Safety Data Sheet

According to Annex II to REACH - Regulation 2015/830

SECTION 1. Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Substance name:	**Magnesium powder or raspings** **"Magnesium Powder" or "Magnesium Raspings"**
EC number	231-104-6
CAS number	7439-95-4
Registration Number	01-2119537203-49-0022
Chemical formula:	Mg
Molecular weight:	24.30 g/mol
Product name:	**MAGNESIUM POWDERS AND RASPINGS**

Full substance identifiers, as per CLP Annex VI, have been provided in subsection 2.1 of this SDS

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

Intended use	Melting, alloying, casting (MAC) Particulates production & handling (PP&H)
	Fine particulates production (FPP)
	Metallurgical uses (MU)
	Solid forming processes (SFP) - incl. production of welding electrodes
	Corrosion protection (CP)
	Welding in industrial settings (W)
	Exposure during etching of magnesium dies
	Welding in professional settings (W)
	Professional use of magnesium powder in signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination Consumer use of pyrotechnical products (FW)
	Service life of magnesium-containing articles by workers
	Etching of magnesium dies
	Service life of magnesium -containing articles by consumers
Uses advised against	Uses other than those indicated above

Please refer to section 16 for a complete list of identified uses for which an exposure scenario is provided as an annex.

1.3. Details of the supplier of the safety data sheet

Name of Manufacturer:

Name	**Société pour la Fabrication du Magnésium SA**
Full address	Rue des Sablons 9
District and Country	1920 Martigny Switzerland
	tel. +41 (0) 27 721 75 90
	fax +41 (0) 27 721 75 95
e-mail address of the competent person responsible for the Safety Data Sheet	info@sfm-magnesium.ch
Name	**Société pour la Fabrication du Magnésium SA**

Name of REACh registered EU importer:

Name	**WIMEX Handelsges.m.b.H.**
Full address	Theresiengasse 67
District and Country	1180, Wien
	Austria

1.4. Emergency telephone number.

For urgent inquiries refer to:	Company Emergency telephone number: **SFM:** Tel. +41 (0) 58 911 0200 (SOS Surveillance Company 24 hours)

SECTION 2. Hazards identification

2.1. Classification of the substance or mixture

Remark: There are two entries in Regulation (EC) No 1272/2008 Annex VI existing for magnesium; one for magnesium powder (pyrophoric) and one for magnesium, powder or turnings, which are given below (section 2.1.1).
According to the current legal classification magnesium powder (pyrophoric) and magnesium, powder or turnings should be classified as follows:

Magnesium, powder or raspings

Identification	**Classification 1272/2008 (CLP)**
	Flammable solids Category 1 Flam. Sol. 1 H228 Self-heating substances and mixtures Category 1 Self-heat. 2 H252 Substances and mixtures which in contact with water emit flammable gases Category 2 Water-react. 2 H261 Classification note according to Annex VI to the CLP Regulation: T

According to Note T of the existing entries “magnesium powder (pyrophoric) (Index no.: 012-001-00-3)” and “magnesium powder or turnings (Index no.: 012-002-00-9)” according to Regulation (EC) 1272/2008 Annex VI: “This substance may be marketed in a form which does not have the physical hazards as indicated by the classification in the entry in Part 3. If the results of the relevant method or methods in accordance with Part 2 of Annex I of Regulation (EC) 1272/2008 show that the specific form of substance marketed does not exhibit this physical property or these physical hazards, the substance shall be classified in accordance with the result or results of this test or these tests. Relevant information, including reference to the relevant test method(s) shall be included in the safety data sheet.”
The full wording of hazard (H) phrases is given in section 16 of the sheet.

2.2. Label elements

Magnesium, powder or turnings
Hazard labelling pursuant to EC Regulation 1272/2008 (CLP) and subsequent amendments and supplements.

Hazard pictograms:

Signal words: **DANGER**

Hazard statements:

H228	Flammable solid.
H252	Self-heating in large quantities; may catch fire.
H261	In contact with water releases flammable gases.

Precautionary statements:

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P233	Keep container tightly closed.
P240:	Ground/bond container and receiving equipment.

2.3. Other hazards

No other hazards identified.
On the basis of available data, the product does not contain any PBT or vPvB in percentage greater than 0,1%.

SECTION 3. Composition/information on ingredients

3.1. Substances

Contains:

Main constituent	**Conc. %**
Magnesium	
CAS 7439-95-4	ca. 99.5 %
EC 231-104-6	
INDEX 012-002-00-9	
Reg. no. 01-2119537203-49-0022	

Impurities
No impurities relevant for classification and labelling.

SECTION 4. First aid measures

4.1. Description of first aid measures

No episodes of harm to the staff authorised to use the product have been reported. The following general measures should be adopted as necessary:
INHALATION: Remove to open air. If the subject stops breathing, administer artificial respiration. Get medical advice/attention.
INGESTION: Get medical advice/attention. Induce vomiting only if indicated by the doctor. Do not give anything by mouth to an unconscious person.
EYES and SKIN: Wash with plenty of water. In the event of persistent irritation, get medical advice/attention.
PROTECTIVE MEASURES FOR THE FIRST RESCUE WORKERS: for PPE (personal protection equipment) required for first aid refer to section 8.2 of this safety data sheet.

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

The substance if ingested can cause diarrhea.

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

Advises are given in section 4.1; No special treatment needed.

SECTION 5. Firefighting measures

5.1. Extinguishing media

SUITABLE EXTINGUISHING EQUIPMENT
Use dry extinguishing materials (e.g. dry sand, fluxes, iron chips, cement, class D fire extinguisher).
UNSUITABLE EXTINGUISHING EQUIPMENT
Do not use water.

5.2. Special hazards arising from the substance or mixture

HAZARDS CAUSED BY EXPOSURE IN THE EVENT OF FIRE
Risk of dust ignition/explosion exists. Keep away from any possible contact with water.
Avoid formation of dust also in case of handling massive objects.

5.3. Advice for firefighters

GENERAL INFORMATION
Avoid contact with water. Use dry extinguishing materials (e.g. dry sand, fluxes, iron chips, cement, class D fire extinguisher).
SPECIAL PROTECTIVE EQUIPMENT FOR FIRE-FIGHTERS
Fire fighting clothing i.e. fire kit (BS EN 469), gloves (BS EN 659) and boots (HO specification A29 and A30) in combination with self-contained open circuit positive pressure compressed air breathing apparatus (BS EN 137).

SECTION 6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1 For non-emergency personnel
Keep away from any possible contact with water, because of violent reaction and possible flash fire. Brush off lose particles from skin.
Do not take any action that involves any personal risk or without adequate training. Evacuate the surrounding areas.
Wear appropriate protective equipment (including personal protective equipment referred to in section 8 of this safety data sheet) to prevent contamination of the skin, eyes and personal clothing. Wear appropriate respirator when ventilation is inadequate.
Do not inhale the dust. Avoid dispersion of the product in the environment. Follow the appropriate internal procedures for unauthorized personnel to intervene directly in case of accidental release.

6.1.2 For emergency responders
Keep away from any possible contact with water, because of violent reaction and possible flash fire. Brush off lose particles from skin.
Evacuate non-authorized personnel. Wear appropriate protective equipment. (see section 8 of this Safety Data Sheet). Follow the appropriate internal procedures for authorized personnel. Check the dust. Isolate the danger area and deny entry. Ventilate enclosed spaces before entering.
Remove unequipped persons. Eliminate all sources of ignition (cigarettes, flames, sparks, etc.) from the area in which the leak occurred.

6.2. Environmental precautions

The product must not penetrate into the sewer system or come into contact with surface water or ground water. No special precautions must be considered. Magnesium is abundantly present in all environmental compartments.

6.3. Methods and material for containment and cleaning up

Avoid dust formation. Pick up the product mechanically in a dry way. Magnesium waste should be recycled as much as possible. Make sure the leakage site is well aired. Evaluate the compatibility of the container to be used, by checking section 10. Contaminated material should be disposed of in compliance with the provisions set forth in point 13.

6.4. Reference to other sections

Any information on personal protection and disposal is given in sections 8 and 13.

SECTION 7. Handling and storage

7.1. Precautions for safe handling

There is a risk of a dust explosion if the following conditions are met:

- The substance is given in very finely distributed form (powder, dust).
- The substance is whirled up in sufficient quantity in the air.
- An ignition source is present (flame, spark, electrostatic discharge, etc.)

Therefore it is important to ensure an adequate earthing system for the equipment and personnel. In order to avoid the risk of fires and explosions, never use compressed air when handling. Keep away from heat, sparks and naked flames; do not smoke or use matches or

lighters. Avoid leakage of the product into the environment. Avoid contact with eyes and skin. Do not breathe powders. Do not eat, drink or smoke during use. Remove any contaminated clothes and personal protective equipment before entering places in which people eat.

7.2. Conditions for safe storage, including any incompatibilities

Store only in the original container. Keep the product in clearly labelled containers. Keep containers well sealed. Store in a ventilated and dry place, far away from sources of ignition. Avoid violent blows. Avoid overheating. Avoid contact with water.
Avoid generation of condensed water due to harsh temperature changes in-between different storages/stocks or as a consequence of thermal difference between transportation and storage conditions.

Store in a cool and well ventilated place, keep far away from sources of heat, naked flames and sparks and other sources of ignition.

7.3. Specific end use(s)

No use other than as indicated in section 1.2 and 16 of this safety data sheet

SECTION 8. Exposure controls/personal protection

8.1. Control parameters

During the risk assessment process, it is essential to take into consideration the ACGIH occupational exposure levels for inert particulate not otherwise classified (PNOC respirable fraction: 3 mg/m3; PNOC inhalable fraction: 10 mg/m3).

PNEC value (dissolved magnesium) for European Union/Member state, based on added Mg concentrations

Country	Freshwater mg Mg/l	Marine water mg Mg/l	Freshwater, intermittent releases mg Mg/l	STP mg Mg/l	Freshwater sediment mg Mg/kg dw	Marine sediment mg Mg/kg dw	Soil mg Mg/kg dw
PNECadded (Predicted No Effect Concentration)	0.41	0.41	1.4	≥10.8	268	268	268
Typical natural background concentration	7.1	1290	7.1	No data	6918	No data	3930

All PNEC values are based on added magnesium concentrations (PNECadded), without taking into account the natural background in the exposure media The PNECtotal can be calculated as the sum of PNECadded and the background concentration for Mg in the corresponding environmental compartment.

DNELs for workers
Magnesium is a non-soluble inert powder with an MMAD of 25.6 µm and GSD of 1.72 µm, and the derived DNEL for inhalation is above 10 mg/m^3 for the inhalable airborne fraction which is the general dust limit for the inhalable airborne fraction. Therefore, this general dust limit will be applied for exposure scenarios with exposure to magnesium oxide dust.

DNELs for general population
Magnesium is a non-soluble inert powder with an MMAD of 25.6 µm and GSD of 1.72 µm, and the derived DNEL for inhalation is above 10 mg/m^3 for the inhalable airborne fraction which is the general dust limit for the inhalable airborne fraction. Therefore, this general dust limit will be applied for exposure scenarios with exposure to magnesium oxide dust.

8.2. Exposure controls

As the use of adequate technical equipment must always take priority over personal protective equipment, make sure that the workplace is well aired through effective local aspiration.

The general practice of hygiene at work involves certain measures (for example, showering and changing clothes at the end of the work shift) in order to avoid any type of third party contamination and appropriate cleaning practices (i.e. regular cleaning with suitable cleaning devices), do not eat and smoke in the workplace. In general, inhalation and ingestion must be avoided. Unless stated otherwise, certified work shoes and clothing must be worn. Contaminated work clothing should not be taken out of the workplace. Good ventilation in the workplace must be ensured. Local forced ventilation (LEV) is required in the case of processes that generate metal dust. The dust must not be removed (for example from dry sprays) by means of compressed air. Regular training on hygiene practices in the workplace and correct use of personal protective equipment (PPE) is required.

If the product may or must come into contact or react with water, suitable technical and/or organisational measures should be taken to

prevent the development of toxic and/or inflammable gases.

HAND PROTECTION
In the case of prolonged contact with the product, protect the hands with penetration-resistant work gloves (see standard EN 374).
Currently there is no information available regading suitable glove materials.
Experience says that polychloroprene, nitrile rubber, butyl rubber, fluoro-caoutchouc, and polyvinyl chloride are suitable as glove materials for protection against un-dissolved solids.
Work glove material must be chosen according to the use process and the products that may form. Latex gloves may cause sensitivity reactions.

SKIN PROTECTION
Wear category I professional long-sleeved overalls and safety footwear (see Regulation 2016/425 and standard EN ISO 20344). Wash body with soap and water after removing protective clothing.
Consider the appropriateness of providing antistatic clothing in the case of working environments in which there is a risk of explosion.

EYE PROTECTION
Wear airtight protective goggles (see standard EN 166).

RESPIRATORY PROTECTION
Use a type P filtering facemask, whose class (1, 2 or 3) and effective need, must be defined according to the outcome of risk assessment (see standard EN 149).

ENVIRONMENTAL EXPOSURE CONTROLS
The emissions generated by manufacturing processes, including those generated by ventilation equipment, should be checked to ensure compliance with environmental standards.

SECTION 9. Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	Powder	
Colour	Silvery-white	
Odour	Odourless	
Odour threshold	Not available	
pH	Not available	
Melting point / freezing point	650 °C	handbook data
Initial boiling point	1095 °C	handbook data
Boiling range	Not available	
Flash point	not applicable (inorganic solid)	
Evaporation Rate	not applicable (inorganic solid with a melting point at 650°C)	
Flammability of solids and gases	highly flammable as powder (study result, EU method A.10)	
Lower inflammability limit	Not available	
Upper inflammability limit	Not available	
Lower explosive limit	non-explosive (the substance is void of any chemical structures commonly associated with explosive properties)	
Upper explosive limit	non-explosive (the substance is void of any chemical structures commonly associated with explosive properties)	
Vapour pressure	Not available	
Vapour density	Not available	
Relative density	176 23°C	Method:OECD TG 109
Solubility	6.7 mg/L (21°C, pH ca. 10.8) (EU method A.6, OECD 105)	
Partition coefficient: n-octanol/water	not applicable	Reason for missing data:Non applicabile (inorganic substance)
Auto-ignition temperature	not self-heating substance (study result, UN-Test N.4)	
Decomposition temperature	not applicable	
Viscosity	not applicable (solid with a melting point at 650°C)	
Explosive properties	non-explosive (the substance is void of any chemical structures commonly associated with explosive properties)	
Oxidising properties	no oxidising properties (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 substance is legally classified as being self-heating (magnesium powder or turnings) and to be flammable in contact with air (magnesium powder (pyrophoric)), respectively according to Regulation (EC) 1272/2008 Annex VI.
The provider of this eSDS likes to note that this current legal classification does not reflect the long-time experience of the magnesium industry. Therefore, new studies have been conducted at BAM (Bundesanstalt für Materialforschung und –prüfung) in accordance to the current valid transport regulation "UN recommendations on transport of dangerous good, manual of tests and criteria, part III" which show that magnesium powder is neither flammable in contact with air nor auto-flammable (measured for magnesium powder samples up to a particle size of D_{50} 40 µm).
Nevertheless, the current legal classification of magnesium according to Regulation (EC) No 1272/2008 Annex VI is obligatory until further notice of ECHA.

SECTION 10. Stability and reactivity

10.1. Reactivity

In the course of hydrolysis slowly releases flammable/explosive hydrogen gas. Generation rate is greatly increased with smaller particles.

10.2. Chemical stability

Under normal conditions of use and storage (closed in original container and under dry conditions) magnesium is stable.

10.3. Possibility of hazardous reactions

See point 10.1 "Reactivity".

10.4. Conditions to avoid

Keep away from any possible contact with water.
Avoid generation of condensed water.

10.5. Incompatible materials

Incompatible materials:
Chips, fines, dust and molten metal are considerably more reactive with the following:
• Strong oxidizers: Violent reaction with considerable heat generation. Can react explosively with nitrates (e.g., ammonium nitrate and fertilizers containing nitrate) when heated or molten.
• Acids and alkalis: Reacts to generate flammable/explosive hydrogen gas. Generation rate is greatly increased with smaller particles (e.g., fines and dusts).
• Halogenated compounds: Many halogenated hydrocarbons, including halogenated fire extinguishing agents, can react violently with finely divided or molten aluminum.
• Iron oxide (rust) and other metal oxides (e.g., copper and lead oxides): A violent thermite reaction generating considerable heat can occur. Reaction with aluminum fines and dusts requires only very weak ignition sources for initiation. Molten aluminum can react violently with iron oxide without external ignition source.
• Iron powder and water: Explosive reaction forming hydrogen gas when heated above 1470°F (800°C).

10.6. Hazardous decomposition products

In contact with water hydrogen is formed which is a highly flammable gas.

SECTION 11. Toxicological information

11.1. Information on toxicological effects

The information provided in this section is consistent with the information provided in the REACH chemical safety report (CSR) for magnesium. During development of the CSR all available toxicological data have been considered and evaluated for relevance and reliability. Non-reliable data have not been considered in the assessment.

Toxicity endpoints	Outcome of the effects assessment
a. Acute toxicity	Magnesium powder is not acutely toxic via the oral, dermal, or inhalation route. Oral, rat, gavage (Read-across - $MgCl_2$ * $6H_2O$) LD_{50} > 2000 mg/kg bw (OECD 423) Dermal Following the HERAG guidance for metals and metal salts, a dermal absorption rate in the range of maximally 0.1-1.0 % can be anticipated. Dermal absorption in this order of magnitude is not considered to be "significant". Inhalation: (Read-across - MgO) No acute inhalation toxicity. Exposure to respirable MgO did not produce any measurable pulmonary inflammation.
b. Skin corrosion / irritation	Based on available data, the classification criteria for skin irritation are not met. (Read across - $MgCl_2$ hexahydrate) Skin irritation: not irritating (in vitro study, equivalent or similar to EU method B.46, reconstructed human epidermis)
c. Serious eye damage / irritation	Based on available data, the classification criteria for eye irritation are not met. (Read across - $MgCl_2$ hexahydrate) Eye irritation: not irritating (OECD 405, rabbit)
d. Respiratory or skin sensitisation	Based on available data, the classification criteria for sensitisation are not met. (Read across - magnesium alloys (with a total magnesium content between 89.2 – 96.8%)). Skin sensitisation: not sensitising (OECD 406, GMPT)
e. Germ cell mutagenicity	Based on available data, the classification criteria for mutagenicity are not met. Read across to various magnesium substances. (i) Bacterial reverse mutation assay (S.typhimurium, E.coli): (Ames test; OECD 471) **negative** (ii) Gene mutation (OECD 476, mouse lymphoma): **negative** (iii) in vitro mammalian chromosome aberration test (Chinese hamster lung fibroblast cell line) (OECD 473): **negative**
f. Carcinogenicity	Based on available data, the classification criteria for carcinogenicity are not met. (Read across - $MgCl_2$ hexahydrate) oral, mice, 96 weeks No evidence of a carcinogenic potential was found
g. Reproductive toxicity	Based on available data, the classification criteria for reporductive toxicity are not met. Data published by the opinion of the Scientific Committee on Food, 2001 stated a lack of effects during the intake of high amounts of magnesium on the reproductive function in humans. The information are sufficient for risk characterisation.
h. STOT-single exposure	Based on available data, the classification criteria for STOT-single exposure are not met. The classification criteria according to regulation (EC) 1272/2008 as specific target organ toxicant (STOT) – single exposure, oral, inhalation are not met since no reversible or irreversible adverse health effects were observed immediately or delayed after exposure.

Toxicity endpoints	Outcome of the effects assessment
i. STOT-repeated exposure	Based on available data, the classification criteria for STOT-repeated exposure are not met. The only effect observed is that magnesium causes diarrhoea if ingested in high doses. According to the scientific committee on food, 2001 it can be assumed that the no-effect level of daily magnesium intake is 250 mg/day. It is explicitly note that this value does not include Mg normally present in foods and beverages. This effect could be regarded as non "significant" or non "severe", and does not indicate functional disturbance or morphological changes of toxicological relevance.
j. Aspiration hazard	No hazard expected.
Further remarks	
Summary CMR effects	Magnesium does not fulfil the criteria for CMR (carcinogen, mutagen, toxic to reproduction) Cat. 1 and Cat. 2 according to regulation (EC) 1272/2008.
Information on the likely route of exposure	The primary routes of human exposure to magnesium are from inhalation of aerosols and ingestion of food and drinking water containing magnesium.

SECTION 12. Ecological information

Use this product according to good working practices. Avoid littering. Inform the competent authorities, should the product reach waterways or contaminate soil or vegetation.

12.1. Toxicity

Acute toxicity

No data are available on ecotoxicity of Mg metal. Read-across from MgSO4 and MgCl2 (and their hydrated forms). All tests were conducted according to international test guidelines (e.g., OECD) or scientifically acceptable methods.

Test Organism	End-point	Value	Reference
Freshwater fish: *Pimephales promelas*	96h-LC_{50}	541 mg Mg/l	Mount et al. 1997
Freshwater invertebrates: *Daphnia magna*	48h-LC_{50}	140 mg Mg/l	Pillard et al. 2000
Freshwater algae: *Scenedesmus subspicatus*	72h-ErC_{50} (growth rate)	>12 mg Mg/l	Biesinger and Christensen 1972
Marine fish: *Menidia beryllina*	48h-LC_{50}	2800 mg Mg/l	Dengler 2010a
Marine invertebrates: *Mysidopsis bahia*	48h-LC_{50}	2650 mg Mg/l	Dengler 2010a

Chronic toxicity

No data are available on ecotoxicity of Mg metal. Read-across from $MgSO_4$ and $MgCl_2$ (and their hydrated forms).

All tests were conducted according to international test guidelines (e.g., OECD) or scientifically acceptable methods.

Test organisms	End-point	Value	Reference
Aquatic toxicity data			
Freshwater invertebrates: *Daphnia magna*	21-day EC_{16} for reproduction	82 mg Mg/l	Pillard et al. 2000
Freshwater algae: *Scenedesmus subspicatus*	72h-NOEC for growth rate	≥12 mg Mg/l	Biesinger and Christensen 1972
No reliable data are available for chronic toxicity of Mg to fish. According to the available toxicity data for aquatic organisms, there is no need for classification of Mg as dangerous to the aquatic environment, and based on the acute toxicity data, fish are less sensitive compared to aquatic invertebrates. The low toxic potential of Mg to aquatic organisms is also illustrated by the fact that Mg is a major essential element for aquatic organisms and that Mg is abundantly present in the aquatic environment with typical natural background concentrations of 7.1 mg Mg/l and 1290 mg Mg/l for freshwater and marine water, respectively.			
Chronic sediment toxicity			

No reliable data are available for the acute or chronic toxicity of magnesium to sediment organisms. PNEC derivation was based on the equilibrium partitioning method, taking into account the PNEC for freshwater or marine water and the sediment Kd-value given in section 12.4.
Chronic terrestrial toxicity
No reliable data are available for the acute or chronic toxicity of magnesium to soil organisms. PNEC derivation was based on the equilibrium partitioning method, taking into account the PNEC for freshwater and the sediment Kd-value given in section 12.4.

Toxicity to micro-organisms e.g. bacteria

No data are available on toxicity of Mg metal. Read-across from $MgCl_2$ hexahydrate.

Test Organism	End-point	Value	Reference
Domestic activated sludge population	3h-EC_{10} for respiration inhibition (according to OECD 209)	≥108 mg Mg/l	Dengler 2010b

Toxicity to birds

There is no potential for bioaccumulation and no risk of secondary poisoning for magnesium below the PNEC for direct toxicity in the various environmental compartments.

Conclusion on environmental classification and labelling

Magnesium is not hardous to the aquatic environment as:

- The lowest acute reference values for fish, invertebrates and algae are > 100 mg Mg/l.
- The lowest aquatic NOEC for these three trophic levels is > 1 mg Mg/l (i.e., 41 mg Mg/l for Daphnia magna; no data are available for fish but based on the acute toxicity data, fish are less sensitive compared to aquatic invertebrates).
- There is no evidence for bioaccumulation or biomagnification in the environment.

12.2. Persistence and degradability

Magnesium is naturally occurring and ubiquitous in the environment. Upon contact with water, magnesium metal dissolves and behaves as magnesium naturally present in the environment. Biodegradation is not relevant for Mg metal, which is considered as not biodegradable.

12.3. Bioaccumulative potential

Bioaccumulation of magnesium in aquatic/terrestrial organisms is considered to be of no concern since magnesium is an essential element for aquatic and terrestrial organisms. The uptake of essential elements is generally under strict homeostatic control. Under these conditions, the internal concentration of these elements is maintained over a wide concentration range in the environment and rises only dramatically under conditions that are toxic for aquatic and terrestrial organisms.

12.4. Mobility in soil

Magnesium metal is soluble in water. A log Kd value of 2.82 l/kg dw has been determined for freshwater sediment and no data are available for soil. Based on this relatively low Kd value, the Mg2+ ions can leach through normal soil and are relatively mobile in sediment.
Results of PBT and vPvB assessment

12.5. Results of PBT and vPvB assessment

On the basis of available data, the product does not contain any PBT or vPvB in percentage greater than 0,1%.

12.6. Other adverse effects

Information not available

SECTION 13. Disposal considerations

13.1. Waste treatment methods

Reuse, when possible. Product residues shall be considered special hazardous waste. The hazards of the wastes containing this product

shall be evaluated according to applicable regulations. (Directive 2008/98/EC and subsequent amendments and supplements).
Disposal must be performed by an authorised waste management enterprise in compliance with national and local regulations.
The legal responsible for disposal is the producer / holder of the waste.
Different EWC codes could be applied to this mixture according to the European Waste Catalogue based on the specific circumstances that generated the waste, possible alterations and / or possible contamination.

The product as such, contained in the original packaging, or poured into in an appropriate recipient for disposal, or contained in a damaged packaging after an accidental leakage, shall be classified with a EWC code that is matching the description of the use shown at section 1.2.

The suitable final destination of the waste shall be evaluated by the producer on the basis of the chemical-physical characteristics of the waste, the compatibility with the authorized facility to which it will be provided for recovery, and the definitive treatment or disposal according to the procedures established by regulations in force.
Disposal through wastewater discharge is not permitted.

For hazardous substances registered according to Regulation EC 1907/2006 (REACH), for which a chemical safety report has been drawn up, refer to the specific information contained in the exposure scenarios attached to the Safety Data Sheets.

CONTAMINATED PACKAGING
Contaminated packaging, properly labeled, shall be sent to recovery or disposal in compliance with national waste management regulations and they shall be classified with the following EWC code: **15 01 10***: packaging containing residues of or contaminated by hazardous substances

SECTION 14. Transport information

The transport regulation for magnesium powder (pyrophoric and powder or turnings) is given in the following:

14.1. UN number

Magnesium Powder

ADR / RID, IMDG, IATA: 1418

Magnesium Raspings

ADR / RID, IMDG, IATA: 1869

14.2. UN proper shipping name

Magnesium Powder

ADR / RID:	MAGNESIUM POWDER
IMDG:	MAGNESIUM POWDER
IATA:	MAGNESIUM POWDER

Magnesium Raspings

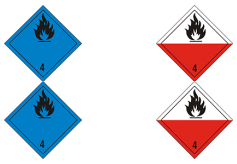
ADR / RID:	MAGNESIUM RASPINGS
IMDG:	MAGNESIUM RASPINGS
IATA:	MAGNESIUM RASPINGS

14.3. Transport hazard class(es)

Magnesium Powder

ADR / RID: Class: 4.3 Label: 4.3 (4.2)

IMDG:	Class: 4.3	Label: 4.3 (4.2)
IATA:	Class: 4.3	Label: 4.3 (4.2)



Magnesium Raspings

ADR / RID:	Class: 4.1	Label: 4.1
IMDG:	Class: 4.1	Label: 4.1
IATA:	Class: 4.1	Label: 4.1

14.4. Packing group

Magnesium Powder

ADR / RID, IMDG, IATA:	PG II

Magnesium Raspings

ADR / RID, IMDG, IATA:	PG III

14.5. Environmental hazards

Magnesium Powder

ADR / RID:	NO
IMDG:	NO
IATA:	NO

Magnesium Raspings

ADR / RID:	NO
IMDG:	NO
IATA:	NO

14.6. Special precautions for user

Magnesium Powder

ADR / RID:	HIN - Kemler: --	Limited Quantities: -	Tunnel restriction code: (E)
	Special Provision: -		
IMDG:	EMS: F-G, S-O	Limited Quantities: -	
IATA:	Cargo:	Maximum quantity: 15 kg	Packaging instructions: 488
	Pass.:	Maximum quantity: Forbidden	Packaging instructions: Forbidden
	Special Instructions:	A3	

Magnesium Raspimgs

ADR / RID:	HIN - Kemler: 40	Limited Quantities: 5 kg	Tunnel restriction code: (E)
	Special Provision: -		
IMDG:	EMS: F-G, S-G	Limited Quantities: 5 kg	
IATA:	Cargo:	Maximum quantity:100 kg	Packaging instructions: 449
	Pass.:	Maximum quantity: 25 Kg	Packaging instructions: 446
	Special Instructions:	A15	

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

Information not relevant

SECTION 15. Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Seveso Category - Directive 2012/18/EC:
P7 - PYROPHORIC LIQUIDS AND SOLIDS

Restrictions relating to the product or contained substances pursuant to Annex XVII to EC Regulation 1907/2006
None

Substances in Candidate List (Art. 59 REACH)
On the basis of available data, the product does not contain any SVHC in percentage ≥ than 0,1%.

Substances subject to authorisation (Annex XIV REACH)
None

Substances subject to exportation reporting pursuant to (EC) Reg. 649/2012:
None

Substances subject to the Rotterdam Convention:
None

Substances subject to the Stockholm Convention:
None

15.2. Chemical safety assessment

A chemical safety assessment has been carried out for this substance and is provided within the technical dossier, submitted to ECHA in October 2010.

SECTION 16. Other information

Proposed alternative classification and labelling according to Regulation (EC) No 1272/2008
Remarks: The current legal classification of magnesium according to Regulation (EC) No 1272/2008 Annex VI is obligatory until further notice of ECHA.
It is noted that a CLH report was submitted to a national authority to ask for inclusion into Regulation (EC) 1272/2008 Annex VI. One additional entry is proposed based on new test results (see subsection 9.2 for details)

Magnesium powder (non-pyrophoric, non-self heating):
- D50 > 50 µm - < 2,000 µm or
- D50 ≥ 2,000 µm but D1 < 500 µm

Flammable solids Category 1, Flam. Sol 1
Substances and mixtures which in contact with water emit flammable gases Category 2 Water-react. 2

Signal word: Danger

Hazard pictogram:

GHS02

Hazard statements:
H228: Flammable solid.
H261: In contact with water releases flammable gases

Precautionary statements:
P210: Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P223: Keep away from any possible contact with water, because of violent reaction and possible flash fire.
P240: Ground/bond container and receiving equipment.

Text of hazard (H) indications mentioned in section 2-3 of the sheet:

Flam. Sol. 1	Flammable solid, category 1
Self-heat. 1	Self-heating substance or mixture, category 1
Self-heat. 2	Self-heating substance or mixture, category 2
Water-react. 2	Substance or mixture which in contact with water emits flammable gas, category 2
H228	Flammable solid.
H252	Self-heating in large quantities; may catch fire.
H261	In contact with water releases flammable gases.
Pyr. Sol. 1	Pyrophoric solid Category 1
Water-react. 1	Substance or mixture which in contact with water emits flammable gas, category 1
H250	Catches fire spontaneously if exposed to air.
H260	In contact with water releases flammable gases which may ignite spontaneously.

LEGEND:
- ADR: European Agreement concerning the carriage of Dangerous goods by Road
- CAS NUMBER: Chemical Abstract Service Number
- CE50: Effective concentration (required to induce a 50% effect)
- CE NUMBER: Identifier in ESIS (European archive of existing substances)
- CLP: EC Regulation 1272/2008
- DNEL: Derived No Effect Level
- EmS: Emergency Schedule
- GHS: Globally Harmonized System of classification and labeling of chemicals
- IATA DGR: International Air Transport Association Dangerous Goods Regulation
- IC50: Immobilization Concentration 50%
- IMDG: International Maritime Code for dangerous goods
- IMO: International Maritime Organization
- INDEX NUMBER: Identifier in Annex VI of CLP
- LC50: Lethal Concentration 50%
- LD50: Lethal dose 50%
- OEL: Occupational Exposure Level
- PBT: Persistent bioaccumulative and toxic as REACH Regulation
- PEC: Predicted environmental Concentration
- PEL: Predicted exposure level
- PNEC: Predicted no effect concentration

- REACH: EC Regulation 1907/2006
- RID: Regulation concerning the international transport of dangerous goods by train
- TLV: Threshold Limit Value
- TLV CEILING: Concentration that should not be exceeded during any time of occupational exposure.
- TWA STEL: Short-term exposure limit
- TWA: Time-weighted average exposure limit
- VOC: Volatile organic Compounds
- vPvB: Very Persistent and very Bioaccumulative as for REACH Regulation
- WGK: Water hazard classes (German).

ABBREVIATIONS

AC	Article category
ADR	European agreement concerning the international carriage of dangerous goods by road
AND	European agreement concerning the international carriage of dangerous goods by inland waterways
BSAF	Bio soil accumulation factor
BCF	Bio concentration factor
CAS	Chemical Abstracts Service
CLP	Classification, labelling and packaging
CMR	Carcinogenic, mutagenic or toxic for reproduction
CSA/CSR	Chemical safety assessment / Chemical safety report
D50	Median particle size
DNEL	Derived no effect level
DSD	Dangerous Substance Directive
EC10	Concentration of a substance where 10% of the population is affected
EC50	Concentration of a substance where 50% of the population is affected
ECHA	European chemicals agency
EINECS	EU list of existing chemical substances
EmS	Emergency schedule
ERC	Environmental release category
ES	Exposure scenario
eSDS	Extended safety data sheet
FOREGS	Forum of European Geological Surveys
GHS	Globally harmonised system
HERAG	Health risk assessment guidance for metals
IATA-DGR	International air transport association - dangerous goods regulations
ICAO	Technical Instructions for the Safe Transport of Dangerous Goods by Air
IU	Identified use
IUPAC	International Union of Pure and Applied Chemistry
IBC code	International code for the construction and equipment of ships carrying dangerous chemicals in bulk
IMDG	International maritime dangerous goods
KP	Partition coefficient
LC10	Lethal concentration of a substance that can be expected to cause death in 10% of the population
LC50	Lethal concentration of a substance that can be expected to cause death in 50% of the population
LD50	Lethal dose of a substance that can be expected to cause death in 50% of the population
MARPOL	73/78 International convention for the prevention of pollution from ships, 1973 as modified by the protocol of 1978
MMAD	Mass median aerodynamic diameter
NO(A)EC	No observed (adverse) effect concentration
NO(A)EL	No observed (adverse) effect level
OECD	Organisation for economic co-operation and development
OEL	Occupational exposure limit
PBT	Persistent, bioaccumulative, and toxic
PC	Product category
PNEC	Predicted no-effect concentration
PROC	Process category
REACH	Registration, evaluation, authorisation and restriction of chemicals (i.e. Regulation (EC) No. 1907/2006)
RID	International rule for transport of dangerous substances by railway
SDS	Safety data sheet
STOT	Specific target organ toxicant
STP	Sewage treatment plant
SU	Sector of end use
TWA	Time weighted average
vPvB	Very persistent, very bioaccumulative

GENERAL BIBLIOGRAPHY

1. Regulation (EC) 1907/2006 (REACH) of the European Parliament
2. Regulation (EC) 1272/2008 (CLP) of the European Parliament
3. Regulation (EU) 790/2009 (I Atp. CLP) of the European Parliament

4. Regulation (EU) 2015/830 of the European Parliament
5. Regulation (EU) 286/2011 (II Atp. CLP) of the European Parliament
6. Regulation (EU) 618/2012 (III Atp. CLP) of the European Parliament
7. Regulation (EU) 487/2013 (IV Atp. CLP) of the European Parliament
8. Regulation (EU) 944/2013 (V Atp. CLP) of the European Parliament
9. Regulation (EU) 605/2014 (VI Atp. CLP) of the European Parliament
10. Regulation (EU) 2015/1221 (VII Atp. CLP) of the European Parliament
11. Regulation (EU) 2016/918 (VIII Atp. CLP) of the European Parliament
12. Regulation (EU) 2016/1179 (IX Atp. CLP)
13. Regulation (EU) 2017/776 (X Atp. CLP)
14. Regulation (EU) 2018/669 (XI Atp. CLP)
15. Regulation (EU) 2018/1480 (XIII Atp. CLP)
16. Regulation (EU) 2019/521 (XII Atp. CLP)
- The Merck Index. - 10th Edition
- Handling Chemical Safety
- INRS - Fiche Toxicologique (toxicological sheet)
- Patty - Industrial Hygiene and Toxicology
- N.I. Sax - Dangerous properties of Industrial Materials-7, 1989 Edition
- IFA GESTIS website
- ECHA website
- Database of SDS models for chemicals - Ministry of Health and ISS (Istituto Superiore di Sanità) - Italy

Key literature references
The information provided in this eSDS is consistent with the information provided in the REACH chemical safety report (CSR) for magnesium. The CSR contains a complete reference list for all data used. Non confidential data from the REACH registration dossier is published by the European Chemicals Agency ECHA, see http://apps.echa.europa.eu/registered/registered-sub.aspx.

Changes to previous review:
The following sections were modified:
01 / 02 / 03 / 04 / 05 / 06 / 07 / 08 / 09 / 10 / 11 / 12 / 13 / 14 / 15 / 16.

Note for the recipient of the Safety Data Sheet (SDS):

The recipient of this SDS shall make sure of reading and understanding the information included by all people who handle, store, use, or otherwise come into contact in any way with the substance or mixture to which this SDS is referred to. In particular, the recipient shall provide adequate training to the personnel for the use of hazardous substances and/or mixtures. The recipient shall verify the suitability and completeness of the provided information according to the specific use of the substance or mixture.

However, the substance or mixture referred to by this SDS shall not be used for uses other than those specified in Section 1. The Supplier don't assume responsibility for improper uses. Since the use of the product does not fall under the direct control of the Supplier, the user shall, under his own responsibility, fulfill national and EU regulations concerning health and safety.

The information included in this SDS are provided in good faith and are based on the current state of scientific and technical knowledge, at the revision date indicated, available to the Supplier indicated in Section 1 of this SDS. It shall not be meant that the SDS is a guarantee of any specific property of the substance or mixture. The information concern only to the substance or mixture specifically designated in Section 1 and it could not be valid for the substance or mixture used in combination with other materials or in any process not specified in the text.

Identified uses
To demonstrate the safe use of magnesium, occupational exposure scenarios (attached to this e-SDS; Annex) have been developed to serve as generic scenarios based on the degree of dustiness of the handled substance. Each scenario includes all processes related to the production and the reported identified uses of magnesium. Each scenario includes the exposure assessment and risk characterisation of occupational/worker exposure, the occupational exposure of downstream users and references to the environmental exposure scenarios.
Each scenario includes the exposure assessment and risk characterisation of occupational/worker exposure, the occupational exposure of downstream users and references to the environmental exposure scenarios.

EXPOSURE SCENARIOS

Name of the substance	Registration number	Identified uses
Magnesium powder **Magnesium Raspings**	01-2119537203-49-0076	**ES1** Manufacture and recycling of massive metal and metal powder (for Melting, alloying, casting & Corrosion protection)
		ES 2 Manufacture of metal compounds (for Melting, alloying, casting & Corrosion protection)
		ES 3: Formulation of massive metal and metal powder (Alloying) (for Melting, alloying, casting & Particulates production and handling & Fine particulates production)
		ES 4: Formulation of metal compounds – incl. production of fireworks (for Particlulates production and handling & Fine particulates production)
		ES 5: Use of massive metal (for Solid forming processes – incl. production of welding electrodes)
		ES 6: Industrial use of metal compounds
		ES 7: Etching of magnesium dies
		ES 8: Welding in industrial and/or professional settings (environmental and occupational exposure)
		ES 9: Professional use of magnesium powder in signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination
		ES10: Consumer use of fireworks
		ES 11: Service life/ Handling of massive objects containing magnesium at ambient temperature

ES 3: Formulation of massive metal and metal powder (Alloying) (for Melting, alloying, casting & Particulates production and handling & Fine particulates production)

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

1. Title

Free short title	Formulation of massive metal and metal powder (Alloying) (for Melting, alloying, casting & Particulates production and handling & Fine particulates production)
Systematic title based on use descriptor	SU3, SU8, SU9, SU10, SU14, SU15, SU16, SU17, SU23 PC3, PC7, PC19 AC1, AC2, AC3, AC7 (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.

2. Operational conditions and risk management measures

2.1 Contributing scenario (1) controlling environmental exposure

Name of contributing scenario

1. Environmental exposure during formulation of massive metal and metal powder (Alloying)

Further specification

ERCs covered in this scenario: ERC 2,3

Instead of using the default ERC2 and 3 values from the ECHA guidance, spERCs based upon measured data are used.
Following sectors are covered by the spERC for formulation of massive metal and metal powder:
- Alloys formulation

Product characteristic

Magnesium can be in the form of raw materials, scrap or ingots

Amounts used

Amounts up to 4000 ton Mg/year can be used at one site (highest value based on 3 questionnaires)

Frequency and duration of use/exposure

Number of operating days: 230 (lowest value based on 3 questionnaires)

Environment factors not influenced by risk management

A default dilution factor of 10 is taken into account for freshwater

Other given operational conditions affecting environmental exposure

Alloying happens indoor.

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

None

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
Different kinds of RMM to prevent releases to the environment are possible: Water: - Chemical precipitation - Sedimentation - Filtration - Electrolysis (not common) Air: - Fabric or bag filters (most common) - Wet scrubbers (second most common) - Electrostatic precipitation (not common) - Ceramic filters - Dry or demi-dry scrubbers Emission factors are based on the metal spERCs: The metal spERC for Formulation of massive metal and metal powder v 1.1 has been used: Release to water: 0.003 % Release to air: 0.007 %
Organizational measures to prevent/limit release from site
No specific organizational measures were considered.
Conditions and measures related to municipal sewage treatment plant
A default municipal STP has been taken into account with a removal efficiency for Mg of 50% (REACH Guidance R.7.13-2, Section 2.2.1: Adjusting multimedia fate models for metals). If no municipal STP is available an on-site treatment with at least the same efficiency is required.
Conditions and measures related to external treatment of waste for disposal
Magnesium waste should be recycled as much as possible
Conditions and measures related to external recovery of waste
None

2.2 Contributing scenario (2) controlling worker exposure for the handling of magnesium metal massive

Name of contributing scenario
Manufacture and industrial uses of magnesium metal massive
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 8a, 8b, 9, 13, 14, 19, 21, 22, 23, 24, 25
Product characteristic
This contributing scenario applies to all industrial uses of magnesium metal massive.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted. Please note that magnesium massive metal is not classified.

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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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
Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Respiratory protective equipment is not required. Gloves are optional for mechanical/heat protection where needed. Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

2.3 Contributing scenario (3) controlling worker exposure for the handling of low dusty magnesium metal powders

Name of contributing scenario
Manufacture and industrial uses of low dusty magnesium metal powders
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 7, 8a, 8b, 9, 10, 13, 14, 19, 21, 22, 23, 24, 25, 26
Product characteristic
This contributing scenario applies to all industrial uses of low dusty magnesium metal powders.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted.
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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.

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, unless otherwise stated below the wearing of standard working clothes and shoes. 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
Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Respiratory protective equipment is not required. Gloves are optional for mechanical/heat protection where needed. Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

2.4 Contributing scenario (4) controlling worker exposure for the handling of medium dusty magnesium metal powders

Name of contributing scenario
Manufacture and industrial uses of medium dusty magnesium metal powders
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 7, 8a, 8b, 9, 10, 13, 14, 19, 22, 23, 24, 25, 26
Product characteristic
This contributing scenario applies to all industrial uses of medium dusty magnesium metal powders.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted.
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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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
Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Respiratory protective equipment is only required if workers may be exposed to medium dusty magnesium metal powders during PROC 7. For such situations a mask offering an assigned protection factor of 4 (e.g. FFP1) is required. Gloves are optional for mechanical/heat protection where needed. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

2.5 Contributing scenario (5) controlling worker exposure for the handling of high dusty magnesium metal powders

Name of contributing scenario
Manufacture and industrial uses of high dusty magnesium metal powders
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 7, 8a, 8b, 9, 10, 13, 14, 19, 22, 23, 24, 25, 26
Product characteristic
This contributing scenario applies to all industrial uses of high dusty magnesium metal powders.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m^3/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted.
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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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)
4, 8b, 9, 10, 14, 19, 26	FFP1 mask	APF=4	gloves are optional for mechanical/heat protection where needed	standard working clothes (overall long sleeve) and safety shoes antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists
8a	FFP2 mask	APF=10		
7	FFP3 mask	APF=20		
1,2, 3, 13, 22, 23, 24, 25	not required	na		

Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

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 exposure estimate and the DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL for magnesium metal of 10 mg/m³.
Due to the negligible dermal absorption of magnesium metal and the non-existing dermal effects, the dermal route is not a relevant exposure path for magnesium metal and a dermal DNEL has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.

The RCRs were calculated far below 1 for all relevant process categories and physical forms. Thus, a safe use is demonstrated for all relevant process categories.

Environmental emissions

Operational conditions	Value	Unit		
Environmental release factor to aquatic	30	g/T	Metal spERC: Formulation of massive metal and metal powder	
Environmental release factor to air	70	g/T	Metal spERC: Formulation of massive metal and metal powder	
Tonnage	4 000	T Mg		
Emission days	230	days		
Dilution factor	10			
Compartment			**PNECadd**	**RCR**
PECadd STP	0.13	mg/l	10.8	0.01
PEClocal,add in aquatic pelagic (freshwater)	12.9	µg/l	410	0.03
PEClocal,add in sediment (freshwater)	8.4	mg/kg dw	268	0.03
PEClocal,add in soil	6.2	mg/kg dw	268	0.02
PECadd,air (100 m)	213	ng/m³		

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 exposure to a level below the 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.
$DNEL_{inhalation}$: 10 mg/m³
Further guidance on how to evaluate whether a DU works inside the boundaries set by the ES is provided in Section 1.1 "Generic exposure scenario

approach" above.
Environmental emissions
If a DU has OC (operational conditions)/RMMs outside the OC/RMM specifications in the ES, then the DU can evaluate whether he works inside the boundaries set by the ES through scaling. The Metal EUSES calculator for DUs can be freely downloaded from http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool. In the registrant-interface, the generic default OCs and RMMs can be entered. In the simple and easy-to-use DU-interface, key OC and RMM can be changed according to the site-specific OC and RMMs of the DU. This includes general parameters as release factors, dilution, presence/absence of municipal sewage treatment plant, etc… It also allows the DU to enter bioavailability-corrected PNECs (Predicted No Effect Concentrations). In the background, the full EUSES model is run to calculate exposure and risks. The resulting risk characterisation ratios allow the DU to assess safe use. In this way, the DU scaling tool enables the DU to check compliance with the ES if his OCs or RMMs differ from those in the ES.
Additional good practice advice (for environment) beyond the REACH CSA Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

ES 4: Formulation of metal compounds – incl. production of fireworks (for Particulates production and handling & Fine particulates production)

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

1. Title

Free short title	Formulation of metal compounds – incl. production of fireworks (for Particulates production and handling & Fine particulates production)
Systematic title based on use descriptor	SU3, SU8, SU9, SU10, SU23 PC3, PC7, PC19 (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.

2. Operational conditions and risk management measures

2.1 Contributing scenario (1) controlling environmental exposure

Name of contributing scenario

1. Environmental exposure during formulation of metal compounds

Further specification

ERCs covered in this scenario: ERC 2,3

Instead of using the default ERC2 and 3 values from the ECHA guidance, spERCs based upon measured data are used.
Following sectors are covered by the spERC for formulation of metal compounds:
- Formulation of magnesium containing mixtures
- Fireworks formulation
- Production of military pyrotechnics (torches and signal rockets)
- Cored wire formulation

Product characteristic

Magnesium is used in powder, granule or grain form

Amounts used

Amounts up to 100 ton Mg/year can be used at one site (highest value based on 3 questionnaires)

Frequency and duration of use/exposure

Number of operating days: 190 (lowest value based on 3 questionnaires)

Environment factors not influenced by risk management

A default dilution factor of 10 is taken into account for freshwater

Other given operational conditions affecting environmental exposure

Formulation happens indoor.

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

None

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
Different kinds of RMM to prevent releases to the environment are possible: Water: - Chemical precipitation - Sedimentation - Filtration - Electrolysis (rare) Air: - Fabric or bag filters (most common) - Wet scrubbers (most common) - Electrostatic precipitation - Ceramic filters - Dry or demi-dry scrubbers Emission factors are based on the metal spERCs: The metal spERC for Formulation of metal compounds v 1.1 has been used: Release to water: 0.5 % Release to air: 0.004 %
Organizational measures to prevent/limit release from site
No specific organizational measures were considered.
Conditions and measures related to municipal sewage treatment plant
A default municipal STP has been taken into account with a removal efficiency for Mg of 50%. If no municipal STP is available an on-site treatment with at least the same efficiency is required (see 9.0.2.2).
Conditions and measures related to external treatment of waste for disposal
Magnesium waste should be recycled as much as possible
Conditions and measures related to external recovery of waste
None

2.2 Contributing scenario (2) controlling worker exposure for the handling of magnesium metal massive

Name of contributing scenario
Manufacture and industrial uses of magnesium metal massive
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 8a, 8b, 9, 13, 14, 19, 21, 22, 23, 24, 25
Product characteristic
This contributing scenario applies to all industrial uses of magnesium metal massive.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted. Please note that magnesium massive metal is not classified.

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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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
Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Respiratory protective equipment is not required. Gloves are optional for mechanical/heat protection where needed. Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

2.3 Contributing scenario (3) controlling worker exposure for the handling of low dusty magnesium metal powders

Name of contributing scenario
Manufacture and industrial uses of low dusty magnesium metal powders
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 7, 8a, 8b, 9, 10, 13, 14, 19, 21, 22, 23, 24, 25, 26
Product characteristic
This contributing scenario applies to all industrial uses of low dusty magnesium metal powders.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted.
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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).

Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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
Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Respiratory protective equipment is not required. Gloves are optional for mechanical/heat protection where needed. Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

2.4 Contributing scenario (4) controlling worker exposure for the handling of medium dusty magnesium metal powders

Name of contributing scenario
Manufacture and industrial uses of medium dusty magnesium metal powders
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 7, 8a, 8b, 9, 10, 13, 14, 19, 22, 23, 24, 25, 26
Product characteristic
This contributing scenario applies to all industrial uses of medium dusty magnesium metal powders.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m^3/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted.
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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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
Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Respiratory protective equipment is only required if workers may be exposed to medium dusty magnesium metal powders during PROC 7. For such situations a mask offering an assigned protection factor of 4 (e.g. FFP1) is required. Gloves are optional for mechanical/heat protection where needed. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

2.5 Contributing scenario (5) controlling worker exposure for the handling of high dusty magnesium metal powders

Name of contributing scenario
Manufacture and industrial uses of high dusty magnesium metal powders
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 7, 8a, 8b, 9, 10, 13, 14, 19, 22, 23, 24, 25, 26
Product characteristic
This contributing scenario applies to all industrial uses of high dusty magnesium metal powders.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted.
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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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)**
4, 8b, 9, 10, 14, 19, 26	FFP1 mask	APF=4	gloves are optional for mechanical/heat protection where needed	standard working clothes (overall long sleeve) and safety shoes antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists
8a	FFP2 mask	APF=10		
7	FFP3 mask	APF=20		
1,2, 3, 13, 22, 23, 24, 25	not required	na		
Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.				

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 exposure estimate and the DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL for magnesium metal of 10 mg/m^3.
Due to the negligible dermal absorption of magnesium metal and the non-existing dermal effects, the dermal route is not a relevant exposure path for magnesium metal and a dermal DNEL has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.

The RCRs were calculated far below 1 for all relevant process categories and physical forms. Thus, a safe use is demonstrated for all relevant process categories.

Environmental emissions

Operational conditions	**Value**	**Unit**		
Environmental release factor to aquatic	5 000	g/T	Metal spERC: Formulation of metal compounds	
Environmental release factor to air	40	g/T	Metal spERC: Formulation of metal compounds	
Tonnage	100	T Mg		
Emission days	190	days		
Dilution factor	10			
Compartment			**PNECadd**	**RCR**
PECadd STP	0.66	mg/l	10.8	0.06
PEClocal,add in aquatic pelagic (freshwater)	65.2	µg/l	410	0.16
PEClocal,add in sediment (freshwater)	42.3	mg/kg dw	268	0.16
PEClocal,add in soil	30.8	mg/kg dw	268	0.12
PECadd,air (100 m)	3.0	ng/m^3		

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 exposure to a level below the 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.

$DNEL_{inhalation}$: 10 mg/m³

Further guidance on how to evaluate whether a DU works inside the boundaries set by the ES is provided in Section 1.1 "Generic exposure scenario approach" above.

Environmental emissions

If a DU has OC (operational conditions)/RMMs outside the OC/RMM specifications in the ES, then the DU can evaluate whether he works inside the boundaries set by the ES through scaling.

The Metal EUSES calculator for DUs can be freely downloaded from http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool.

In the registrant-interface, the generic default OCs and RMMs can be entered.

In the simple and easy-to-use DU-interface, key OC and RMM can be changed according to the site-specific OC and RMMs of the DU. This includes general parameters as release factors, dilution, presence/absence of municipal sewage treatment plant, etc… It also allows the DU to enter bioavailability-corrected PNECs (Predicted No Effect Concentrations).

In the background, the full EUSES model is run to calculate exposure and risks. The resulting risk characterisation ratios allow the DU to assess safe use. In this way, the DU scaling tool enables the DU to check compliance with the ES if his OCs or RMMs differ from those in the ES.

Additional good practice advice (for environment) beyond the REACH CSA

Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

ES 5: Use of massive metal (for Solid forming processes – incl. production of welding electrodes &

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

1. Title

Free short title	Use of massive metal
Systematic title based on use descriptor	SU3, SU8, SU9, SU10, SU14, SU15, SU16, SU17, SU23 PC3, PC7, PC14, PC19, PC0 (pyrotechnic composition) AC1, AC2, AC3, AC7 (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.

2. Operational conditions and risk management measures

2.1 Contributing scenario (1) controlling environmental exposure

Name of contributing scenario

1. Environmental exposure during use of massive metal in shaping

Further specification

ERCs covered in this scenario: ERC 12a
Instead of using the default ERC12a values from the ECHA guidance, spERCs based upon measured data are used.
Following sectors are covered by the spERC for use of massive metal in shaping:
- Metal processing industry (extrusion, forging, wrought rolling, maching of semi-finished products)
- Particulates production
- Welding of Mg parts

Product characteristic

Magnesium is used in massive form

Amounts used

Amounts up to 6 000 ton Mg/year can be used at one site (highest value based on 2 questionnaires)

Frequency and duration of use/exposure

Number of operating days: 250 (lowest value based on 2 questionnaires)

Environment factors not influenced by risk management

A default dilution factor of 10 is taken into account for freshwater

Other given operational conditions affecting environmental exposure

Use/shaping happens indoor.

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

None

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

Different kinds of RMM to prevent releases to the environment are possible:
Water:
- Chemical precipitation (most common)
- Sedimentation
- Filtration
- Electrolysis (rare)

Air:
- Fabric or bag filters
- Wet scrubbers
- Electrostatic precipitation
- Ceramic filters
- Dry or demi-dry scrubbers

Emission factors are based on the metal spERCs:
The metal spERC for Use of massive metal v 1.2 has been used:
Release to water: 0.01 %
Release to air: 0.02 %

Organizational measures to prevent/limit release from site
No specific organizational measures were considered.
Conditions and measures related to municipal sewage treatment plant
A default municipal STP has been taken into account with a removal efficiency for Mg of 50% (REACH Guidance R.7.13-2, Section 2.2.1: Adjusting multimedia fate models for metals). If no municipal STP is available an on-site treatment with at least the same efficiency is required
Conditions and measures related to external treatment of waste for disposal
Magnesium waste should be recycled as much as possible
Conditions and measures related to external recovery of waste
None

2.2 Contributing scenario (2) controlling worker exposure for the handling of magnesium metal massive

Name of contributing scenario
Manufacture and industrial uses of magnesium metal massive
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 8a, 8b, 9, 13, 14, 19, 21, 22, 23, 24, 25
Product characteristic
This contributing scenario applies to all industrial uses of magnesium metal massive.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted. Please note that magnesium massive metal is not classified.
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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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

Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Respiratory protective equipment is not required. Gloves are optional for mechanical/heat protection where needed. Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

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 exposure estimate and the DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL for magnesium metal of 10 mg/m^3.
Due to the negligible dermal absorption of magnesium metal and the non-existing dermal effects, the dermal route is not a relevant exposure path for magnesium metal and a dermal DNEL has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.

The RCRs were calculated far below 1 for all relevant process categories and physical forms. Thus, a safe use is demonstrated for all relevant process categories.

Environmental emissions

Operational conditions	**Value**	**Unit**		
Environmental release factor to aquatic	100	g/T	Metal spERC: Use of massive metal	
Environmental release factor to air	200	g/T	Metal spERC: Use of massive metal	
Tonnage	6 000	T Mg		
Emission days	250	days		
Dilution factor	10			
Compartment			**PNECadd**	**RCR**
PECadd STP	0.60	mg/l	10.8	0.06
PEClocal,add in aquatic pelagic (freshwater)	59.4	µg/l	410	0.14
PEClocal,add in sediment (freshwater)	38.6	mg/kg dw	268	0.14
PEClocal,add in soil	28.5	mg/kg dw	268	0.11
PECadd,air (100 m)	914	ng/m^3		

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 exposure to a level below the 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.
$DNEL_{inhalation}$: 10 mg/m³
Further guidance on how to evaluate whether a DU works inside the boundaries set by the ES is provided in Section 1.1 "Generic exposure scenario approach" above.

Environmental emissions

If a DU has OC (operational conditions)/RMMs outside the OC/RMM specifications in the ES, then the DU can evaluate whether he works inside the boundaries set by the ES through scaling.
The Metal EUSES calculator for DUs can be freely downloaded from http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool.
In the registrant-interface, the generic default OCs and RMMs can be entered.
In the simple and easy-to-use DU-interface, key OC and RMM can be changed according to the site-specific OC and RMMs of the DU. This includes general parameters as release factors, dilution, presence/absence of municipal sewage treatment plant, etc… It also allows the DU to enter bioavailability-corrected PNECs (Predicted No Effect Concentrations).
In the background, the full EUSES model is run to calculate exposure and risks. The resulting risk characterisation ratios allow the DU to assess safe use. In this way, the DU scaling tool enables the DU to check compliance with the ES if his OCs or RMMs differ from those in the ES.

Additional good practice advice (for environment) beyond the REACH CSA
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

ES 6: Industrial use of metal compounds

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

1. Title

Free short title	Industrial use of metal compounds
Systematic title based on use descriptor	SU3, SU8, SU9, SU10, SU14, SU15, SU16, SU17, SU23 PC3, PC7, PC14, PC19, PC0 (pyrotechnic composition) AC1, AC2, AC3, AC7 (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.

2. Operational conditions and risk management measures

2.1 Contributing scenario (1) controlling environmental exposure

Name of contributing scenario

1. Environmental exposure during industrial use of metal compounds

Further specification

ERCs covered in this scenario: 4-7

Instead of using the default ERC 4, 5, 6 and 6 values from the ECHA guidance, spERCs based upon measured data are used.
Following sectors are covered by the spERC for industrial use of metal compounds:
- Metallurgical industry (steel desulphurization, cast iron, metal reduction/deoxidation, debismuthising of Pb)
- Use in hydrogen storage tanks

Product characteristic

Magnesium is used in powder, granule or grain form

Amounts used

Amounts up to 1 200 ton Mg/year can be used at one site

Frequency and duration of use/exposure

Number of operating days: 350 (value based on 1 questionnaire)

Environment factors not influenced by risk management

A specific dilution factor of 20 is needed for freshwater to obtain a high enough dilution.

Other given operational conditions affecting environmental exposure

Use happens indoor.

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

None

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

Different kinds of RMM to prevent releases to the environment are possible:
Water:
- Chemical precipitation
- Sedimentation
- Filtration
- Electrolysis

Air:
- Fabric or bag filters (most common)
- Wet scrubbers
- Electrostatic precipitation
- Ceramic filters
- Dry or demi-dry scrubbers

Emission factors are based on the metal spERCs:
The metal spERC for industrial use of metal compounds v 1.1 has been used:
Release to water: 0.6 %
Release to air: 0.1 %

Organizational measures to prevent/limit release from site

No specific organizational measures were considered.

Conditions and measures related to municipal sewage treatment plant
A default municipal STP has been taken into account with a removal efficiency for Mg of 50% (REACH Guidance R.7.13-2, Section 2.2.1: Adjusting multimedia fate models for metals). If no municipal STP is available an on-site treatment with at least the same efficiency is required.
Conditions and measures related to external treatment of waste for disposal
Magnesium waste should be recycled as much as possible
Conditions and measures related to external recovery of waste
None

2.2 Contributing scenario (2) controlling worker exposure for the handling of magnesium metal massive

Name of contributing scenario
Manufacture and industrial uses of magnesium metal massive
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 8a, 8b, 9, 13, 14, 19, 21, 22, 23, 24, 25
Product characteristic
This contributing scenario applies to all industrial uses of magnesium metal massive.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted. Please note that magnesium massive metal is not classified.
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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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
Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Respiratory protective equipment is not required. Gloves are optional for mechanical/heat protection where needed. Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

2.3 Contributing scenario (3) controlling worker exposure for the handling of low dusty magnesium metal powders

Name of contributing scenario
Manufacture and industrial uses of low dusty magnesium metal powders
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 7, 8a, 8b, 9, 10, 13, 14, 19, 21, 22, 23, 24, 25, 26
Product characteristic
This contributing scenario applies to all industrial uses of low dusty magnesium metal powders.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted.
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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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
Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Respiratory protective equipment is not required. Gloves are optional for mechanical/heat protection where needed. Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

2.4 Contributing scenario (4) controlling worker exposure for the handling of medium dusty magnesium metal powders

Name of contributing scenario

Manufacture and industrial uses of medium dusty magnesium metal powders

Further specification

PROCs covered in this scenario: PROCs 1, 2, 3, 4, 7, 8a, 8b, 9, 10, 13, 14, 19, 22, 23, 24, 25, 26

Product characteristic

This contributing scenario applies to all industrial uses of medium dusty magnesium metal powders.

Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.

Frequency and duration of use/exposure

The exposure duration is not restricted for all applicable processes in this scenario.

Human factors not influenced by risk management

The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.

Other given operational conditions affecting workers exposure

Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions.
For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles:

- the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention,
- the avoidance of the ignition of explosive atmospheres, and
- the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers.

To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted.

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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).

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

Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.

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, unless otherwise stated below the wearing of standard working clothes and shoes. 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

Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Respiratory protective equipment is only required if workers may be exposed to medium dusty magnesium metal powders during PROC 7. For such situations a mask offering an assigned protection factor of 4 (e.g. FFP1) is required. Gloves are optional for mechanical/heat protection where needed. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Reference is given to the section “Selection of appropriate respiratory equipment” and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

2.5 Contributing scenario (5) controlling worker exposure for the handling of high dusty magnesium metal powders

Name of contributing scenario

Manufacture and industrial uses of high dusty magnesium metal powders

Further specification

PROCs covered in this scenario: PROCs 1, 2, 3, 4, 7, 8a, 8b, 9, 10, 13, 14, 19, 22, 23, 24, 25, 26

MAGNESIUM POWDERS AND RASPINGS

Product characteristic

This contributing scenario applies to all industrial uses of high dusty magnesium metal powders.

Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.

Frequency and duration of use/exposure

The exposure duration is not restricted for all applicable processes in this scenario.

Human factors not influenced by risk management

The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.

Other given operational conditions affecting workers exposure

Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions.
For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles:

- the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention,
- the avoidance of the ignition of explosive atmospheres, and
- the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers.

To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted.

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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).

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

Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.

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, unless otherwise stated below the wearing of standard working clothes and shoes. 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)
4, 8b, 9, 10, 14, 19, 26	FFP1 mask	APF=4	gloves are optional for mechanical/heat protection where needed	standard working clothes (overall long sleeve) and safety shoes antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists
8a	FFP2 mask	APF=10		
7	FFP3 mask	APF=20		
1,2, 3, 13, 22, 23, 24, 25	not required	na		

Reference is given to the section “Selection of appropriate respiratory equipment” and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

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 exposure estimate and the DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL for magnesium metal of 10 mg/m³.
Due to the negligible dermal absorption of magnesium metal and the non-existing dermal effects, the dermal route is not a relevant exposure path for magnesium metal and a dermal DNEL has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.

The RCRs were calculated far below 1 for all relevant process categories and physical forms. Thus, a safe use is demonstrated for all relevant process categories.

Environmental emissions

Operational conditions	**Value**	**Unit**		
Environmental release factor to aquatic	6 000	g/T	Metal spERC: Industrial use of metal compounds	
Environmental release factor to air	1 000	g/T	Metal spERC: Industrial use of metal compounds	
Tonnage	1 200	T Mg		
Emission days	350	days		
Dilution factor	20			
Compartment			**PNECadd**	**RCR**
PECadd STP	5.14	mg/l	10.8	0.48
PEClocal,add in aquatic pelagic (freshwater)	254.6	µg/l	410	0.62
PEClocal,add in sediment (freshwater)	165.3	mg/kg dw	268	0.62
PEClocal,add in soil	241.5	mg/kg dw	268	0.90
PECadd,air (100 m)	914	ng/m³		

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 exposure to a level below the 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.
$DNEL_{inhalation}$: 10 mg/m³
Further guidance on how to evaluate whether a DU works inside the boundaries set by the ES is provided in Section 1.1 "Generic exposure scenario approach" above.

Environmental emissions

If a DU has OC (operational conditions)/RMMs outside the OC/RMM specifications in the ES, then the DU can evaluate whether he works inside the boundaries set by the ES through scaling.
The Metal EUSES calculator for DUs can be freely downloaded from http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool.
In the registrant-interface, the generic default OCs and RMMs can be entered.
In the simple and easy-to-use DU-interface, key OC and RMM can be changed according to the site-specific OC and RMMs of the DU. This includes general parameters as release factors, dilution, presence/absence of municipal sewage treatment plant, etc… It also allows the DU to enter bioavailability-corrected PNECs (Predicted No Effect Concentrations).
In the background, the full EUSES model is run to calculate exposure and risks. The resulting risk characterisation ratios allow the DU to assess safe use. In this way, the DU scaling tool enables the DU to check compliance with the ES if his OCs or RMMs differ from those in the ES.

Additional good practice advice (for environment) beyond the REACH CSA
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

ES 7: Etching of magnesium dies

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

1. Title

Free short title	Etching of magnesium dies
Systematic title based on use descriptor	SU3, SU8, SU9, SU10, SU14, SU15, SU16, SU17, SU23 PC3, PC7, PC14, PC19, PC0 (pyrotechnic composition) AC1, AC2, AC3, AC7 (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.

2. Operational conditions and risk management measures

2.1 Contributing scenario (1) controlling environmental exposure

Name of contributing scenario

1. Environmental exposure during etching of magnesium dies

Further specification

ERCs covered in this scenario: ERC 12b

Instead of using the default ERC12b values from the ECHA guidance, measured data are used.
Following sector is covered by sector specific data:
- Etching of magnesium dies

Product characteristic

Magnesium is used in massive form and etched away

Amounts used

Amounts used not relevant for this scenario but approximate 400 ton/year (value based on 1 questionnaire)

Frequency and duration of use/exposure

Release is mostly intermittent but can also happen continuously

Environment factors not influenced by risk management

A default dilution factor of 10 is taken into account for freshwater

Other given operational conditions affecting environmental exposure

Use happens in batches, batches are discharged between 1 time per month to 2 times per day.

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

None

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

Different kinds of RMM to prevent releases to the environment are possible:
Water:
- Chemical precipitation
- Sedimentation
- Filtration
- Electrolysis (rare)

Air:
Not relevant, no releases to air.

Emissions are not expressed in emission factors. A batch is discharged once it contains too much magnesium, usually around 5kg per 120 l bath. Those baths are diluted with washing water or water from other processes before being discharged to a water treatment plant. Worst case would assume discharging batches twice a day so 10 kg Mg release per day.

Organizational measures to prevent/limit release from site

No specific organizational measures were considered.

Conditions and measures related to municipal sewage treatment plant

A default municipal STP has been taken into account with a removal efficiency for Mg of 50% (REACH Guidance R.7.13-2, Section 2.2.1: Adjusting multimedia fate models for metals). If no municipal STP is available an on-site treatment with at least the same efficiency is required

Conditions and measures related to external treatment of waste for disposal
Magnesium waste should be recycled as much as possible
Conditions and measures related to external recovery of waste
None

2.2 Contributing scenario (2) controlling worker exposure for the handling of magnesium metal massive

Name of contributing scenario
Manufacture and industrial uses of magnesium metal massive
Further specification
PROCs covered in this scenario: PROCs 1, 2, 3, 4, 8a, 8b, 9, 13, 14, 19, 21, 22, 23, 24, 25
Product characteristic
This contributing scenario applies to all industrial uses of magnesium metal massive.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Operational conditions like process temperature and process pressure have been considered on a worst case basis for occupational exposure assessment of the conducted processes and a safe use was demonstrated under these conditions. For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted. Please note that magnesium massive metal is not classified.
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 not required in the applicable processes unless such requirements are inherently required by the selected process category (e.g. closed process for PROC 1-3).
Technical conditions and measures to control dispersion from source towards the worker
Further localised controls are not required for the conducted processes. The risk of dust explosion shall be considered if a local exhaust ventilation is used.
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, unless otherwise stated below the wearing of standard working clothes and shoes. 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

Standard working clothes (overall long sleeve) and safety shoes are required for all processes for good occupational hygiene practice. Antistatic worker equipment including cotton overalls, antistatic safety shoes and gloves are required for workplaces where the risk of powder ignition/ dust explosion exists. Respiratory protective equipment is not required. Gloves are optional for mechanical/heat protection where needed. Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

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 exposure estimate and the DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL for magnesium metal of 10 mg/m³.
Due to the negligible dermal absorption of magnesium metal and the non-existing dermal effects, the dermal route is not a relevant exposure path for magnesium metal and a dermal DNEL has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.

The RCRs were calculated far below 1 for all relevant process categories and physical forms. Thus, a safe use is demonstrated for all relevant process categories.

Environmental emissions

Operational conditions	**Value**	**Unit**		
Environmental release factor to aquatic	10	kg/d	Value based on questionnaires	
Environmental release factor to air	Not relevant			
Tonnage	Batch discharged 1/month till 2/day			
Dilution factor	10			
Compartment			**PNECadd**	**RCR**
PECadd STP	2.50	mg/l	10.8	0.23
PEClocal,add in aquatic pelagic (freshwater)	247.6	µg/l	410	0.60
PEClocal,add in sediment (freshwater)	160.7	mg/kg dw	268	0.60
PEClocal,add in soil	117.2	mg/kg dw	268	0.44
PECadd,air (100 m)	No emission to air			

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 exposure to a level below the 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.
$DNEL_{inhalation}$: 10 mg/m³
Further guidance on how to evaluate whether a DU works inside the boundaries set by the ES is provided in Section 1.1 "Generic exposure scenario approach" above.

Environmental emissions

If a DU has OC (operational conditions)/RMMs outside the OC/RMM specifications in the ES, then the DU can evaluate whether he works inside the boundaries set by the ES through scaling.
The Metal EUSES calculator for DUs can be freely downloaded from http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool.
In the registrant-interface, the generic default OCs and RMMs can be entered.
In the simple and easy-to-use DU-interface, key OC and RMM can be changed according to the site-specific OC and RMMs of the DU. This includes general parameters as release factors, dilution, presence/absence of municipal sewage treatment plant, etc… It also allows the DU to enter bioavailability-corrected PNECs (Predicted No Effect Concentrations).
In the background, the full EUSES model is run to calculate exposure and risks. The resulting risk characterisation ratios allow the DU to assess safe use. In this way, the DU scaling tool enables the DU to check compliance with the ES if his OCs or RMMs differ from those in the ES.

Additional good practice advice (for environment) beyond the REACH CSA

Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

ES 8: Welding in industrial and/or professional settings (environmental and occupational exposure)

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

1. Title

Free short title	Welding in industrial and/or professional settings (environmental and occupational exposure)
Systematic title based on use descriptor	SU3 (Industrial uses), SU22 (Professional uses) PC7, PC14, PC38 AC1, AC2, AC7 (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 hazard potential associated with welding processes is driven by the diversity of exposures to different contaminants which may either be contained in the welding objects or in the welding consumables. In addition, these contaminants may be released as gas or coarse or fine dust particles depending on the specific welding process and materials used. This exposure scenario therefore aims at providing information on the risk management measures to be implemented to ensure safe welding instead of just focussing the safe handling of magnesium. A detailed catalogue of the required risk management measures depending on the welding process and materials used have been published by Eurometaux, Eurofer and the European Welding Association (2010). This exposure scenario makes use of this document as far as possible but reference is given to the original document for additional information. The exposure assessment itself has been made on an exemplary basis on worst case assumptions using the exposure modelling tool MEASE.

2. Operational conditions and risk management measures

Task	Involved tasks	Involved PROCs	ERCs
Welding in industrial and/or professional settings	handling of electrodes and metal objects, welding	21, 25	8c, 8f

2.1 Control of workers exposure

Product characteristic
During welding in industrial and/or professional settings, magnesium is in a molten/gaseous form with a high emission potential.
Amounts used
The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario.
Frequency and duration of use/exposure
The exposure duration is not restricted for all applicable processes in this scenario.
Human factors not influenced by risk management
The safe use of the substance has been demonstrated by assuming a standard breathing volume of 10 m³/shift for workers. If doubts exist that the actual breathing volume exceeds this value on a regular basis, a refined exposure scenario may be required.
Other given operational conditions affecting workers exposure
Not considered relevant for occupational exposure assessment of the conducted processes.
Technical conditions and measures at process level (source) to prevent release
To be selected according to the EUROMETAUX / EUROFER / EWA catalogue of risk management measures (see below for an abbreviated version of this catalogue)
Technical conditions and measures to control dispersion from source towards the worker
To be selected according to the EUROMETAUX / EUROFER / EWA catalogue of risk management measures (see below for an abbreviated version of this catalogue)
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 in the workplace, unless otherwise stated below the wearing of standard working clothes and shoes. 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
Standard working clothes (long-sleeve overall) and safety shoes are required for all processes for good occupational hygiene practice. Gloves are optional for process steps at ambient temperature, thermal protective gloves should be used for hot processes. Respiratory protective equipment has o be selected according to the EUROMETAUX / EUROFER / EWA catalogue of risk management measures (see below for an abbreviated version of this catalogue). Reference is given to the section "Selection of appropriate respiratory equipment" and BS EN 529:2005 for a more detailed description of the requirements of personal protective equipment.

MAGNESIUM POWDERS AND RASPINGS

RMM catalogue (REACH and the welding of Metals and Alloys), full version available at: http://www.eurofer.be/index.php/eng/REACH/Documents-and-useful-web-links/Welding						
Class	**Process** *(according to ISO 4063)*	**Base materials**	**Remarks**	**Ventilation / Extraction / Filtration**	**RPE DC<15%**	**RPE DC>15%**
Unconfined space (no segregation, separation)						
I	GTAW 141	All	Except Al	GV low	n.a.	n.a.
	SAW 12					
	Autogenous 3					
	PAW 15					
	ESW / EGW 72/73					
	Resistance 2					
	Stud welding 78					
	Solid state 521					
	Gases brazing 9		Except Cd-alloys			
II	GTAW 141	Al	n.a.	GV medium	n.a.	FFP2
III	MMAW 111	All	Except stainless, Be-, V-, Mn- and Ni-alloys	GV low LEV low	Improved helmet	FFP2
	FCAW 136/137		Except stainless and Ni-alloys			
	GMAW 131/135		Except Cu, Be- and V-alloys			
	Powder plasma arc 152		Except stainless, Be-, V-, Cu-, Mn- and Ni-alloys			
IV	All processes class I	Painted / primed / oiled	No Pb containing primer	GV low	FFP2	FFP3 TH2/P2 LDH2
	All processes class II			GV low LEV low		
V	MMAW 111	Stainless, Ni-, Be- and V-alloys	n.a.	LEV high	TH3/P3 LDH3	TH3/P3 LDH3
	FCAW 136/137	Stainless, Mn- and Ni-alloys				
	GMAW 131	Cu-alloys				
	Powder plasma arc 152	Stainless, Mn, Ni- and Cu-alloys				
VI	GMAW 131	Be- and V-alloys	n.a.	Reduce (negative) pressure area LEV low	TH3/P3 LDH3	TH3/P3 LDH3
	Powder plasma arc 152					
VII	Self shielded FCAW 114	Un- and high alloyed steel	Cored wire, not containing Ba	Reduce (negative) pressure area LEV medium	TH3/P3 LDH3	TH3/P3 LDH3
			Cored wire, containing Ba	Reduce (negative) pressure area LEV high		
	All	Painted / primed	Paint / primer containing Pb			
	Arc gouging and cutting	All	n.a.			
	Thermal spray					
	Gases brazing	Cd-alloys				
Closed system or confined space						
I	Laser welding 52	All	Closed system	GV medium	n.a.	n.a.
	Laser cutting 84					
	Electron beam 51					
VIII	All	All	Confined space	LEV high External air supply	LDH3	LDH3

Glossary

Class: approximate ranking to mitigate risk by selecting process/material combinations with the lowest value. Identified collective and individual risk management measures shall be applied
DC: Duty cycle expressed on 8 hours.
General Ventilation (GV) Low: With additional Local Exhaust Ventilation (LEV) and extracted air to the outside, the GV or LEV capacity may be reduced to 1/5 of the original requirement.
General Ventilation (GV) Medium: double compared to Low
Reduced (negative) pressured Area: A separate, ventilated area where reduced (negative) pressure, compared to the surrounded area, is maintained
Local Exhaust Ventilation (LEV) High, extraction at source (includes table, hood, arm or torch extraction)
Local Exhaust Ventilation (LEV) Low, extraction at source (includes table, hood, arm or torch extraction)
Local Exhaust Ventilation (LEV) Medium, extraction at source (includes table, hood, arm or torch extraction)
A **confined space**, despite its name, is not necessarily small. Examples of confined spaces include ship, silos, utility vaults, tanks, etc.
Improved helmet, designed to avoid direct flow of welding fumes inside

Reference is given to the original document available at for more information:
http://www.eurofer.be/index.php/eng/REACH/Documents-and-useful-web-links/Welding

2.2 Control of environmental exposure

Product characteristics

Not relevant for exposure estimation.

Amounts used

Total amounts used are not relevant since the assessment is done based on concentrations in STPs.

Frequency and duration of use

Usually continuous use/release: 365 days/year (wide dispersive use)

Environment factors not influenced by risk management

Flow rate of receiving surface should be sufficiently high to dilute the effluent concentration of the STP below the PNEC for water and sediment.

Other given operational conditions affecting environmental exposure

Indoor or outdoor use is possible
There are no intended releases of magnesium to water. The non-intended releases are negligible and pose no threat to the environment.

Conditions and measures related to municipal sewage treatment plant

Presence of a municipal sewage treatment plant is assumed.

Conditions and measures related to external treatment of waste for disposal

Waste discharged on own internal or external waste dumps.

Conditions and measures related to external recovery of waste

Not relevant

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 exposure estimate and the DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL for magnesium metal of 10 mg/m^3.
Due to the negligible dermal absorption of metallic magnesium, the dermal route is not a relevant exposure path for metallic magnesium and a DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.

The RCRs were calculated far below 1 for all relevant processes. Thus, a safe use is demonstrated for all relevant processes.

Environmental emissions

There are no intended releases of magnesium to water due to the professional use of magnesium coated welding electrodes. The non-intended releases are negligible and pose no threat to the environment.

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 exposure to a level below the 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.
DNELinhalation: 10 mg/m³

Further guidance on how to evaluate whether a DU works inside the boundaries set by the ES is provided in Section 1.1 "Generic exposure scenario approach" above.
Environmental emissions
There are no intended releases of magnesium to water due to the professional use of magnesium coated welding electrodes. The non-intended releases are negligible and pose no threat to the environment.

ES 9: Professional use of magnesium powder in signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination

Exposure Scenario Format (1) addressing uses carried out by workers			
1. Title			
Free short title	Professional use of magnesium powder in signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination		
Systematic title based on use descriptor	SU22 (Professional uses) (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 and dermal exposure is based on the exposure estimation tool MEASE. The environmental assessment method is given in Section 2 below.		
2. Operational conditions and risk management measures			
Task	**Involved tasks**	**Involved PROCs**	**Involved ERCs**
Handling of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	handling of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	21	8e
Use of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	use of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination, launching/impaction (It is explicitly noted, that any containing magnesium is completely transformed into magnesium oxide during burning/impaction. Exposure to magnesium is therefore excluded.)	0	

2.1 Control of workers exposure

Product characteristics

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.

Workplace	**Used in preparation?**	**Content in preparation**	**Physical form**	**Emission potential**
Handling of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	not restricted (used in closed container)		closed massive container	very low
Use of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	Not restricted (used in closed container until impaction/burning, high dilution by ambient air after burning). It is explicitly noted, that any containing magnesium is completely transformed into magnesium oxide during burning. Exposure to magnesium is therefore excluded.		not relevant	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 (per shift/day)**			
Handling of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	480 minutes			
Use of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	only short durations per day			
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				
Task	**Room volume**	**Outdoors or indoors?**	**Process temperature**	**Process pressure**
Handling of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	not restricted	not restricted	Not considered relevant for occupational exposure assessment of the conducted processes.	
Use of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	not restricted	outdoor use		
For workplaces for which the risk of dust ignition/explosion exists, parallel existing legislation and/or standards have to be considered (e.g. 1999/92/EC, EN14797 and EN13463). Technical and/or organisational measures shall be taken appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles: - the prevention of the formation of explosive atmospheres, or where the nature of the activity does not allow such prevention, - the avoidance of the ignition of explosive atmospheres, and - the mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers. To account for the high flammability of magnesium powder, measures to prevent ignition (e.g. no open fire in workplace, avoidance of electro-static discharges) are to be taken. Additionally, magnesium powder is classified as being flammable in contact with water, Thus direct contact of magnesium powder with water has to be omitted.				
Technical conditions and measures at process level (source) to prevent release				
Task	**Level of containment**	**Level of segregation**		
Handling of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	not required	not required		
Use of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination				

Technical conditions and measures to control dispersion from source towards the worker				
Task	**Level of separation**	**Type of ventilation**	**Efficiency of ventilation (according to MEASE)**	**Further information**
Handling of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	not required	not required	na	-
Use of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	not required	dilution ventilation	Because of the outdoor setting of this scenario and the safety distance during burning, it is assumed that any emitted magnesium is diluted to an extent which renders occupational exposure very low.	try to maintain a certain distance to the emerging fume and try not to stand upwind if possible, otherwise, try not to spend a long time in the emerging fume

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, unless otherwise stated below the wearing of standard working clothes and shoes. 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				
Task	**Specification of respiratory protective equipment (RPE)**	**RPE efficiency (assigned protection factor, APF)**	**Specification of gloves**	**Further personal protective equipment (PPE)**
Handling of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	not required	na	not required	standard working equipment (clothing and shoes), eye and ear protection should be worn as appropriate
Use of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	not required	na	during the use of signal flares, signal rockets or marking ammunition, protective gloves should be worn as appropriate	

2.2 Control of environmental exposure
No quantitative environmental exposure is performed for the professional use of magnesium powder in signal flares, signal rockets, marking ammunition and signaling and simulation ammunition and illumination. These products are predominantly used in open air at sea (>90%) and land (<10%). During use, all magnesium is completely burned and transformed into MgO, and the MgO emitted will be deposited in the marine water or on soil surface. Because of the limited total amount of Mg used for this application (<100 tons/year), the small amount of Mg per individual product (<50 g per product), the wide dispersive nature of this use, and the large natural background concentration of Mg in the receiving environmental compartments (3930 mg Mg/kg soil and 1290 mg Mg/l seawater, see section 9.16.1), it is concluded that this specific use results in negligible additional environmental exposure to Mg or MgO and therefore has no impact on the environment.

3. Exposure estimation and reference to its source

Occupational exposure

The assessment of occupational exposure is based on MEASE. The risk characterisation ratio (RCR) is the quotient of the exposure estimate and the 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 (long-term, systemic effects) for magnesium of 10 mg/m³. The dermal exposure estimates as given by MEASE were divided by a default body weight for workers of 70 kg to compare the values with the systemic dermal DNEL.

Task	Method used for inhalation exposure assessment (refer to introduction)	Inhalation exposure estimate (RCR)	Method used for dermal exposure assessment (refer to introduction)	Dermal exposure estimate (RCR)
Handling of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	MEASE	0.05 mg/m³ (0.005)	According to the HERAG guidance for metals (HERAG fact sheet - Assessment of occupational dermal exposure and dermal absorption for metals and inorganic metal substances; EBRC Consulting GmbH / Hannover /Germany; August 2007), the dermal absorption of magnesium is assumingly very low, i.e. 0.1 % from dry (dust) exposure. In addition, no systemic/local effects are expected for Mg cations following exposure of intact or damaged skin. Therefore, a dermal DNEL has not been derived. Nevertheless, a dermal exposure estimate is given here: The highest possible estimate for dermal exposure in MEASE is 14.1 mg/kg bw/day (under worst case assumptions, i.e. wide dispersive use, direct handling, extensive contact, largest exposed dermal area and not considering the wearing of gloves and a dermal absorption of 0.1 %). Dermal exposure is not further assessed in this exposure scenario.	
Use of signal flares, signal rockets, marking ammunition, signalling and simulation ammunition and illumination	It is explicitly noted, that any containing magnesium is completely transformed into magnesium oxide during burning. Exposure to magnesium is therefore excluded.	not relevant for magnesium	It is explicitly noted, that any containing magnesium is completely transformed into magnesium oxide during burning. Exposure to magnesium is therefore excluded.	not relevant for magnesium

Environmental emissions

No quantitative environmental exposure is performed for the professional use of magnesium powder in signal flares, signal rockets, marking ammunition and signaling and simulation ammunition and illumination. These products are predominantly used in open air at sea (>90%) and land (<10%). During use, all magnesium is completely burned and transformed into MgO, and the MgO emitted will be deposited in the marine water or on soil surface. Because of the limited total amount of Mg used for this application (<100 tons/year), the small amount of Mg per individual product (<50 g per product), the wide dispersive nature of this use, and the large natural background concentration of Mg in the receiving environmental compartments (3930 mg Mg/kg soil and 1290 mg Mg/l seawater, see section 9.16.1), it is concluded that this specific use results in negligible additional environmental exposure to Mg or MgO and therefore has no impact on the environment.

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 exposure to a level below the 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.

$DNEL_{inhalation}$: 10 mg/m³

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Environmental emissions
No quantitative environmental exposure is performed for the professional use of magnesium powder in signal flares, signal rockets, marking ammunition and signaling and simulation ammunition and illumination. These products are predominantly used in open air at sea (>90%) and land (<10%). During use, all magnesium is completely burned and transformed into MgO, and the MgO emitted will be deposited in the marine water or on soil surface. Because of the limited total amount of Mg used for this application (<100 tons/year), the small amount of Mg per individual product (<50 g per product), the wide dispersive nature of this use, and the large natural background concentration of Mg in the receiving environmental compartments (3930 mg Mg/kg soil and 1290 mg Mg/l seawater, see section 9.16.1), it is concluded that this specific use results in negligible additional environmental exposure to Mg or MgO and therefore has no impact on the environment.

ES10 Consumer use of fireworks

Exposure Scenario Format (2) addressing uses carried out by consumers	
1. Title	
Free short title	Consumer use of fireworks
Systematic title based on use descriptor	SU21, PC0 (pyrophoric composition), TARIC 3604 (Fireworks, signalling flares, rain rockets, fog signals and other pyrotechnic articles), ERC 8D, ERC 8E
Processes, tasks activities covered	Use of fireworks Post-application exposure to air-borne particulates
Assessment Method*	Human health A qualitative assessment has been performed for oral, dermal and inhalation exposure. Environment A qualitative assessment has been performed.
2. Operational conditions and risk management measures	
RMM	The pyrotechnic articles must meet essential safety requirements acc to Directive 2007/23/EC, which are mandatory to European market access.
PC/ERC	**Description of activity referring to product categories (PC) and environmental release categories (ERC)**
PC 0, TARIC 3604	Use of fireworks. Post-application exposure to air-borne particulates (burned firework particles).
ERC 8D/8E	Wide dispersive outdoor use of processing aids/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**
Fireworks contain an explosive powder, along with a binding paste, mixed with the signature chemicals responsible for its bright colours.	10-30% in pyrothechnic composition Magnesium powder is used as fuel and to provide a brilliant white flame	Solid, powder, enclosed in container	Not relevant, as no contact to magnesium powder	Protective cover, in acc. with directive 2007/23/EC

Amounts used

Fireworks Category I	Effect composition: 3.0g
Fireworks Category II	Combination /batteries: 200g (propellant composition + effect composition) Single part like bombette candle total volume: 50g Fireworks rocket: 20g e.g. 10g effect composition

Frequency and duration of use/exposure

Description of the task	**Duration of exposure per event**	**frequency of events**
Use of fireworks	Typical ≤ 1 h	1 per year
Post-application	~ 1h	Several per year (bystander)

Human factors not influenced by risk management

Description of the task	**Population exposed**	**Breathing rate**	**Exposed body part**	**Corresponding skin area cm²]**
Use of fireworks (Category I)	Adult/child (> 12 years)	1.25 m³/hr (light working activity)	Palm of hands	Not relevant
Use of fireworks (Category II)	Adult (> 18 years)	1.25 m³/hr (light working activity)	Palm of hands	Not relevant
Post-application	Adult/child	1.25 m³/hr (light working activity)	-	-

Exposure Scenario Format (2) addressing uses carried out by consumers

Other given operational conditions affecting consumers exposure

Description of the task	Indoor/outdoor	Room volume	Air exchange rate
Use of fireworks (Category I)	Indoor/outdoor	-	Indoor: general ventilation Outdoor: natural ventilation
Use of fireworks (Category II)	outdoor	-	Natural ventilation
Post-application (bystander)	outdoor	-	Natural ventilation

Conditions and measures related to information and behavioural advice to consumers

Keep out of reach of children.
Do not open the pyrotechnic container.
Carefully read the instructions of the fireworks.
Keep away from flammable material.
Do not through towards other people.
Shower unexploded fireworks with water before dispose of and never reignite.

Conditions and measures at level of article production to prevent release during service life

In order to demonstrate that their pyrotechnic articles comply with the essential safety requirements, manufacturers must, have the following properties assessed by independent testing institutes (notified bodies):

- Physical and chemical stability; compatibility of all components
- Resistance to normal, foreseeable handling and transportation
- Resistance against water and low and high temperatures
- Safety features to prevent untimely or inadvertent initiation or ignition
- Suitable instructions in the official language or languages of the recipient Member State
- Ability to withstand deterioration.

Conditions and measures related to personal protection and hygiene

None

2.2 Control of environmental exposure

Regarding environmental exposure during consumer use of magnesium in pyrotechnical products (fireworks) no exposure assessment is done. Because of the small amount of Mg used and the large natural background concentration of Mg in the environment, it can be assumed that this identified use will have no impact on the environment.

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). As a qualitative exposure assessment has been conducted no RCR can be deduced.

Human exposure

Use of fireworks

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 Dermal exposure does not occur, as magnesium is part of the mixture inside the pyrotechnic article, which will be enclosed by a protective cover.
Inhalation	-	Qualitative assessment Inhalation exposure does not occur, as magnesium is part of the mixture inside the pyrotechnic article, which will be enclosed by a protective cover. No dust formation possible.
Post-application exposure to air-borne particulates		
Inhalation	Qualitative assessment: No exposure towards magnesium is expected after the application of fireworks, due to the intended function. Magnesium powder will function as fuel for the firework and will provide a brilliant white flame. Certified pyrotechnic articles will completely burn down. Therefore, it can safely be assumed that magnesium has been converted to magnesium oxide after burning the fireworks. Therefore, any exposure will be to magnesium oxide.	

	Based on the toxicological data available on magnesium oxide it is concluded that magnesium oxide does not elicit any relevant local effects in lungs if inhaled. Hence, no DNEL for acute or long-term inhalation for local effects in the general population had been derived. The DNEL for the inhalation, systemic effects have been derived to be above the general dust limits of 10 mg/m^3 for the inhalable airborne fraction. As magnesium oxide represents only a minor percentage (30% of the pyrophoric composition) of the air-borne particulates after the burning of a firework, it can safely be assumed that the use of magnesium in fireworks is not of concern.
Environmental exposure	
Regarding environmental exposure during consumer use of magnesium in pyrotechnical products (fireworks) no exposure assessment is done. Because of the small amount of Mg used and the large natural background concentration of Mg in the environment, it can be assumed that this identified use will have no impact on the environment.	
4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	
The DU needs to comply with the safety requirements acc. to Directive 2007/23/EC, which are mandatory to European market access.	

ES 11 Service life/ Handling of massive objects containing magnesium at ambient temperature

Exposure Scenario Format (4) addressing service life resulting from downstream use (article handled by consumer)	
1. Title	
Free short title	Service life/ Handling of massive objects containing magnesium at ambient temperature
Systematic title based on use descriptor for article service life	SU21 (Consumer use), AC1 (vehicles), AC7 (Metal articles), ERC 10A, ERC 11A
Systematic title based on use descriptor for downstream use leading to inclusion in article	SU15 (Manufacture of fabricated metal products, except machinery and equipment)
Processes, tasks activities covered	Handling of massive objects containing magnesium metal at ambient temperature.
Assessment Method*	Human Health A qualitative assessment has been performed for all three exposure routes. Environment A qualitative assessment has been performed for all three exposure routes.
2. Operational conditions and risk management measures	
RMM	The visible magnesium applications will receive a surface treatment for corrosion or cosmetic reasons. Untreated applications will be invisible/enclosed.
AC/ERC	**Description of activity referring to article categories (AC) and environmental release categories (ERC)**
AC 1/7	Handling of massive objects containing magnesium metal at ambient temperature.
ERC 10A/11A	Wide dispersive outdoor/indoor use of long-life articles, low release.
2.1 Control of consumers exposure	
Product (article) characteristic	
AC	**Article characteristics**
AC 1	Magnesium alloys will be used in various parts of an automotive like in the interior part (e.g. door handles or decorative strips) in the engine compartment (e.g. engine blocks or cylinder head cover) or in the exterior part (e.g. external mirror frames and base and rims). The visible magnesium applications will receive a surface treatment for corrosion or cosmetic reasons. Untreated applications will be invisible/enclosed.
AC 2, 7	Magnesium alloys will be used in various applications like mobile phone housings, door handles, cleats for soccer shoes, camping equipment and for various bicycles parts. The visible magnesium applications will receive a surface treatment for corrosion or cosmetic reasons. Untreated applications will be invisible/enclosed.
Amounts used	
AC	**Amount of substance in article**
AC 1	Depending on the alloy used the content will be 90-95% magnesium.
AC 2, 7	Depending on the alloy used the content will be 90-95% magnesium.
Frequency and duration of use/exposure from service life	
Not relevant	
Human factors not influenced by risk management	
Not relevant	
Other given operational conditions affecting consumers exposure from article service life	
Not applicable.	
Conditions and measures at level of article production to prevent release during service life	
Not applicable.	
Exposure Scenario Format (4) addressing service life resulting from downstream use (article handled by consumer)	
Conditions and measures related to information and behavioural advice to consumers	

Not applicable.

Conditions and measures related to personal protective equipment and hygiene

Not applicable.

2.2 Control of environmental exposure

Magnesium is not expected to be released from articles to the environment due to use.

Mg is strongly bound into a material without any intended release. In case of contact with water only a very small fraction at the surface of the article might be available for release but Mg is not expected to migrate out of the article. Mg is not volatile so once fixed in an article there will be no release to air.

3. Exposure estimation and reference to its source

Human exposure

The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level). As a qualitative exposure assessment has been conducted no RCR can be deduced.

Route of exposure	Exposure estimate (RCR)	Method used, comments
Oral	-	Qualitative assessment Oral exposure does not occur as part of the intended product use.
Dermal	Due to the negligible dermal absorption of magnesium (1%; based on HERAG) and no systemic/local effects are expected for magnesium cations following exposure of intact or damaged skin, the dermal route is not a relevant exposure path for magnesium metal. Thus, dermal exposure is not assessed in this exposure scenario	
Inhalation	-	Qualitative assessment Inhalation exposure is insignificant due to the extremely low vapour pressure of magnesium. Furthermore, no abrasive tasks are considered for consumers, therefore no particle/dust formation needs to be considered for massive objects.

Environmental exposure

No significant releases to the environment are expected.

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