and impurities in raw materials handling are considered here. Emissions of the impurities in waste from the processes are considered to be addressed in the assessments of the production of acetylene and calcium cyanamide.

**Operational conditions related to frequency, duration and amount of use**

A document (EIGA 2008) calculating emissions of acetylene to air from an acetylene production plant provides information on the amounts used per day at a typical site, and the number of days worked. These are included in Table 1.22.

Table 1.22. Duration, frequency and amount

Information type	Data field	Explanation
Used amount of substance per day	10.08 tonnes	From EIGA (2008)
Duration of exposure per day at workplace [for one worker]	1-4 hours	Information from industry
Frequency of exposure at workplace [for one worker]	Once	Information from industry
Annual amount used per site	2520 tonnes	From EIGA (2008)
Emission days per site	250	From EIGA (2008)

**Operational conditions and risk management measures related to product<sup>6</sup> characteristics**

Table 1.23 shows the product characteristics. Industrial use of calcium carbide as an intermediate in the production of acetylene and calcium cyanamide takes place in a closed, controlled process with occasional controlled exposure. Transfer of calcium carbide to vessels or large containers takes place at dedicated facilities.

– <sup>6</sup> “Product” includes substances, preparations and articles

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Table 1.23. Characteristics of the substance or preparation

Information type	Data field	Explanation
Physical state	solid	
For solids: Categorisation of dust grades	Medium for acetylene production; high for calcium cyanamide production.	
Risk management measures related to the design of product	Calcium carbide granules are used for the acetylene production	

**Operational conditions related to available dilution capacity and characteristics of exposed humans**

See Table 1.4.

Environmental surroundings characteristics

Standard environmental characteristics are appropriate for this scenario.

**Other operational conditions of use**

The REACH default environmental release estimates for industrial use of intermediates (ERC6A) are:

Release to air: 5 %

Release to wastewater: 2%

Releases to air

Releases to air during production are controlled by dust or particulate matter control devices such as fabric filter, with a dust emission limit of 50 mg/m<sup>3</sup>.

Release of calcium carbide dust to air during the production of acetylene occurs when calcium carbide is charged to the acetylene generation. However, this is only applicable to an open generator system and not a closed system (EIGA 2008). Calcium carbide dust emission to air (from a cyclone) at an open generator system acetylene production plant handling 2,520 t/year of calcium carbide has been estimated as 4 kg/yr (EIGA 2008), or 4/250 = 0.016 kg/d. This gives a release estimate of 0.00015% of calcium carbide dust to air.

Release to wastewater

Wastewater is generated from acetylene production process and will contain impurities from the calcium carbide used as well as by-products from the reaction. This is assumed to be dealt with in the CSR for acetylene production.

Release to soil

Releases to soil are assumed not to occur.

**Risk management measures**

See Table 1.5.

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**Waste related measures**

Wastes are recycled into the processes.

*Exposure estimation*

**Workers exposure**

Acute/Short term exposure

Workers at industrial sites are routinely involved with the same tasks; therefore it is more appropriate to consider long-term exposure.

Long-term exposure

Exposures as measured for the production scenario may also be relevant. Therefore personal protective equipment as described for ES 1 will also be needed if the limits are exceeded locally. Duration of exposure (in the areas with the greatest dust) per personnel at most sites is reported to be for 1-4 hours per shift

Oral exposure

Eating and drinking at the workplace is forbidden across sites. Hence, workers' exposure via ingestion of Calcium Carbide is not expected.

Dermal exposure

Risk management measures used to prevent dermal exposures at most sites include gloves, protective clothing and goggles. In appropriate use of PPE can result in skin irritation and burns.

Inhalation exposure

Exposure of workers via inhalation is prevented by air exhaustion and use of respirators.

Table 1.24. Long-term exposure concentrations to workers

Routes of exposure	Estimated Exposure Concentrations		Measured exposure concentrations		Explanation / source of measured data
	Value	Unit	Value	Unit	
Dermal exposure <sup>a</sup>	0.14	mg/kg/day	-	-	ECETOC TRA model prediction for PROC 2 (acetylene and calcium cyanamide)
Inhalation exposure	0.05	mg/m <sup>3</sup>	-	-	ECETOC TRA model prediction for PROC 2 (acetylene)
	0.1	mg/m <sup>3</sup>	-	-	ECETOC TRA model prediction for PROC 2 (calcium cyanamide)

Notes: <sup>a</sup> Calculated assuming a default bodyweight of 70 kg for workers and a default respiratory volume of 10 m<sup>3</sup>, light activity, for an 8 hour work shift.

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Table 1.25. Summary of long-term exposure concentration to workers

Routes of exposure	Concentrations	Justification
Dermal local exposure (in mg/cm <sup>2</sup> )	0.02	ECETOC TRA model prediction for PROC 2 (acetylene and calcium cyanamide)
Dermal systemic exposure <sup>a</sup> (in mg/kg bw/d)	0.14	ECETOC TRA model prediction for PROC 2 (acetylene and calcium cyanamide)
Inhalation exposure <sup>a</sup> (in mg/m <sup>3</sup> )/8h workday <sup>7</sup>	0.007	ECETOC TRA model prediction for PROC 2 (acetylene)
Inhalation exposure <sup>a</sup> (in mg/m <sup>3</sup> )/8h workday <sup>8</sup>	0.14	ECETOC TRA model prediction for PROC 2 (calcium cyanamide)

Notes: <sup>a</sup> Calculated assuming a default bodyweight of 70 kg for workers and a default respiratory volume of 10 m<sup>3</sup>, light activity, for an 8 hour work shift.

### Consumer exposure

None expected.

### Indirect exposure of humans via the environment (oral)

Neither of the two impurities being considered accumulates in the food chain, so the assessment of secondary poisoning is not considered further.

### Environmental exposure

Predicted Environmental Calculations (PECs) have been determined using EUSES 2.1.1. The EUSES program implements the environmental exposure models described in REACH Technical Guidance Chapter R16. Default model parameters have been used.

Local tonnage – 10.08 tonnes per day

Number of days – 250 days.

### Environmental releases

The release fractions are discussed in 1.26. From this, emissions to air as dust are 0.016 kg/day, as calcium carbide from a representative plant. As discussed in Section 7 for the environment the assessment is considering the two impurities calcium cyanamide (as cyanamide) and calcium sulfide. The maximum content of calcium cyanamide in calcium cyanamide is 5% by weight (see Section 1.2), hence the emission is 0.8 g/day. For calcium sulfide, the maximum content is 1.3% by weight (see Section 1.2), hence the emission is 0.21 g/day.

– <sup>7</sup> air concentration at the workplace

– <sup>8</sup> air concentration at the workplace

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No measured values for released amounts are available, so the calculated values are used in the exposure estimation. These are summarised in Table 1.26.

Table 1.26. Summary of the releases to the environment

Compartments	Release from point source (kg/d) (local exposure estimation)	Justification
Aquatic (without STP)		Not addressed here, but in acetylene CSR.
Aquatic (after STP)		Not addressed here, but in acetylene CSR.
Air (direct + STP)	8E-04 cyanamide 2.1E-04 calcium sulfide	As dust, direct.
Soil (direct releases only)		Not addressed here, but in acetylene CSR.

#### Exposure concentrations in the environment

The only relevant emissions are to air, therefore only concentrations in air and in soil through deposition have been calculated. The results are summarised in Table 1.27.

Table 1.27. **Summary of exposure concentrations from acetylene production - cyanamide**

LOCAL CONCENTRATIONS AND DEPOSITIONS	Value	Unit
<b>AIR</b>		
Concentration in air during emission episode	9.45E-08	[mg.m-3]
Annual average concentration in air, 100 m from point source	6.47E-08	[mg.m-3]
Total deposition flux during emission episode	1.71E-07	[mg.m-2.d-1]
Annual average total deposition flux	1.17E-07	[mg.m-2.d-1]
<b>SOIL, GROUNDWATER</b>		
Concentration in agric. soil averaged over 30 days	1.12E-08	[mg.kgwwt-1]
Concentration in agric. soil averaged over 180 days	1.12E-08	[mg.kgwwt-1]
Concentration in grassland averaged over 180 days	1.80E-08	[mg.kgwwt-1]
Fraction of steady-state (agricultural soil)	1	[-]
Fraction of steady-state (grassland soil)	1	[-]
<b>LOCAL PECS [ACETYLENE PRODUCTION]</b>	<b>Value</b>	<b>Unit</b>
<b>AIR</b>		

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Annual average local PEC in air (total)	6.47E-08	[mg.m-3]
<b>SOIL, GROUNDWATER</b>		
Local PEC in agric. soil (total) averaged over 30 days	1.12E-08	[mg.kgwwt-1]
Local PEC in agric. soil (total) averaged over 180 days	1.12E-08	[mg.kgwwt-1]
Local PEC in grassland (total) averaged over 180 days	1.80E-08	[mg.kgwwt-1]
Local PEC in pore water of agricultural soil	6.00E-08	[mg.l-1]
Local PEC in pore water of grassland	9.63E-08	[mg.l-1]
Local PEC in groundwater under agricultural soil	6.00E-08	[mg.l-1]

The exposure concentrations from acetylene production for calcium sulfide are summarised in Table 1.28. The only relevant emissions are to air, therefore only concentrations in air and in soil through deposition have been calculated.

Table 1.28. **Summary of exposure concentrations from acetylene production – calcium sulfide**

<b>LOCAL CONCENTRATIONS AND DEPOSITIONS</b>	<b>Value</b>	<b>Unit</b>
<b>AIR</b>		
Concentration in air during emission episode	4.73E-08	[mg.m-3]
Annual average concentration in air, 100 m from point source	3.24E-08	[mg.m-3]
Total deposition flux during emission episode	1.69E-06	[mg.m-2.d-1]
Annual average total deposition flux	1.16E-06	[mg.m-2.d-1]
<b>SOIL, GROUNDWATER</b>		
Concentration in agric. soil averaged over 30 days	4.86E-09	[mg.kgwwt-1]
Concentration in agric. soil averaged over 180 days	4.86E-09	[mg.kgwwt-1]
Concentration in grassland averaged over 180 days	9.62E-09	[mg.kgwwt-1]
Fraction of steady-state (agricultural soil)	1	[-]
Fraction of steady-state (grassland soil)	1	[-]
<b>LOCAL PECS [ACETYLENE PRODUCTION]</b>		
<b>AIR</b>		
Annual average local PEC in air (total)	3.24E-08	[mg.m-3]
<b>SOIL, GROUNDWATER</b>		
Local PEC in agric. soil (total) averaged over 30 days	4.86E-09	[mg.kgwwt-1]
Local PEC in agric. soil (total) averaged over 180 days	4.86E-09	[mg.kgwwt-1]
Local PEC in grassland (total) averaged over 180 days	9.62E-09	[mg.kgwwt-1]
Local PEC in pore water of agricultural soil	2.80E-08	[mg.l-1]
Local PEC in pore water of grassland	5.55E-08	[mg.l-1]
Local PEC in groundwater under agricultural soil	2.80E-08	[mg.l-1]

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Exposure concentration relevant for the food chain (Secondary poisoning)

Neither of the two impurities being considered accumulates in the food chain, so the assessment of secondary poisoning is not considered further.

#### **ES 4: Use of calcium carbide in metallurgy**

##### *Exposure scenario*

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The REACH default release estimates for industrial use of reactive processing aids (ERC6B) are:

Release to air: 0.1 %

Release to wastewater: 5%

These values are unrealistically high, and they may be ignored on the basis of a site visit to an iron foundry. This shows that at the worst there may be occasional losses of carbide from transfer lines, but there is no carbide/oxide dust in the area. The entire facility is free from use of water. Losses will therefore be even lower than those estimated for production of calcium carbide.

Exposures have been assessed as minimal, and less than those from production, based on site visits, and therefore do not need to be quantified.

#### **Regional exposure concentrations**

Regional concentrations cannot be added to the exposure scenario because there is no realistic way to assess regional exposure for inorganic substances. The standard models, e.g. EUSES 2.1.1 are parameterised for organic substances.

Furthermore, the ultimate degradation products in the environment are inorganic species already present in the environment at high concentration.

It is concluded that regional exposure assessment need not be performed.