
Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals

Forty-seventh session

Geneva, 22 – 26 June 2015

Item 7 of the provisional agenda

**Global harmonization of transport of dangerous
goods regulations with the Model Regulations**

17 June 2015

Transport of toxic powdered metals

Transmitted by the expert from France

**IMO Reference Documents CCC 1/13 (par. 6.25 & 6.26) E&T
23/WP.1 (upcoming final report)**

Background

1. At the CCC 1 Sub-Committee of IMO, France, by the document CCC 1/6/2, has set out the regulatory difficulties posed by the transport (maritime and inter-modal) of cobalt powder (see annex 4).
2. Until the recent past (early 2012), this material was assessed as flammable and could be transported under UN 3089, METAL POWDER, FLAMMABLE, N.O.S., a solid flammable material in class 4.1.
3. Within the framework of European regulation (EC) No. 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP Regulation), which implements at the European Union level the Globally Harmonized System for Classification and Labelling of Chemicals (GHS), and European Regulation (EC) No. 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), the European consortium on cobalt conducted new tests on ultra-fine cobalt powder in 2012.
4. The test for toxicity by inhalation, conducted on rats, showed a risk of acute toxicity by inhalation for ultra-fine cobalt powder, as indicated on the Safety Data Sheets attached in annexes (Cobalt powder CO6101 and Cobalt powder CO7106 dated June 2014).
5. The consequences of the elements in paragraph 4 above bring into question the classification of cobalt powder and its transport under entry UN 3089.
6. Considering the Material Safety Data Sheets attached in annexes 2 and 3, it appears in Section 11 that the provided value of the ATE (dust, mist) (Acute Toxicity Estimation) is 0.01 mg/l/4h, which, according 2.6.2.2.4.2 of the Model Regulations corresponds to a LC50 of 0.04 mg/l relating to one hour exposure.
7. Such a value of LC50 (mg/l) corresponds to a Packing Group I by application of the table in 2.6.2.2.4.1 of the Model Regulations, and according to 2.0.3.1 g), such primary hazard takes precedence in all situations.
8. It appears that the new hazard (toxicity by inhalation) is mainly caused by the low particle size of the substance.

This phenomenon might appear for metal powders other than cobalt powder.

Which leads to consider more generally the possibility to extend these combined hazards from cobalt powder to generic entries “powdered metals N.O.S. or inorganic solids N.O.S.”,

Discussion

9. By application of the “Table of precedence” in 2.0.3.3, four situations have to be taken in account:

- The primary hazard is the toxicity (6.1) and the subsidiary risk is the flammability (4.1), with PG I;
- The primary hazard is the toxicity (6.1) and the subsidiary risk is the flammability (4.1), with PG II;
- The primary hazard is the flammability (4.1) and the subsidiary risk is the toxicity (6.1), with PG II;
- The primary hazard is the flammability (4.1) and the subsidiary risk is the toxicity (6.1), with PG III;

10. In order to solve the two situations where the primary hazard is the flammability (4.1) the existing entries UN 3179, FLAMMABLE SOLID, TOXIC, INORGANIC, N.O.S., PG II or PG III might be used

11. This solution is not currently possible for maritime (and intermodal) transports, because of the existence of the specifically maritime Special Provision 915:

"915 This entry shall not be used for wetted explosives, self-reactive substances or metal powders."

12. At its former meeting in May 2015, the Editorial and Technical Group (E&T 23), attached to the IMO Sub-committee CCC (Carriage of Cargoes and Containers) proposed to delete the Special Provision 915 into the upcoming IMDG Code (Amendment 38-16).

This solution would solve one part of the problem and is subject to the agreement by the IMO bodies Sub-committee CCC, and thus by the Maritime Safety Committee (MSC).

13. However, the two situations where the primary hazard is the toxicity (6.1) require to create specific new entries; which needs to be approved in a multi-modal context by this subcommittee

Annex 1

Proposals for amendments to UN Model Regulations

“Insert the following new entries in the Dangerous Goods List:

UN No.	Name and description	Class or division	Subsidiary risk	UN packing group	Special provisions	Limited and excepted quantities		Packagings and IBCs		Portable tanks and bulk containers	
						(7a)	(7b)	Packing instruction	Special packing provisions	Instructions	Special provisions
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)
-	3.1.2	2.0	2.0	2.0.1.3	3.3	3.4	3.5	4.1.4	4.1.4	4.2.5 / 4.3.2	4.2.5
35xx	[METAL POWDER, TOXIC, FLAMMABLE, N.O.S.] / [TOXIC SOLID, FLAMMABLE, INORGANIC, N.O.S.]	6.1	4.1	I	274	0	E5	P002 IBC99	PP31 -	T6	TP33
35yy	[METAL POWDER, TOXIC, FLAMMABLE, N.O.S.] / [TOXIC SOLID, FLAMMABLE, INORGANIC, N.O.S.]	6.1	4.1	II	274	500 g	E4	P002 IBC08	PP31 B2, B3, B4	T3	TP33



Cobalt powder CO6101

Date of issue: 04/06/2014

Revision date : 04/06/2014

Version: 4.0

Safety Data Sheet

according to Regulation (EC) No. 453/2010

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

1.1. Product identifier

Trade name : CO6101
 EC index no : 027-001-00-9
 EC no : 231-158-0
 CAS No. : 7440-48-4
 REACH registration No. : 01-2119517392-44

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

1.2.1. Relevant identified uses

Title	Sector of use	Product category	Process category	Article category	Environmental release	SPERC
Professional use of diamond tools and other cobalt-containing tools	SU22		PROC3, PROC 2, PROC1, PROC4, PROC21, PROC24	AC2, AC7	ERC10b, ERC11b	
Manufacture and industrial use of cobalt containing alloys, steels and tools (ES Ref.: ES6_Cobalt Gen)	SU14, SU15	PC7, PC14, PC38	PROC1, PROC5, PROC8b, PROC13, PROC14, PROC21, PROC22, PROC23, PROC24, PROC25, PROC26, PROC27a, PROC27b	AC1, AC2, AC7	ERC2, ERC3, ERC12a	
Industrial use of cobalt in the production of diamond tools (ES Ref.: ES11_Cobalt OD)	SU3, SU15	PC7	PROC4, PROC5, PROC8b, PROC9, PROC14, PROC21, PROC22, PROC24, PROC25, PROC26, PROC8a	AC2, AC7	ERC12a	

Full text of use descriptors: see section 16.

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

Eurotungstene
 9 rue André Sibellas - BP152X
 38042 Grenoble cedex 09
 France
 tel : +33(0) 4 76 70 54 54
 fax : +33(0) 2 41 93 48 23
 msds-eurotungstene@erametgroup.com

1.4. Emergency telephone number

Emergency number : http://www.who.int/gho/phe/chemical_safety/poisons_centres/en/index.html

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Sol. 1 H228
 Acute Tox. 4 (Oral) H302
 Acute Tox. 1 (Inhalation:dust,mist) H330
 Eye Irrit. 2 H319
 Resp. Sens. 1 H334
 Skin Sens. 1 H317
 Carc. 1B H350i
 Repr. 2 H361
 Aquatic Acute 1 H400 (M=10)

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Aquatic Chronic 1 H410 (M=1)

Full text of H-phrases: see section 16

Classification according to Directive 67/548/EEC or 1999/45/EC

Repr.Cat.3; R62

Carc.Cat.2; R49

F; R11

T+; R26

Xn; R22

Xn; R42

Xi; R36

Xi; R43

N; R50/53

Full text of R-phrases: see section 16

Adverse physicochemical, human health and environmental effects

Additional information on classification. Self classification.

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :



GHS02

GHS06

GHS08

GHS09

Signal word (CLP) : Danger

Hazard statements (CLP) :

H228 - Flammable solid
 H302 - Harmful if swallowed
 H317 - May cause an allergic skin reaction
 H319 - Causes serious eye irritation
 H330 - Fatal if inhaled
 H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
 H350i - May cause cancer by inhalation
 H361 - Suspected of damaging fertility or the unborn child
 H410 - Very toxic to aquatic life with long lasting effects

Precautionary statements (CLP) :

P210 - Keep away from heat, sparks, open flames, hot surfaces. - No smoking
 P261 - Avoid breathing dust
 P273 - Avoid release to the environment
 P280 - Wear protective clothing, eye protection
 P285 - In case of inadequate ventilation wear respiratory protection
 P308+P313 - IF exposed or concerned: Get medical advice/attention

2.3. Other hazards

Other hazards not contributing to the classification : Inhalation of dust may cause irritation of the respiratory system.

SECTION 3: Composition/information on ingredients

3.1. Substances

Name	Product identifier	%	Classification according to Directive 67/548/EEC
CO6101 (Main constituent)	(CAS No.) 7440-48-4 (EC no) 231-158-0 (EC index no) 027-001-00-9 (REACH-no) 01-2119517392-44	> 99,9	Repr.Cat.3; R62 Cat.Carc.2 : R49 F; R11 T+; R26 Xn; R22

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			Xn; R42 Xi; R36 Xi; R43 N; R50/53
Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
CO6101 (Main constituent)	(CAS No.) 7440-48-4 (EC no) 231-158-0 (EC index no) 027-001-00-9 (REACH-no) 01-2119517392-44	> 99,9	Flam. Sol. 1, H228 Acute Tox. 4 (Oral), H302 Acute Tox. 1 (Inhalation), H330 Eye Irrit. 2, H319 Resp. Sens. 1, H334 Skin Sens. 1, H317 Repr. 2, H361 Carc. 1B, H350i Aquatic Acute 1, H400 (M=10) Aquatic Chronic 1, H410

Full text of R-, H- and EUH-phrases: see section 16

3.2. Mixtures

Not applicable

SECTION 4: First aid measures**4.1. Description of first aid measures**

First-aid measures general	: Medical examination necessary even merely on suspicion of intoxication.
First-aid measures after inhalation	: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. Where appropriate artificial ventilation. In case of respiratory arrest, administer artificial respiration. Get medical advice/ attention.
First-aid measures after skin contact	: Wash with plenty of soap and water. Wash contaminated clothing before reuse. If skin irritation occurs: Get medical advice/attention.
First-aid measures after eye contact	: In case of contact with eyes flush immediately with plenty of flowing water for 10 to 15 minutes holding eyelids apart and consult an ophthalmologist. Remove contact lenses, if present and easy to do. Continue rinsing. Consult an ophthalmologist.
First-aid measures after ingestion	: If swallowed, rinse mouth with water (only if the person is conscious). Call a POISON CENTER or doctor/physician.

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

Symptoms/injuries	: Allergic reactions.
Symptoms/injuries after inhalation	: Cough. Respiratory complaints. Sensitised persons may subsequently show asthmatic symptoms when exposed to atmospheric concentrations well below the OEL.
Symptoms/injuries after skin contact	: Allergic reactions. Skin irritation, dermatitis and sensitisation.
Symptoms/injuries after eye contact	: Irritating to eyes.
Symptoms/injuries after ingestion	: Abdominal pain. Vomiting.
Chronic symptoms	: May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction.

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

No additional information available

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SECTION 5: Firefighting measures**5.1. Extinguishing media**

Suitable extinguishing media : Co-ordinate fire-fighting measures to the fire surroundings. Extinguishing/inerting agent. Extinguish by smothering. Foam. ABC-powder. Carbon dioxide (CO₂).

Unsuitable extinguishing media : High power water jet.

5.2. Special hazards arising from the substance or mixture

Fire hazard : In case of fire may be liberated: Metal oxide smoke, toxic.

Reactivity : The product is stable at normal handling- and storage conditions.

5.3. Advice for firefighters

Precautionary measures fire : Co-ordinate fire-fighting measures to the fire surroundings.

Firefighting instructions : In case of fire: Wear self-contained breathing apparatus.

Other information : Do not allow run-off from fire-fighting to enter drains or water courses.

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

General measures : Avoid generation of dust. See protective measures under point 7 and 8.

6.1.1. For non-emergency personnel

Emergency procedures : Evacuate area.

6.1.2. For emergency responders

Protective equipment : Wear breathing apparatus if exposed to vapours/dusts/aerosols. Wear suitable gloves and eye/face protection.

Emergency procedures : Remove persons to safety.

6.2. Environmental precautions

Avoid release to the environment.

6.3. Methods and material for containment and cleaning up

For containment : Collect spillage.

Methods for cleaning up : Take up dust-free and set down dust-free. Clean contaminated objects and areas thoroughly observing environmental regulations. Retain contaminated washing water and dispose it.

Other information : Treat the recovered material as prescribed in the section on waste disposal.

6.4. Reference to other sections

See protective measures under point 7 and 8. Treat the recovered material as prescribed in the section on waste disposal.

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

Additional hazards when processed : Persons with a history of asthma, allergies, chronic or recurrent respiratory disease should not be exposed to any process in which this product is used.

Precautions for safe handling : Provide adequate ventilation as well as local exhaust at critical locations. Avoid generation of dust. Avoid contact with skin and eyes. Avoid release to the environment.

Hygiene measures : Do not eat, drink or smoke when using this product. Contaminated work clothing should not be allowed out of the workplace. Wash hands before break and at end of works.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Keep container tightly closed and in a well-ventilated place.

Incompatible products : Acid. Oxidising.

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- Heat-ignition : Remove all sources of ignition.
- Special rules on packaging : Repeat the labelling if the packaging is divided up.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Cobalt powder (7440-48-4)		
USA ACGIH	ACGIH TWA (mg/m ³)	0,02 mg/m ³
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	0,05 mg/m ³
USA OSHA	OSHA PEL (TWA) (mg/m ³)	0,1 mg/m ³

Cobalt powder (7440-48-4)	
DNEL/DMEL (Workers)	
Long-term - local effects, inhalation	0,04 mg/m ³ /day
DNEL/DMEL (General population)	
Long-term - systemic effects, dermal	0,0095 mg/kg bodyweight/day
Long-term - local effects, inhalation	0,0063 mg/m ³ /day
PNEC (Water)	
PNEC aqua (freshwater)	0,60 µg/l
PNEC aqua (marine water)	2.36 µg/l
PNEC (Sediment)	
PNEC sediment (freshwater)	11,2 mg/kg dwt
PNEC sediment (marine water)	9,5 mg/kg dwt
PNEC (Soil)	
PNEC soil	10,9 mg/kg dwt
PNEC (STP)	
PNEC sewage treatment plant	0,373 mg/l

8.2. Exposure controls

- Appropriate engineering controls : Technical measures and the application of suitable work processes have priority over personal protection equipment.
- Personal protective equipment : In case of dust production: protective goggles. Gloves. Dust production: dust mask with filter type P3. In case of dust production: dustproof clothing.



- Hand protection : The quality of the protective gloves resistant to chemicals must be chosen as a function of the specific working place concentration and quantity of hazardous substances. Recommended glove articles. DIN EN 374.
- Eye protection : Dust protection eye glasses.

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Respiratory protection	: Provide adequate ventilation as well as local exhaust at critical locations. If technical exhaust or ventilation measures are not possible or insufficient, respiratory protection must be worn. Recommended respiratory protection articles. Filtering Half-face mask (DIN EN 149).
Environmental exposure controls	: Avoid release to the environment.

SECTION 9: Physical and chemical properties**9.1. Information on basic physical and chemical properties**

Physical state	: Solid
Molecular mass	: 58,93 g/mol
Colour	: grey.
Odour	: odourless.
Odour threshold	: Not applicable
pH	: Not required.
pH solution	: Not applicable
Melting point	: 1494 °C
Boiling point	: 2927 °C
Flash point	: Not applicable
Relative evaporation rate (ether=1)	: Not applicable
Flammability (solid, gas)	: Flammable
Explosive limits	: Not applicable Not applicable
Vapour pressure	: Not applicable
Vapour pressure at 50 °C	: Not applicable
Relative vapour density at 20 °C	: Not applicable
Relative density	: 8,89
Relative density of saturated gas/air mixture	: Not required.
Critical temperature	: Not applicable
Critical pressure	: Not applicable
Solubility	: Water: 2,94 mg/l
Partition coefficient: n-octanol/water	: Not required.
Self ignition temperature	: Not applicable
Decomposition temperature	: Not applicable
Viscosity	: Not applicable
Explosive properties	: St1.
Oxidising properties	: not oxidizing.

9.2. Other information

Other properties	: Particle size (µm): 1.6
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SECTION 10: Stability and reactivity**10.1. Reactivity**

The product is stable at normal handling- and storage conditions.

10.2. Chemical stability

The product is stable at normal handling- and storage conditions.

10.3. Possibility of hazardous reactions

The product is stable at normal handling- and storage conditions.

10.4. Conditions to avoid

Avoid generation of dust.

10.5. Incompatible materials

A fire or explosion hazard arises since highly flammable gas (hydrogen) is released when it is in contact with : Strong acid.

10.6. Hazardous decomposition products

metallic oxide.

SECTION 11: Toxicological information**11.1. Information on toxicological effects**

Acute toxicity : Harmful if swallowed. Fatal if inhaled.

Cobalt powder (7440-48-4)	
LD50 oral rat	550 mg/kg
LD50 dermal rat	2 000 mg/kg
ATE (dust,mist)	0,01 mg/l/4h

Skin corrosion/irritation : Not classified

Serious eye damage/irritation : Causes serious eye irritation.

Respiratory or skin sensitisation : May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction.

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Suspected of damaging fertility or the unborn child.

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

SECTION 12: Ecological information**12.1. Toxicity**

Cobalt powder (7440-48-4)	
LC50 fish 1	1,5 mg/l FRESH WATER
LC50 other aquatic organisms 1	0,61 mg/l FRESH WATER
LC50 other aquatic organisms 2	2,32 mg/l (marine water)

12.2. Persistence and degradability

No additional information available

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12.3. Bioaccumulative potential

Cobalt powder (7440-48-4)

BCF fish 1	< 10
BCF fish 2	< 10
BCF other aquatic organisms 1	100 - 5000
Bioaccumulative potential	Low.

12.4. Mobility in soil

No additional information available

12.5. Results of PBT and vPvB assessment

No additional information available

12.6. Other adverse effects

No additional information available

SECTION 13: Disposal considerations**13.1. Waste treatment methods**

Regional legislation (waste)	: Disposal must be done according to official regulations.
Waste treatment methods	: Waste disposal according to EC directives 75/442/EEC and 91/689/EEC in the corresponding versions, covering waste and dangerous waste. Do not empty into drains. Dispose of this material and its container to hazardous or special waste collection point.
Sewage disposal recommendations	: Do not discharge into drains or the environment. Retain contaminated washing water and dispose it.
Ecology - waste materials	: Do not empty into drains, dispose of this material and its container at hazardous or special waste collection point.

SECTION 14: Transport information

In accordance with ADR / RID / ADN / IMDG / ICAO / IATA

14.1. UN number

UN-No. : 3179

14.2. UN proper shipping name

Proper Shipping Name : FLAMMABLE SOLID, TOXIC, INORGANIC, N.O.S.

Transport document description : UN 3179 FLAMMABLE SOLID, TOXIC, INORGANIC, N.O.S., 4.1 (6.1), (E)

14.3. Transport hazard class(es)

Class (UN) : 4.1

Hazard labels (UN) : 4.1, 6.1

**14.4. Packing group**

Packing group (UN) : II

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14.5. Environmental hazards

Marine pollutant

:



Other information

: No supplementary information available.

14.6. Special precautions for user

14.6.1. Overland transport

Hazard identification number (Kemler No.) : 46

Classification code (ADR) : FT2

Tunnel restriction code : E

LQ : 1 Kg

Excepted quantities (ADR) : E2

14.6.2. Transport by sea

Limited quantities (IMDG) : chap. 3.2 col(7a)

14.6.3. Air transport

Instruction "passenger" - Limited quantities (ICAO) : Tab. 4.2 col H

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

SECTION 15: Regulatory information

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

15.1.1. EU-Regulations

No REACH Annex XVII restrictions

15.1.2. National regulations

No additional information available

15.2. Chemical safety assessment

A chemical safety assessment has been carried out

SECTION 16: Other information

Indication of changes : according to Regulation (EC) No. 453/2010.

Data sources : Chemical Safety Assessment.

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Abbreviations and acronyms	: ACGIH American Conference of Governmental Industrial Hygienists BAF Bioaccumulation Factor BCF Bioconcentration Factor CAS Chemical Abstract Service NOEC No Observed Effect Concentration NIOSH National Institute of Occupational Safety and Health LD50 Lethal Dose 50 LC50 Lethal Concentration 50 EINECS European Inventory of Existing Commercial Chemical Substances DNEL Derived No Effect Level NOHSC National Occupational Health & Safety Commission OSHA Occupational Safety and Health Administration PEL Permissible Exposure Limits PBT Persistent, Bioaccumulative and Toxic PNEC Predicted No Effect Concentration REACH Registration, Evaluation, Autorisation of CHemicals REL Recommended Exposure Limits SCOEL Scientific Committee on Occupational Exposure Limits STOT Specific Target Organ Toxicity STP Sewage Treatment Plant TWA Time Weighted Average vPvB very Persistent and very Bioaccumulative.
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Other information : The above information describes exclusively the safety requirements of the product and is based on our present-day knowledge. The information is intended to give you advice about the safe handling of the product named in this safety data sheet, for storage, processing, transport and disposal. The information cannot be transferred to other products. In the case of mixing the product with other products or in the case of processing, the information on this safety data sheet is not necessarily valid for the new made-up material.

Full text of R-, H- and EUH-phrases::

Acute Tox. 1 (Inhalation:dust,mist)	Acute toxicity (inhalation:dust,mist) Category 1
Acute Tox. 4 (Oral)	Acute toxicity (oral) Category 4
Aquatic Acute 1	Hazardous to the aquatic environment - Acute Hazard Category 1
Aquatic Chronic 1	Hazardous to the aquatic environment - Chronic Hazard Category 1
Eye Irrit. 2	Serious eye damage/eye irritation Category 2
Flam. Sol. 1	Flammable solids Category 1
Repr. 2	Reproductive toxicity Category 2
Resp. Sens. 1	Respiratory sensitisation Category 1
Skin Sens. 1	Skin sensitisation Category 1
H228	Flammable solid
H302	Harmful if swallowed
H317	May cause an allergic skin reaction
H319	Causes serious eye irritation
H330	Fatal if inhaled
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled
H361	Suspected of damaging fertility or the unborn child
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects
R11	Highly flammable.
R22	Harmful if swallowed.
R26	Very toxic by inhalation.
R36	Irritating to eyes.
R42	May cause sensitization by inhalation.
R43	May cause sensitisation by skin contact.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R62	Possible risk of impaired fertility.
F	Highly flammable

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N	Dangerous for the environment
T+	Very toxic
Xi	Irritant
Xn	Harmful
AC1	Vehicles
AC2	Machinery, mechanical appliances, electrical/electronic articles
AC7	Metal articles
ERC1	Manufacture of substances
ERC10b	Wide dispersive outdoor use of long-life articles and materials with high or intended release (including abrasive processing)
ERC11b	Wide dispersive indoor use of long-life articles and materials with high or intended release (including abrasive processing)
ERC12a	Industrial processing of articles with abrasive techniques (low release)
ERC2	Formulation of preparations
ERC3	Formulation in materials
PC14	Metal surface treatment products, including galvanic and electroplating products
PC38	Welding and soldering products (with flux coatings or flux cores.), flux products
PC7	Base metals and alloys
PROC 2	Use in closed, continuous process with occasional controlled exposure
PROC1	Use in closed process, no likelihood of exposure
PROC13	Treatment of articles by dipping and pouring
PROC14	Production of preparations or articles by tableting, compression, extrusion, pelletisation
PROC21	Low energy manipulation of substances bound in materials and/or articles
PROC22	Potentially closed processing operations with minerals/metals at elevated temperature Industrial setting
PROC23	Open processing and transfer operations with minerals/metals at elevated temperature
PROC24	High (mechanical) energy work-up of substances bound in materials and/or articles
PROC25	Other hot work operations with metals
PROC26	Handling of solid inorganic substances at ambient temperature
PROC27a	Production of metal powders (hot processes)
PROC27b	Production of metal powders (wet processes)
PROC3	Use in closed batch process (synthesis or formulation)
PROC4	Use in batch and other process (synthesis) where opportunity for exposure arises
PROC5	Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
SU10	Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
SU14	Manufacture of basic metals, including alloys
SU15	Manufacture of fabricated metal products, except machinery and equipment
SU22	Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
SU3	Industrial uses: Uses of substances as such or in preparations* at industrial sites

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

Exposure scenario

<i>Manufacture and industrial use of cobalt containing alloys, steels and tools</i>		
Systematic title based on use descriptor	SU3 (Industrial use), SU14, SU15 PC7, PC14, PC38 AC1, AC2, AC7 (appropriate PROCs are given in Section 2 below)	
2. Operational conditions and risk management measures		
Workplace	Involved task	Involved PROCs
Handling of massive materials	Weighing, unpacking, preparation of charge for furnaces	8b, 21
Melting and casting	Melting, casting, dross removal, degassing	22, 23
Finishing of massive objects	Packaging, peeling, hot rolling, forging, pickling, gouging, flame cutting, extrusion, dry honing, sectioning, cutting, crushing	13, 14, 21, 24, 25
Mechanical treatment of hard coated metals and/or alloys – low kinetic energy	Machining, dressing, polishing, stripping, boring, assembly, disassembly	21
Mechanical treatment of hard coated metals and/or alloys – high kinetic energy	Sectioning, grinding, cutting, abrasive cutting	24
Handling of powders	Packaging, furnace loading, sieving, mixing	5, 26
Powder production	Atomisation, handling in a closed system	1 (27a, 27b)
Further processing	Cold and hot isostatic pressing in a closed system	1 (24)
Thermal spraying – fully automated	Flame spraying - melt fusion, plasma spraying / high-velocity flame spraying	1 (25)
Thermal spraying – NOT fully automated	Flame spraying - melt fusion, plasma spraying / high-velocity flame spraying	25
Use of tools in industrial settings	Cutting or drilling	24
Cleaning & maintenance	Manual cleaning, repair and maintenance operations, removal of residuals from e.g. filters/overspill or as waste.	8a, 26

2.1 Control of workers exposure		
Product characteristics		
Workplace	Use in preparation and content in preparation	Physical form of the product
Handling of massive materials	No restriction	Massive cobalt and massive scrap (e.g. ingots, cathodes, rounds)
Melting and casting		Massive (e.g. ingots, cathodes) / Molten
Finishing of massive objects	No restriction (up to 90 %)	Massive
Mechanical treatment of hard coated metals and/or alloys – low kinetic energy	No restriction	Massive
Mechanical treatment of hard coated metals and/or alloys – high kinetic energy		Massive
Handling of powders		Scrap steel and alloy powders and solids
Powder production		Molten
Further processing		Cobalt in alloy
Thermal spraying – fully automated		Powder
Thermal spraying – NOT fully automated		Powder
Use of tools in industrial settings		Massive
Cleaning & maintenance	Not applicable	Powder, Dust
Amounts used		
No restriction.		
Frequency and duration of use/exposure		
No restriction.		
Human factors not influenced by risk management		
The shift breathing volume 10 m ³ /8 h (full shift).		
Other given operational conditions affecting workers exposure		
Room volume not applicable, process temperature or pressure ambient or no restriction respectively for all workplace except: melting and casting, and powder production – process temperature 1500°C, further processing – process temperature 1200°C and high pressure, thermal spraying – fully automated/NOT fully automated – flame temperature up to approx. 3,100°C, sintering at 1,000°C to 1,200°C; plasma can reach temperatures up to 30,000°C and high pressure applied during plasma and high – velocity flame spraying. Cleaning & maintenance - room volume: no restriction, process temperature or pressure ambient (system not in operation). Indoor use.		
Technical conditions and measures at process level (source) to prevent release		
Melting and casting closed furnace, powder production and further processing closed system. Thermal spraying – fully automated full containment and enclosed space. Other workplace level of containment/segregation not required.		
Technical conditions and measures to control dispersion from source towards the worker		

Localised controls (LC) not required for all workplace except: melting and casting, handling of powders and thermal spraying – NOT fully automated (local exhaust ventilation, efficiency up to 78%), use of tools in industrial settings (local exhaust ventilation, efficiency up to 84%). Level of separation if required see frequency and duration of exposure section. Installation of ventilated (positive pressure) control rooms can also reduce exposure. Additional Information: cleaning & maintenance: maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.			
Organisational measures to prevent/limit releases, dispersion and exposure			
Additional information See Section: 7, 8, 11 (SDS).			
Conditions and measures related to personal protection, hygiene and health evaluation			
Workplace	Specification of respiratory protective equipment (RPE)	RPE efficiency (assigned protection factor, APF)	Specification of gloves and further personal protective equipment (PPE)
Handling of massive materials	No measures required	Not applicable	Since cobalt has sensitising properties, the use of suitable chemical resistant gloves (EN 374) providing protection for the duration of activity (e.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm)) is a prerequisite for all process steps in which direct contact to cobalt substances is possible. In cases where direct contact with cobalt cannot be avoided, a protective suit conforming to EN13982 should be worn. As a general requirement for the conducted processes: standard working clothes (long-sleeve overall) and safety shoes.
Melting and casting			
Finishing of massive objects			
Mechanical treatment of hard coated metals and/or alloys – low kinetic energy			
Mechanical treatment of hard coated metals and/or alloys – high kinetic energy	Mask type: FFP2	APF=10	
Handling of powders	Powered filtering device incorporating a hood or a helmet, TH3	APF=40	
Powder production	No measures required	Not applicable	
Further processing			
Thermal spraying – fully automated			
Thermal spraying – NOT fully automated	Mask type: FFP3	APF=20	
Use of tools in industrial settings	No measures required	Not applicable	
Cleaning & maintenance	Mask type: FFP2 (low - medium dusty materials)	APF=10	
	Mask type: powered filtering device incorporating a hood or a helmet, TH3 (high dusty materials)	APF=40	

2.2 Control of environmental exposure

Amounts used

750 tonnes Co/annum/site

Frequency and duration of use/exposure
Continuous use/release. Days/year to the air compartment: >250; Days/year to the water compartment: >336
Environment factors not influenced by risk management
The dilution capacity of the receiving surface water (calculated as the ratio between the flow rate of the river/lake/estuary/sea to the effluent discharge rate): <ul style="list-style-type: none"> - Dilution factor for the freshwater environment (Fresh water – STP ES): 100 - Dilution factor for the freshwater environment (Fresh water – direct discharge ES): 150 - Dilution factor for the marine environment: 150
Other given operational conditions affecting environmental exposure
Not applicable.
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
<p><u>Water</u>: One or more of the following measures (as set out in the BAT Reference Document on Non-Ferrous Metal Processes), to be taken for emissions to water:</p> <ul style="list-style-type: none"> - Chemical precipitation: used primarily to remove the metal ions - Sedimentation - Filtration: used as final clarification step - Electrolysis: for low metal concentration - Reverse Osmosis (OR): extensively used for the removal of dissolved metals - Ion exchange: final cleaning step in the removal of heavy metal from process wastewater <p><u>Air</u>: One or more of the following measures (as set out in the BAT Reference Document on Non-Ferrous Metal Processes) to be taken for emissions to air:</p> <ul style="list-style-type: none"> - Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm³ - Wet electrostatic precipitators: < 5 mg/Nm³ - Cyclones, but as primary collector: < 50 mg/Nm³ - Fabric or bag filters: high efficiency in controlling fine particulate (melting): < 5 mg/Nm³ (membrane filtration achieves < 1 mg/Nm³) - Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm³ - Wet scrubbers: < 4 mg/Nm³ <p><u>Soil</u>: No measures to reduce emissions to soil</p> <p>The release factors to both the water and air compartments after on-site treatment are:</p> <ul style="list-style-type: none"> - Estimated fraction released to water (g Co/tonne): 24.9 - Estimated fraction released to air (g Co/tonne): 422.1
Organisational measures to prevent/limit release from site
Please see section 8 SDS for more details.
Conditions and measures related to municipal sewage treatment plant
Two different exposure scenarios (ES) for the freshwater environment were considered. As default exposure scenario, an offsite municipal STP is included and sludge is applied to agricultural soil. As a second exposure scenario, no off-site municipal STP (direct discharge) is included and no sludge is applied to agricultural soil. For the marine environment, the ES considers no off-site municipal STP (direct discharge) treatment and no sludge application to agricultural soil. The assumption by default for the off site municipal sewage treatment plant is 2,000 m ³ /day. The fraction of Co removed by the municipal STP is set at 40 %.

Conditions and measures related to external treatment of waste for disposal
<p>Suitable disposal: Wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants (Council Directive 2008/98/EC, Directive 2000/76/EC and BAT Reference Document 2006) or hazardous waste landfills as hazardous waste (Directive 1999/31/EC). Releases to the floor, water and soil are to be prevented. If the cobalt content of the waste is elevated enough, internal or external recovery/recycling might be considered. Fraction of daily/annual use expected in waste: 0.001 or 0.1%</p> <p>Appropriate waste codes: 01 03 07*; 11 02 07*; 06 05 02*; 15 01 10*; 10 08 04; 10 10 11*; 12 01 03; 12 01 04; 06 03 13*; 06 03 15*; 10 10 03; 10 10 05*; 10 10 07*; 16 06 05; 16 08 02* 16 08 03</p>

3. Exposure estimation and reference to its source				
Occupational exposure				
Cobalt: The risk characterisation ratio (RCR) is the quotient of the exposure estimate. The respective Derived No Effect Level (DNEL) has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL of: 40µg/m ³				
Workplace	Method used for inhalation exposure assessment	Inhalation exposure estimate (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate (RCR)
Handling of massive materials	Analogous data	9 µg/m ³ (0.225)	Since cobalt has sensitising properties, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.	
Melting and casting	Measured data	2 µg/m ³ (0.053)		
Finishing of massive objects	Analogous data	24 µg/m ³ (0.59)		
Mechanical treatment of hard coated metals and/or alloys – low kinetic energy	Measured data	10 µg/m ³ (0.25)		
Mechanical treatment of hard coated metals and/or alloys – high kinetic energy		29 µg/m ³ (0.725)		
Handling of powders		27 µg/m ³ (0.68)		
Powder production	MEASE	10 µg/m ³ (0.25)		
Further processing		10 µg/m ³ (0.25)		
Thermal spraying – fully automated		10 µg/m ³ (0.25)		
Thermal spraying – NOT fully automated	Published data	20 µg/m ³ (0.49)		
Use of tools in industrial settings	Analogous data	20 µg/m ³ (0.5)		
Cleaning & maintenance	Analogous data	21 µg/m ³ (0.53) (low - medium dusty materials)		
		24 µg/m ³ (0.61) (high dusty materials)		
Environmental emissions				
The risk characterisation ratio (RCR) is the quotient of the local Predicted Environmental Concentration (PEC) and the respective PNEC (Predicted No Effect Concentration) and has to be below 1 to demonstrate a safe use.				

Compartment	Predicted Environmental Concentration	Predicted No Effect Concentration	Risk characterisation ratio
Fresh water – STP	0.21 µg/l	0.51 µg/l	0.40
Fresh water – direct discharge	0.22 µg/l	0.51 µg/l	0.43
Sea water	0.10 µg/l	2.36 µg/l	0.04
Freshwater sediment – STP	8.31 mg/kg	9.5 mg/kg dw	0.87
Freshwater sediment – direct discharge	8.76 mg/kg	9.5 mg/kg dw	0.92
Marine water sediment	7.56 mg/kg	9.5 mg/kg dw	0.80
Terrestrial – sludge application	0.64 mg/kg	10.9 mg/kg dw	0.59
Terrestrial – no sludge application	0.12 mg/kg	10.9 mg/kg dw	0.011
Sewage treatment plant	0.017 mg/l	0.37 mg/l	0.05
4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES			
Occupational and Environmental exposure			
<p>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. For human health, 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. For the environment, this has to be done by showing that they limit the PEC below the PNEC for the respective environmental compartment. If measured data are not available, the DU may make use of an appropriate scaling tool such as the DU-Scaling tool (http://www.arche-consulting.be/Metal-CSA-toolbox/duscaling-tool) to estimate PEC values.</p>			

<i>Industrial use of cobalt in the production of diamond tools</i>		
Systematic title based on use descriptor	SU3 (Industrial use), SU15 PC7, AC2, AC7, ERC12a (appropriate PROCs are given in Section 2 below)	
2. Operational conditions and risk management measures		
Workplace	Involved task	Involved PROCs
Raw material handling	Loading/unloading	8b, 9, 26
Wet processes	Weighing, mixing, moistening, granulation, drying, sieving, cold pressing	4, 5
Hot (metallurgical) processes	Hot pressing, sintering	14, 22, 25
Mechanical finishing processes	Machining, assembly	21, 24
Packaging	Packaging	21
Cleaning & maintenance	Manual cleaning, repair and maintenance operations, removal of residuals from e.g. filters/overspill or as waste.	8a, 26

2.1 Control of workers exposure				
Product characteristics				
Workplace	Use in preparation and content in preparation		Physical form of the product	
Raw material handling	Yes (cobalt-containing feed material). Varying content of cobalt (No restriction)		Various (Powder, Granulate)	
Wet processes			Solution	
Hot (metallurgical) processes	Yes. Varying content of cobalt (No restriction)		Massive	
Mechanical finishing processes	Yes (tool considered as article). (No restriction)		Massive	
Packaging				
Cleaning & maintenance	Not applicable		Powder, Dust	
Amounts used				
No restriction.				
Frequency and duration of use/exposure				
No restriction.				
Human factors not influenced by risk management				
The shift breathing volume 10 m ³ / 8 h (full shift).				
Other given operational conditions affecting workers exposure				
Room volume/process temperature or pressure ambient or no restriction respectively for all workplaces except: hot (metallurgical) processes - process temperature 1200°C, process pressure 1500mPa. Cleaning & maintenance - room volume: no restriction, process temperature or pressure ambient (system not in operation). Indoor use.				
Technical conditions and measures at process level (source) to prevent release				
Hot (metallurgical) processes closed system furnaces. Other workplace level of containment/segregation not required.				
Technical conditions and measures to control dispersion from source towards the worker				
Workplace	Level of separation	Localised controls (LC)	Efficiency of LC (according to MEASE)	Additional information
Raw material handling	Level of separation if required see frequency and duration of exposure section. Installation of ventilated (positive pressure) control rooms can also reduce exposure.	Local exhaust ventilation is required	90 %	Manual semi-automatic process
Wet processes		Local exhaust ventilation is required	78 %	-
Hot (metallurgical) processes		exhaust ventilation in calcination area	90 %	
Mechanical finishing processes		No measures required	Not applicable	
Packaging		No measures required	Not applicable	
Cleaning & maintenance			No measures required	Not applicable

Organisational measures to prevent/limit releases, dispersion and exposure			
Additional information See Section: 7, 8, 11 (SDS).			
Conditions and measures related to personal protection, hygiene and health evaluation			
Workplace	Specification of respiratory protective equipment (RPE)	RPE efficiency (assigned protection factor, APF)	Specification of gloves and further personal protective equipment (PPE)
Raw material handling	Mask type: FFP2 (Handling: Powder)	APF=10	Since cobalt has sensitising properties, the use of suitable chemical resistant gloves (EN 374) providing protection for the duration of activity (e.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm) is a prerequisite for all process steps in which direct contact to cobalt substances is possible. In cases where direct contact with cobalt cannot be avoided, a protective suit conforming to EN13982 should be worn. As a general requirement for the conducted processes: standard working clothes (long-sleeve overall) and safety shoes.
Wet processes	No measures required	Not applicable	
Hot (metallurgical) processes	Mask type: FFP2	APF=10	
Mechanical finishing processes	No measures required	Not applicable	
Packaging	No measures required	Not applicable	
Cleaning & maintenance	Mask type: FFP2 (low - medium dusty materials)	APF=10	
	Mask type: powered filtering device incorporating a hood or a helmet, TH3 (high dusty materials)	APF=40	
2.2 Control of environmental exposure			
Amounts used			
51 tonnes Co/annum/site			
Frequency and duration of use/exposure			
Continuous use/release. Days/year to the air and water compartment: >236			
Environment factors not influenced by risk management			
The dilution capacity of the receiving surface water (calculated as the ratio between the flow rate of the river/lake/estuary/sea to the effluent discharge rate): <ul style="list-style-type: none"> - Dilution factor for the freshwater environment (Fresh water-STP ES): 100 - Dilution factor for the freshwater environment (Fresh water-direct discharge ES): 200 - Dilution factor for the marine environment: 100 			
Other given operational conditions affecting environmental exposure			
Not applicable.			

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
<p>Water: One or more of the following measures (as set out in the BAT Reference Document on Non-Ferrous Metal Processes), to be taken for emissions to water:</p> <ul style="list-style-type: none"> - Chemical precipitation: used primarily to remove the metal ions - Sedimentation - Filtration: used as final clarification step - Electrolysis: for low metal concentration - Reverse Osmosis (OR): extensively used for the removal of dissolved metals - Ion exchange: final cleaning step in the removal of heavy metal from process wastewater <p>Air: One or more of the following measures (as set out in the BAT Reference Document on Non-Ferrous Metal Processes), to be taken for emissions to air:</p> <ul style="list-style-type: none"> - Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm³ - Wet electrostatic precipitators: < 5 mg/Nm³ - Cyclones, but as primary collector: < 50 mg/Nm³ - Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values < 5 mg/Nm³. Membrane filtration techniques can achieve < 1 mg/Nm³ - Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm³ - Wet scrubbers: < 4 mg/Nm³
<p>Soil: No measures to reduce emissions to soil</p> <p>The release factors to both the water and air compartments after on-site treatment are:</p> <ul style="list-style-type: none"> - Estimated fraction released to water (g Co/tonne): 200 (SPERC use) - Estimated fraction released to air (g Co/tonne): 30 (SPERC use)
Organisational measures to prevent/limit release from site
Please see section 8 SDS for more details.
Conditions and measures related to municipal sewage treatment plant
Two different exposure scenarios (ES) for the freshwater environment were considered. As default exposure scenario, an offsite municipal STP is included and sludge is applied to agricultural soil. As a second exposure scenario, no off-site municipal STP (direct discharge) is included and no sludge is applied to agricultural soil. For the marine environment, the ES considers no off-site municipal STP (direct discharge) treatment and no sludge application to agricultural soil. The assumption by default for the off site municipal sewage treatment plant is 2,000 m ³ /day. The fraction of Co removed by the municipal STP is set at 40 %.
Conditions and measures related to external treatment of waste for disposal
<p>Suitable disposal: Wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants (Council Directive 2008/98/EC, Directive 2000/76/EC and BAT Reference Document 2006) or hazardous waste landfills as hazardous waste (Directive 1999/31/EC). Releases to the floor, water and soil are to be prevented. If the cobalt content of the waste is elevated enough, internal or external recovery/recycling might be considered. Fraction of daily/annual use expected in waste: 0.001 or 0.1%</p> <p>Appropriate waste codes: 01 03 07*; 11 02 07*; 06 05 02*; 15 01 10*; 10 08 04; 10 10 11*; 12 01 03; 12 01 04; 06 03 13*; 06 03 15*; 06 04 05*; 10 10 03; 10 10 05*; 10 10 07*; 16 06 05; 16 08 02* 16 08 03</p>
3. Exposure estimation and reference to its source
Occupational exposure
Cobalt: The risk characterisation ratio (RCR) is the quotient of the exposure estimate. The respective Derived No Effect Level (DNEL) has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL of: 40µg/m ³

Workplace	Method used for inhalation exposure assessment	Inhalation exposure estimate (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate (RCR)
Raw material handling	Analogous data	21 µg/m ³ (0.53)	Since cobalt has sensitising properties, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.	
Wet processes	MEASE	11 µg/m ³ (0.275)		
Hot (metallurgical) processes	Analogous data	16 µg/m ³ (0.4)		
Mechanical finishing processes	Analogous data	20 µg/m ³ (0.5)		
Packaging	Analogous data	9 µg/m ³ (0.225)		
Cleaning & maintenance	Analogous data	21 µg/m ³ (0.53) (low - medium dusty materials)		
		24 µg/m ³ (0.61) (high dusty materials)		
Environmental emissions				
The risk characterisation ratio (RCR) is the quotient of the local Predicted Environmental Concentration (PEC) and the respective PNEC (Predicted No Effect Concentration) and has to be below 1 to demonstrate a safe use.				
Compartment	Predicted Environmental Concentration	Predicted No Effect Concentration	Risk characterisation ratio	
Fresh water – STP	0.18 µg/l	0.51 µg/l	0.36	
Fresh water – direct discharge	0.17 µg/l	0.51 µg/l	0.33	
Sea water	0.11 µg/l	2.36 µg/l	0.05	
Freshwater sediment – STP	7.41 mg/kg	9.5 mg/kg dw	0.78	
Freshwater sediment – direct discharge	6.88 mg/kg	9.5 mg/kg dw	0.72	
Marine water sediment	8.71 mg/kg	9.5 mg/kg dw	0.92	
Terrestrial – sludge application	0.42 mg/kg	10.9 mg/kg dw	0.04	
Terrestrial – no sludge application	0.01 mg/kg	10.9 mg/kg dw	0.001	
Sewage treatment plant	0.013 mg/l	0.37 mg/l	0.04	

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

Occupational and Environmental 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. For human health, 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. For the environment, this has to be done by showing that they limit the PEC below the PNEC for the respective environmental compartment. If measured data are not available, the DU may make use of an appropriate scaling tool such as the DU-Scaling tool (<http://www.arche-consulting.be/Metal-CSA-toolbox/duscaling-tool>) to estimate PEC values.

Professional use of diamond tools and other cobalt-containing tools			
Systematic title based on use descriptor	SU22 (Professional use) AC2, AC7, ERC10b, ERC11b (appropriate PROCs are given in Section 2 below)		
2. Operational conditions and risk management measures			
Task	Involved task	Involved PROCs	
Automated use of diamond tools with confined and/or extracted machines	Milling/shaping, sawing, grinding	3 (or PROC 1, 2, 4, 24)	
Manual tasks using diamond tools	Abrasive cutting, sawing, grinding, drilling	21, 24	
2.1 Control of workers exposure			
Product characteristics			
Task	Amount of substance in article	Release potential	
Automated use of diamond tools with confined and/or extracted machines	< 25 % (cobalt as binder, the use of cobalt in hard metal is not considered in the scenario)	medium	
Manual tasks using diamond tools			
Amounts used			
No restriction.			
Frequency and duration of use/exposure			
Automated use of diamond tools with confined and/or extracted machines: No restriction. Manual tasks using diamond tools: <60 min.			
Human factors not influenced by risk management			
The shift breathing volume 10 m ³ /8 h (full shift).			
Other given operational conditions affecting workers exposure			
Room volume not restricted. Process temperature or pressure not considered relevant. Indoor and outdoor use.			
Technical conditions and measures at process level (source) to prevent release			
Automated use of diamond tools with confined and/or extracted machines is automated process. Other workplace level of containment/segregation not required.			
Technical conditions and measures to control dispersion from source towards the worker			
Task	Level of separation	Type of ventilation	Efficiency of LC (according to MEASE)
Automated use of diamond tools with confined and/or extracted machines	Level of separation if required see frequency and duration of exposure section. Installation of ventilated (positive pressure) control rooms can also reduce exposure.	Integrated extraction/wet suppression	95 %
Manual tasks using diamond tools		Not required/wet suppression	Not applicable
Organisational measures to prevent/limit releases, dispersion and exposure			
Additional information See Section: 7, 8, 11 (SDS).			
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 and further personal protective equipment (PPE)
Automated use of diamond tools with confined and/or extracted machines	No measures required	Not applicable	Since cobalt has sensitising properties, the use of suitable chemical resistant gloves (EN 374) providing protection for the duration of activity (e.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm) is a prerequisite for all process steps in which direct contact to cobalt substances is possible. In cases where direct contact with cobalt cannot be avoided, a protective suit conforming to EN13982 should be worn. As a general requirement for the conducted processes: standard working clothes (long-sleeve overall) and safety shoes.
Manual tasks using diamond tools	Mask type: FFP3	APF=20	

2.2 Control of environmental exposure
Product characteristics
Cobalt can be in any form in an article.
Amounts used
Not applicable.
Frequency and duration of use/exposure
Continuous use/release: 365 days/year.
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 (Water/Sedimentation).
Other given operational conditions affecting environmental exposure
Indoor or outdoor use of products containing cobalt is possible. There are no intended Co releases due to wide dispersive use and the non-intended releases are negligible and pose no threat to the environment.
Conditions and measures related to municipal sewage treatment plant
Presence of municipal sewage treatment plant.
Conditions and measures related to external treatment of waste for disposal
Fraction of daily/annual use expected in waste: 60% of all articles, 40% is recycled. (EC, 2010) Appropriate waste codes: 20 01 34; 20 01 33; 20 01 40; 20 03 01; 20 03 07 Suitable Disposal: Waste from end-of-life articles can be disposed of as municipal waste, except when they are separately regulated, like electronic devices, batteries, vehicles, etc. Disposal of wastes is possible via incineration (Directive 2000/76/EC) or landfilling (BAT Reference Document 2006, Council Directive 1999/31/EC and Council Decision 19/12/2002).
Conditions and measures related to external recovery of waste
Shredders pre-treating metal wastes maximum release factors to air of 0.0015 after RMM and no releases to water and soil.
3. Exposure estimation and reference to its source
Occupational exposure
Cobalt: The risk characterisation ratio (RCR) is the quotient of the exposure estimate. The respective Derived No Effect Level (DNEL) has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL of: 40µg/m ³

Task	Method used for inhalation exposure assessment	Inhalation exposure estimate (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate (RCR)
Automated use of diamond tools with confined and/or extracted machines	MEASE (PROC 3)	30 µg/m ³ (0.75)		Since cobalt has sensitising properties, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.
Manual tasks using diamond tools	MEASE (PROC 24)	18 µg/m ³ (0.45)		
Environmental emissions				
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.				
4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES				
The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. For human health, 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.				



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

1.1. Product identifier

Trade name : CO7106
EC index no : 027-001-00-9
EC no : 231-158-0
CAS No. : 7440-48-4
REACH registration No. : 01-2119517392-44

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

1.2.1. Relevant identified uses

Title	Sector of use	Product category	Process category	Article category	Environmental release	SPERC
Professional use of diamond tools and other cobalt-containing tools	SU22		PROC3, PROC 2, PROC1, PROC4, PROC21, PROC24	AC2, AC7	ERC10b, ERC11b	
Manufacture and industrial use of cobalt containing alloys, steels and tools (ES Ref.: ES6_Cobalt Gen)	SU14, SU15	PC7, PC14, PC38	PROC1, PROC5, PROC8b, PROC13, PROC14, PROC21, PROC22, PROC23, PROC24, PROC25, PROC26, PROC27a, PROC27b	AC1, AC2, AC7	ERC2, ERC3, ERC12a	
Industrial use of cobalt in the production of diamond tools (ES Ref.: ES11_Cobalt OD)	SU3, SU15	PC7	PROC4, PROC5, PROC8b, PROC9, PROC14, PROC21, PROC22, PROC24, PROC25, PROC26, PROC8a	AC2, AC7	ERC12a	

Full text of use descriptors: see section 16.

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

Eurotungstene
9 rue André Sibellas - BP152X
38042 Grenoble cedex 09
France
tel : +33(0) 4 76 70 54 54
fax : +33(0) 2 41 93 48 23
msds-eurotungstene@erametgroup.com

1.4. Emergency telephone number

Emergency number : http://www.who.int/gho/phe/chemical_safety/poisons_centres/en/index.html

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Sol. 1 H228
Acute Tox. 4 (Oral) H302
Acute Tox. 1 (Inhalation:dust,mist) H330
Eye Irrit. 2 H319
Resp. Sens. 1 H334
Skin Sens. 1 H317
Carc. 1B H350i
Repr. 2 H361
Aquatic Acute 1 H400 (M=10)

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Aquatic Chronic 1 H410 (M=1)

Full text of H-phrases: see section 16

Classification according to Directive 67/548/EEC or 1999/45/EC

Repr.Cat.3; R62

Carc.Cat.2; R49

F; R11

T+; R26

Xn; R22

Xn; R42

Xi; R36

Xi; R43

N; R50/53

Full text of R-phrases: see section 16

Adverse physicochemical, human health and environmental effects

Additional information on classification. Self classification.

2.2. Label elements**Labelling according to Regulation (EC) No. 1272/2008 [CLP]**

Hazard pictograms (CLP) :



GHS02

GHS06

GHS08

GHS09

Signal word (CLP) : Danger

Hazard statements (CLP) :

H228 - Flammable solid
 H302 - Harmful if swallowed
 H317 - May cause an allergic skin reaction
 H319 - Causes serious eye irritation
 H330 - Fatal if inhaled
 H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
 H350i - May cause cancer by inhalation
 H361 - Suspected of damaging fertility or the unborn child
 H410 - Very toxic to aquatic life with long lasting effects

Precautionary statements (CLP) :

P210 - Keep away from heat, sparks, open flames, hot surfaces. - No smoking
 P261 - Avoid breathing dust
 P273 - Avoid release to the environment
 P280 - Wear protective clothing, eye protection
 P285 - In case of inadequate ventilation wear respiratory protection
 P308+P313 - IF exposed or concerned: Get medical advice/attention

2.3. Other hazards

Other hazards not contributing to the classification : Inhalation of dust may cause irritation of the respiratory system.

SECTION 3: Composition/information on ingredients**3.1. Substances**

Name	Product identifier	%	Classification according to Directive 67/548/EEC
CO7106 (Main constituent)	(CAS No.) 7440-48-4 (EC no) 231-158-0 (EC index no) 027-001-00-9 (REACH-no) 01-2119517392-44	> 99,9	Repr.Cat.3; R62 Cat.Carc.2 : R49 F; R11 T+; R26 Xn; R22

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			Xn; R42 Xi; R36 Xi; R43 N; R50/53
Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
CO7106 (Main constituent)	(CAS No.) 7440-48-4 (EC no) 231-158-0 (EC index no) 027-001-00-9 (REACH-no) 01-2119517392-44	> 99,9	Flam. Sol. 1, H228 Acute Tox. 4 (Oral), H302 Acute Tox. 1 (Inhalation), H330 Eye Irrit. 2, H319 Resp. Sens. 1, H334 Skin Sens. 1, H317 Repr. 2, H361 Carc. 1B, H350i Aquatic Acute 1, H400 (M=10) Aquatic Chronic 1, H410

Full text of R-, H- and EUH-phrases: see section 16

3.2. Mixtures

Not applicable

SECTION 4: First aid measures**4.1. Description of first aid measures**

First-aid measures general	: Medical examination necessary even merely on suspicion of intoxication.
First-aid measures after inhalation	: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. Where appropriate artificial ventilation. In case of respiratory arrest, administer artificial respiration. Get medical advice/ attention.
First-aid measures after skin contact	: Wash with plenty of soap and water. Wash contaminated clothing before reuse. If skin irritation occurs: Get medical advice/attention.
First-aid measures after eye contact	: In case of contact with eyes flush immediately with plenty of flowing water for 10 to 15 minutes holding eyelids apart and consult an ophthalmologist. Remove contact lenses, if present and easy to do. Continue rinsing. Consult an ophthalmologist.
First-aid measures after ingestion	: If swallowed, rinse mouth with water (only if the person is conscious). Call a POISON CENTER or doctor/physician.

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

Symptoms/injuries	: Allergic reactions.
Symptoms/injuries after inhalation	: Cough. Respiratory complaints. Sensitised persons may subsequently show asthmatic symptoms when exposed to atmospheric concentrations well below the OEL.
Symptoms/injuries after skin contact	: Allergic reactions. Skin irritation, dermatitis and sensitisation.
Symptoms/injuries after eye contact	: Irritating to eyes.
Symptoms/injuries after ingestion	: Abdominal pain. Vomiting.
Chronic symptoms	: May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction.

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

No additional information available

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SECTION 5: Firefighting measures**5.1. Extinguishing media**

Suitable extinguishing media : Co-ordinate fire-fighting measures to the fire surroundings. Extinguishing/inerting agent. Extinguish by smothering. Foam. ABC-powder. Carbon dioxide (CO₂).

Unsuitable extinguishing media : High power water jet.

5.2. Special hazards arising from the substance or mixture

Fire hazard : In case of fire may be liberated: Metal oxide smoke, toxic.

Reactivity : The product is stable at normal handling- and storage conditions.

5.3. Advice for firefighters

Precautionary measures fire : Co-ordinate fire-fighting measures to the fire surroundings.

Firefighting instructions : In case of fire: Wear self-contained breathing apparatus.

Other information : Do not allow run-off from fire-fighting to enter drains or water courses.

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

General measures : Avoid generation of dust. See protective measures under point 7 and 8.

6.1.1. For non-emergency personnel

Emergency procedures : Evacuate area.

6.1.2. For emergency responders

Protective equipment : Wear breathing apparatus if exposed to vapours/dusts/aerosols. Wear suitable gloves and eye/face protection.

Emergency procedures : Remove persons to safety.

6.2. Environmental precautions

Avoid release to the environment.

6.3. Methods and material for containment and cleaning up

For containment : Collect spillage.

Methods for cleaning up : Take up dust-free and set down dust-free. Clean contaminated objects and areas thoroughly observing environmental regulations. Retain contaminated washing water and dispose it.

Other information : Treat the recovered material as prescribed in the section on waste disposal.

6.4. Reference to other sections

See protective measures under point 7 and 8. Treat the recovered material as prescribed in the section on waste disposal.

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

Additional hazards when processed : Persons with a history of asthma, allergies, chronic or recurrent respiratory disease should not be exposed to any process in which this product is used.

Precautions for safe handling : Provide adequate ventilation as well as local exhaust at critical locations. Avoid generation of dust. Avoid contact with skin and eyes. Avoid release to the environment.

Hygiene measures : Do not eat, drink or smoke when using this product. Contaminated work clothing should not be allowed out of the workplace. Wash hands before break and at end of works.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Keep container tightly closed and in a well-ventilated place.

Incompatible products : Acid. Oxidising.

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- Heat-ignition : Remove all sources of ignition.
- Special rules on packaging : Repeat the labelling if the packaging is divided up.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection**8.1. Control parameters**

Cobalt powder (7440-48-4)		
USA ACGIH	ACGIH TWA (mg/m ³)	0,02 mg/m ³
USA NIOSH	NIOSH REL (TWA) (mg/m ³)	0,05 mg/m ³
USA OSHA	OSHA PEL (TWA) (mg/m ³)	0,1 mg/m ³

Cobalt powder (7440-48-4)	
DNEL/DMEL (Workers)	
Long-term - local effects, inhalation	0,04 mg/m ³ /day
DNEL/DMEL (General population)	
Long-term - systemic effects, dermal	0,0095 mg/kg bodyweight/day
Long-term - local effects, inhalation	0,0063 mg/m ³ /day
PNEC (Water)	
PNEC aqua (freshwater)	0,60 µg/l
PNEC aqua (marine water)	2.36 µg/l
PNEC (Sediment)	
PNEC sediment (freshwater)	11,2 mg/kg dwt
PNEC sediment (marine water)	9,5 mg/kg dwt
PNEC (Soil)	
PNEC soil	10,9 mg/kg dwt
PNEC (STP)	
PNEC sewage treatment plant	0,373 mg/l

8.2. Exposure controls

- Appropriate engineering controls : Technical measures and the application of suitable work processes have priority over personal protection equipment.
- Personal protective equipment : In case of dust production: protective goggles. Gloves. Dust production: dust mask with filter type P3. In case of dust production: dustproof clothing.



- Hand protection : The quality of the protective gloves resistant to chemicals must be chosen as a function of the specific working place concentration and quantity of hazardous substances. Recommended glove articles. DIN EN 374.
- Eye protection : Dust protection eye glasses.

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Respiratory protection	: Provide adequate ventilation as well as local exhaust at critical locations. If technical exhaust or ventilation measures are not possible or insufficient, respiratory protection must be worn. Recommended respiratory protection articles. Filtering Half-face mask (DIN EN 149).
Environmental exposure controls	: Avoid release to the environment.

SECTION 9: Physical and chemical properties**9.1. Information on basic physical and chemical properties**

Physical state	: Solid
Molecular mass	: 58,93 g/mol
Colour	: grey.
Odour	: odourless.
Odour threshold	: Not applicable
pH	: Not required.
pH solution	: Not applicable
Melting point	: 1494 °C
Boiling point	: 2927 °C
Flash point	: Not applicable
Relative evaporation rate (ether=1)	: Not applicable
Flammability (solid, gas)	: Flammable
Explosive limits	: Not applicable Not applicable
Vapour pressure	: Not applicable
Vapour pressure at 50 °C	: Not applicable
Relative vapour density at 20 °C	: Not applicable
Relative density	: 8,89
Relative density of saturated gas/air mixture	: Not required.
Critical temperature	: Not applicable
Critical pressure	: Not applicable
Solubility	: Water: 2,94 mg/l
Partition coefficient: n-octanol/water	: Not required.
Self ignition temperature	: Not applicable
Decomposition temperature	: Not applicable
Viscosity	: Not applicable
Explosive properties	: St1.
Oxidising properties	: not oxidizing.

9.2. Other information

Other properties	: Particle size (µm): 0.9
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SECTION 10: Stability and reactivity**10.1. Reactivity**

The product is stable at normal handling- and storage conditions.

10.2. Chemical stability

The product is stable at normal handling- and storage conditions.

10.3. Possibility of hazardous reactions

The product is stable at normal handling- and storage conditions.

10.4. Conditions to avoid

Avoid generation of dust.

10.5. Incompatible materials

A fire or explosion hazard arises since highly flammable gas (hydrogen) is released when it is in contact with : Strong acid.

10.6. Hazardous decomposition products

metallic oxide.

SECTION 11: Toxicological information**11.1. Information on toxicological effects**

Acute toxicity : Harmful if swallowed. Fatal if inhaled.

Cobalt powder (7440-48-4)	
LD50 oral rat	550 mg/kg
LD50 dermal rat	2 000 mg/kg
ATE (dust,mist)	0,01 mg/l/4h

Skin corrosion/irritation : Not classified

Serious eye damage/irritation : Causes serious eye irritation.

Respiratory or skin sensitisation : May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction.

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Suspected of damaging fertility or the unborn child.

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

SECTION 12: Ecological information**12.1. Toxicity**

Cobalt powder (7440-48-4)	
LC50 fish 1	1,5 mg/l FRESH WATER
LC50 other aquatic organisms 1	0,61 mg/l FRESH WATER
LC50 other aquatic organisms 2	2,32 mg/l (marine water)

12.2. Persistence and degradability

No additional information available

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12.3. Bioaccumulative potential

Cobalt powder (7440-48-4)

BCF fish 1	< 10
BCF fish 2	< 10
BCF other aquatic organisms 1	100 - 5000
Bioaccumulative potential	Low.

12.4. Mobility in soil

No additional information available

12.5. Results of PBT and vPvB assessment

No additional information available

12.6. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Regional legislation (waste)	: Disposal must be done according to official regulations.
Waste treatment methods	: Waste disposal according to EC directives 75/442/EEC and 91/689/EEC in the corresponding versions, covering waste and dangerous waste. Do not empty into drains. Dispose of this material and its container to hazardous or special waste collection point.
Sewage disposal recommendations	: Do not discharge into drains or the environment. Retain contaminated washing water and dispose it.
Ecology - waste materials	: Do not empty into drains, dispose of this material and its container at hazardous or special waste collection point.

SECTION 14: Transport information

In accordance with ADR / RID / ADN / IMDG / ICAO / IATA

14.1. UN number

UN-No. : 3179

14.2. UN proper shipping name

Proper Shipping Name : FLAMMABLE SOLID, TOXIC, INORGANIC, N.O.S.

Transport document description : UN 3179 FLAMMABLE SOLID, TOXIC, INORGANIC, N.O.S., 4.1 (6.1), (E)

14.3. Transport hazard class(es)

Class (UN) : 4.1

Hazard labels (UN) : 4.1, 6.1



14.4. Packing group

Packing group (UN) : II

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14.5. Environmental hazards

Marine pollutant



Other information

: No supplementary information available.

14.6. Special precautions for user**14.6.1. Overland transport**

Hazard identification number (Kemler No.) : 46

Classification code (ADR) : FT2

Tunnel restriction code : E

LQ : 1 Kg

Excepted quantities (ADR) : E2

14.6.2. Transport by sea

Limited quantities (IMDG) : chap. 3.2 col(7a)

14.6.3. Air transport

Instruction "passenger" - Limited quantities (ICAO) : Tab. 4.2 col H

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

SECTION 15: Regulatory information**15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture****15.1.1. EU-Regulations**

No REACH Annex XVII restrictions

15.1.2. National regulations

No additional information available

15.2. Chemical safety assessment

A chemical safety assessment has been carried out

SECTION 16: Other information

Indication of changes : according to Regulation (EC) No. 453/2010.

Data sources : Chemical Safety Assessment.

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Abbreviations and acronyms	: ACGIH American Conference of Governmental Industrial Hygienists BAF Bioaccumulation Factor BCF Bioconcentration Factor CAS Chemical Abstract Service NOEC No Observed Effect Concentration NIOSH National Institute of Occupational Safety and Health LD50 Lethal Dose 50 LC50 Lethal Concentration 50 EINECS European Inventory of Existing Commercial Chemical Substances DNEL Derived No Effect Level NOHSC National Occupational Health & Safety Commission OSHA Occupational Safety and Health Administration PEL Permissible Exposure Limits PBT Persistent, Bioaccumulative and Toxic PNEC Predicted No Effect Concentration REACH Registration, Evaluation, Autorisation of CHemicals REL Recommended Exposure Limits SCOEL Scientific Committee on Occupational Exposure Limits STOT Specific Target Organ Toxicity STP Sewage Treatment Plant TWA Time Weighted Average vPvB very Persistent and very Bioaccumulative.
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Other information : The above information describes exclusively the safety requirements of the product and is based on our present-day knowledge. The information is intended to give you advice about the safe handling of the product named in this safety data sheet, for storage, processing, transport and disposal. The information cannot be transferred to other products. In the case of mixing the product with other products or in the case of processing, the information on this safety data sheet is not necessarily valid for the new made-up material.

Full text of R-, H- and EUH-phrases::

Acute Tox. 1 (Inhalation:dust,mist)	Acute toxicity (inhalation:dust,mist) Category 1
Acute Tox. 4 (Oral)	Acute toxicity (oral) Category 4
Aquatic Acute 1	Hazardous to the aquatic environment - Acute Hazard Category 1
Aquatic Chronic 1	Hazardous to the aquatic environment - Chronic Hazard Category 1
Eye Irrit. 2	Serious eye damage/eye irritation Category 2
Flam. Sol. 1	Flammable solids Category 1
Repr. 2	Reproductive toxicity Category 2
Resp. Sens. 1	Respiratory sensitisation Category 1
Skin Sens. 1	Skin sensitisation Category 1
H228	Flammable solid
H302	Harmful if swallowed
H317	May cause an allergic skin reaction
H319	Causes serious eye irritation
H330	Fatal if inhaled
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled
H361	Suspected of damaging fertility or the unborn child
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects
R11	Highly flammable.
R22	Harmful if swallowed.
R26	Very toxic by inhalation.
R36	Irritating to eyes.
R42	May cause sensitization by inhalation.
R43	May cause sensitisation by skin contact.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R62	Possible risk of impaired fertility.
F	Highly flammable

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N	Dangerous for the environment
T+	Very toxic
Xi	Irritant
Xn	Harmful
AC1	Vehicles
AC2	Machinery, mechanical appliances, electrical/electronic articles
AC7	Metal articles
ERC1	Manufacture of substances
ERC10b	Wide dispersive outdoor use of long-life articles and materials with high or intended release (including abrasive processing)
ERC11b	Wide dispersive indoor use of long-life articles and materials with high or intended release (including abrasive processing)
ERC12a	Industrial processing of articles with abrasive techniques (low release)
ERC2	Formulation of preparations
ERC3	Formulation in materials
PC14	Metal surface treatment products, including galvanic and electroplating products
PC38	Welding and soldering products (with flux coatings or flux cores.), flux products
PC7	Base metals and alloys
PROC 2	Use in closed, continuous process with occasional controlled exposure
PROC1	Use in closed process, no likelihood of exposure
PROC13	Treatment of articles by dipping and pouring
PROC14	Production of preparations or articles by tableting, compression, extrusion, pelletisation
PROC21	Low energy manipulation of substances bound in materials and/or articles
PROC22	Potentially closed processing operations with minerals/metals at elevated temperature Industrial setting
PROC23	Open processing and transfer operations with minerals/metals at elevated temperature
PROC24	High (mechanical) energy work-up of substances bound in materials and/or articles
PROC25	Other hot work operations with metals
PROC26	Handling of solid inorganic substances at ambient temperature
PROC27a	Production of metal powders (hot processes)
PROC27b	Production of metal powders (wet processes)
PROC3	Use in closed batch process (synthesis or formulation)
PROC4	Use in batch and other process (synthesis) where opportunity for exposure arises
PROC5	Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
SU10	Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
SU14	Manufacture of basic metals, including alloys
SU15	Manufacture of fabricated metal products, except machinery and equipment
SU22	Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
SU3	Industrial uses: Uses of substances as such or in preparations* at industrial sites

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

Exposure scenario

<i>Manufacture and industrial use of cobalt containing alloys, steels and tools</i>		
Systematic title based on use descriptor	SU3 (Industrial use), SU14, SU15 PC7, PC14, PC38 AC1, AC2, AC7 (appropriate PROCs are given in Section 2 below)	
2. Operational conditions and risk management measures		
Workplace	Involved task	Involved PROCs
Handling of massive materials	Weighing, unpacking, preparation of charge for furnaces	8b, 21
Melting and casting	Melting, casting, dross removal, degassing	22, 23
Finishing of massive objects	Packaging, peeling, hot rolling, forging, pickling, gouging, flame cutting, extrusion, dry honing, sectioning, cutting, crushing	13, 14, 21, 24, 25
Mechanical treatment of hard coated metals and/or alloys – low kinetic energy	Machining, dressing, polishing, stripping, boring, assembly, disassembly	21
Mechanical treatment of hard coated metals and/or alloys – high kinetic energy	Sectioning, grinding, cutting, abrasive cutting	24
Handling of powders	Packaging, furnace loading, sieving, mixing	5, 26
Powder production	Atomisation, handling in a closed system	1 (27a, 27b)
Further processing	Cold and hot isostatic pressing in a closed system	1 (24)
Thermal spraying – fully automated	Flame spraying - melt fusion, plasma spraying / high-velocity flame spraying	1 (25)
Thermal spraying – NOT fully automated	Flame spraying - melt fusion, plasma spraying / high-velocity flame spraying	25
Use of tools in industrial settings	Cutting or drilling	24
Cleaning & maintenance	Manual cleaning, repair and maintenance operations, removal of residuals from e.g. filters/overspill or as waste.	8a, 26

2.1 Control of workers exposure		
Product characteristics		
Workplace	Use in preparation and content in preparation	Physical form of the product
Handling of massive materials	No restriction	Massive cobalt and massive scrap (e.g. ingots, cathodes, rounds)
Melting and casting		Massive (e.g. ingots, cathodes) / Molten
Finishing of massive objects	No restriction (up to 90 %)	Massive
Mechanical treatment of hard coated metals and/or alloys – low kinetic energy	No restriction	Massive
Mechanical treatment of hard coated metals and/or alloys – high kinetic energy		Massive
Handling of powders		Scrap steel and alloy powders and solids
Powder production		Molten
Further processing		Cobalt in alloy
Thermal spraying – fully automated		Powder
Thermal spraying – NOT fully automated		Powder
Use of tools in industrial settings		Massive
Cleaning & maintenance	Not applicable	Powder, Dust
Amounts used		
No restriction.		
Frequency and duration of use/exposure		
No restriction.		
Human factors not influenced by risk management		
The shift breathing volume 10 m ³ /8 h (full shift).		
Other given operational conditions affecting workers exposure		
Room volume not applicable, process temperature or pressure ambient or no restriction respectively for all workplace except: melting and casting, and powder production – process temperature 1500°C, further processing – process temperature 1200°C and high pressure, thermal spraying – fully automated/NOT fully automated – flame temperature up to approx. 3,100°C, sintering at 1,000°C to 1,200°C; plasma can reach temperatures up to 30,000°C and high pressure applied during plasma and high – velocity flame spraying. Cleaning & maintenance - room volume: no restriction, process temperature or pressure ambient (system not in operation). Indoor use.		
Technical conditions and measures at process level (source) to prevent release		
Melting and casting closed furnace, powder production and further processing closed system. Thermal spraying – fully automated full containment and enclosed space. Other workplace level of containment/segregation not required.		
Technical conditions and measures to control dispersion from source towards the worker		

Localised controls (LC) not required for all workplace except: melting and casting, handling of powders and thermal spraying – NOT fully automated (local exhaust ventilation, efficiency up to 78%), use of tools in industrial settings (local exhaust ventilation, efficiency up to 84%). Level of separation if required see frequency and duration of exposure section. Installation of ventilated (positive pressure) control rooms can also reduce exposure. Additional Information: cleaning & maintenance: maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.			
Organisational measures to prevent/limit releases, dispersion and exposure			
Additional information See Section: 7, 8, 11 (SDS).			
Conditions and measures related to personal protection, hygiene and health evaluation			
Workplace	Specification of respiratory protective equipment (RPE)	RPE efficiency (assigned protection factor, APF)	Specification of gloves and further personal protective equipment (PPE)
Handling of massive materials	No measures required	Not applicable	Since cobalt has sensitising properties, the use of suitable chemical resistant gloves (EN 374) providing protection for the duration of activity (e.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm)) is a prerequisite for all process steps in which direct contact to cobalt substances is possible. In cases where direct contact with cobalt cannot be avoided, a protective suit conforming to EN13982 should be worn. As a general requirement for the conducted processes: standard working clothes (long-sleeve overall) and safety shoes.
Melting and casting			
Finishing of massive objects			
Mechanical treatment of hard coated metals and/or alloys – low kinetic energy			
Mechanical treatment of hard coated metals and/or alloys – high kinetic energy	Mask type: FFP2	APF=10	
Handling of powders	Powered filtering device incorporating a hood or a helmet, TH3	APF=40	
Powder production	No measures required	Not applicable	
Further processing			
Thermal spraying – fully automated			
Thermal spraying – NOT fully automated	Mask type: FFP3	APF=20	
Use of tools in industrial settings	No measures required	Not applicable	
Cleaning & maintenance	Mask type: FFP2 (low - medium dusty materials)	APF=10	
	Mask type: powered filtering device incorporating a hood or a helmet, TH3 (high dusty materials)	APF=40	

2.2 Control of environmental exposure
Amounts used
750 tonnes Co/annum/site

Frequency and duration of use/exposure
Continuous use/release. Days/year to the air compartment: >250; Days/year to the water compartment: >336
Environment factors not influenced by risk management
The dilution capacity of the receiving surface water (calculated as the ratio between the flow rate of the river/lake/estuary/sea to the effluent discharge rate): <ul style="list-style-type: none"> - Dilution factor for the freshwater environment (Fresh water – STP ES): 100 - Dilution factor for the freshwater environment (Fresh water – direct discharge ES): 150 - Dilution factor for the marine environment: 150
Other given operational conditions affecting environmental exposure
Not applicable.
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
<p><u>Water</u>: One or more of the following measures (as set out in the BAT Reference Document on Non-Ferrous Metal Processes), to be taken for emissions to water:</p> <ul style="list-style-type: none"> - Chemical precipitation: used primarily to remove the metal ions - Sedimentation - Filtration: used as final clarification step - Electrolysis: for low metal concentration - Reverse Osmosis (OR): extensively used for the removal of dissolved metals - Ion exchange: final cleaning step in the removal of heavy metal from process wastewater <p><u>Air</u>: One or more of the following measures (as set out in the BAT Reference Document on Non-Ferrous Metal Processes) to be taken for emissions to air:</p> <ul style="list-style-type: none"> - Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm³ - Wet electrostatic precipitators: < 5 mg/Nm³ - Cyclones, but as primary collector: < 50 mg/Nm³ - Fabric or bag filters: high efficiency in controlling fine particulate (melting): < 5 mg/Nm³ (membrane filtration achieves < 1 mg/Nm³) - Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm³ - Wet scrubbers: < 4 mg/Nm³ <p><u>Soil</u>: No measures to reduce emissions to soil</p> <p>The release factors to both the water and air compartments after on-site treatment are:</p> <ul style="list-style-type: none"> - Estimated fraction released to water (g Co/tonne): 24.9 - Estimated fraction released to air (g Co/tonne): 422.1
Organisational measures to prevent/limit release from site
Please see section 8 SDS for more details.
Conditions and measures related to municipal sewage treatment plant
Two different exposure scenarios (ES) for the freshwater environment were considered. As default exposure scenario, an offsite municipal STP is included and sludge is applied to agricultural soil. As a second exposure scenario, no off-site municipal STP (direct discharge) is included and no sludge is applied to agricultural soil. For the marine environment, the ES considers no off-site municipal STP (direct discharge) treatment and no sludge application to agricultural soil. The assumption by default for the off site municipal sewage treatment plant is 2,000 m ³ /day. The fraction of Co removed by the municipal STP is set at 40 %.

Conditions and measures related to external treatment of waste for disposal
<p>Suitable disposal: Wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants (Council Directive 2008/98/EC, Directive 2000/76/EC and BAT Reference Document 2006) or hazardous waste landfills as hazardous waste (Directive 1999/31/EC). Releases to the floor, water and soil are to be prevented. If the cobalt content of the waste is elevated enough, internal or external recovery/recycling might be considered. Fraction of daily/annual use expected in waste: 0.001 or 0.1%</p> <p>Appropriate waste codes: 01 03 07*; 11 02 07*; 06 05 02*; 15 01 10*; 10 08 04; 10 10 11*; 12 01 03; 12 01 04; 06 03 13*; 06 03 15*; 10 10 03; 10 10 05*; 10 10 07*; 16 06 05; 16 08 02* 16 08 03</p>

3. Exposure estimation and reference to its source				
Occupational exposure				
Cobalt: The risk characterisation ratio (RCR) is the quotient of the exposure estimate. The respective Derived No Effect Level (DNEL) has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL of: 40µg/m ³				
Workplace	Method used for inhalation exposure assessment	Inhalation exposure estimate (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate (RCR)
Handling of massive materials	Analogous data	9 µg/m ³ (0.225)	Since cobalt has sensitising properties, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.	
Melting and casting	Measured data	2 µg/m ³ (0.053)		
Finishing of massive objects	Analogous data	24 µg/m ³ (0.59)		
Mechanical treatment of hard coated metals and/or alloys – low kinetic energy	Measured data	10 µg/m ³ (0.25)		
Mechanical treatment of hard coated metals and/or alloys – high kinetic energy		29 µg/m ³ (0.725)		
Handling of powders		27 µg/m ³ (0.68)		
Powder production	MEASE	10 µg/m ³ (0.25)		
Further processing		10 µg/m ³ (0.25)		
Thermal spraying – fully automated		10 µg/m ³ (0.25)		
Thermal spraying – NOT fully automated	Published data	20 µg/m ³ (0.49)		
Use of tools in industrial settings	Analogous data	20 µg/m ³ (0.5)		
Cleaning & maintenance	Analogous data	21 µg/m ³ (0.53) (low - medium dusty materials)		
		24 µg/m ³ (0.61) (high dusty materials)		
Environmental emissions				
The risk characterisation ratio (RCR) is the quotient of the local Predicted Environmental Concentration (PEC) and the respective PNEC (Predicted No Effect Concentration) and has to be below 1 to demonstrate a safe use.				

Compartment	Predicted Environmental Concentration	Predicted No Effect Concentration	Risk characterisation ratio
Fresh water – STP	0.21 µg/l	0.51 µg/l	0.40
Fresh water – direct discharge	0.22 µg/l	0.51 µg/l	0.43
Sea water	0.10 µg/l	2.36 µg/l	0.04
Freshwater sediment – STP	8.31 mg/kg	9.5 mg/kg dw	0.87
Freshwater sediment – direct discharge	8.76 mg/kg	9.5 mg/kg dw	0.92
Marine water sediment	7.56 mg/kg	9.5 mg/kg dw	0.80
Terrestrial – sludge application	0.64 mg/kg	10.9 mg/kg dw	0.59
Terrestrial – no sludge application	0.12 mg/kg	10.9 mg/kg dw	0.011
Sewage treatment plant	0.017 mg/l	0.37 mg/l	0.05
4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES			
Occupational and Environmental exposure			
<p>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. For human health, 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. For the environment, this has to be done by showing that they limit the PEC below the PNEC for the respective environmental compartment. If measured data are not available, the DU may make use of an appropriate scaling tool such as the DU-Scaling tool (http://www.arche-consulting.be/Metal-CSA-toolbox/duscaling-tool) to estimate PEC values.</p>			

<i>Industrial use of cobalt in the production of diamond tools</i>		
Systematic title based on use descriptor	SU3 (Industrial use), SU15 PC7, AC2, AC7, ERC12a (appropriate PROCs are given in Section 2 below)	
2. Operational conditions and risk management measures		
Workplace	Involved task	Involved PROCs
Raw material handling	Loading/unloading	8b, 9, 26
Wet processes	Weighing, mixing, moistening, granulation, drying, sieving, cold pressing	4, 5
Hot (metallurgical) processes	Hot pressing, sintering	14, 22, 25
Mechanical finishing processes	Machining, assembly	21, 24
Packaging	Packaging	21
Cleaning & maintenance	Manual cleaning, repair and maintenance operations, removal of residuals from e.g. filters/overspill or as waste.	8a, 26

2.1 Control of workers exposure				
Product characteristics				
Workplace	Use in preparation and content in preparation		Physical form of the product	
Raw material handling	Yes (cobalt-containing feed material). Varying content of cobalt (No restriction)		Various (Powder, Granulate)	
Wet processes			Solution	
Hot (metallurgical) processes	Yes. Varying content of cobalt (No restriction)		Massive	
Mechanical finishing processes	Yes (tool considered as article). (No restriction)		Massive	
Packaging				
Cleaning & maintenance	Not applicable		Powder, Dust	
Amounts used				
No restriction.				
Frequency and duration of use/exposure				
No restriction.				
Human factors not influenced by risk management				
The shift breathing volume 10 m ³ / 8 h (full shift).				
Other given operational conditions affecting workers exposure				
Room volume/process temperature or pressure ambient or no restriction respectively for all workplaces except: hot (metallurgical) processes - process temperature 1200°C, process pressure 1500mPa. Cleaning & maintenance - room volume: no restriction, process temperature or pressure ambient (system not in operation). Indoor use.				
Technical conditions and measures at process level (source) to prevent release				
Hot (metallurgical) processes closed system furnaces. Other workplace level of containment/segregation not required.				
Technical conditions and measures to control dispersion from source towards the worker				
Workplace	Level of separation	Localised controls (LC)	Efficiency of LC (according to MEASE)	Additional information
Raw material handling	Level of separation if required see frequency and duration of exposure section. Installation of ventilated (positive pressure) control rooms can also reduce exposure.	Local exhaust ventilation is required	90 %	Manual semi-automatic process
Wet processes		Local exhaust ventilation is required	78 %	
Hot (metallurgical) processes		exhaust ventilation in calcination area	90 %	
Mechanical finishing processes		No measures required	Not applicable	
Packaging		No measures required	Not applicable	
Cleaning & maintenance		No measures required	Not applicable	Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.

Organisational measures to prevent/limit releases, dispersion and exposure			
Additional information See Section: 7, 8, 11 (SDS).			
Conditions and measures related to personal protection, hygiene and health evaluation			
Workplace	Specification of respiratory protective equipment (RPE)	RPE efficiency (assigned protection factor, APF)	Specification of gloves and further personal protective equipment (PPE)
Raw material handling	Mask type: FFP2 (Handling: Powder)	APF=10	Since cobalt has sensitising properties, the use of suitable chemical resistant gloves (EN 374) providing protection for the duration of activity (e.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm) is a prerequisite for all process steps in which direct contact to cobalt substances is possible. In cases where direct contact with cobalt cannot be avoided, a protective suit conforming to EN13982 should be worn. As a general requirement for the conducted processes: standard working clothes (long-sleeve overall) and safety shoes.
Wet processes	No measures required	Not applicable	
Hot (metallurgical) processes	Mask type: FFP2	APF=10	
Mechanical finishing processes	No measures required	Not applicable	
Packaging	No measures required	Not applicable	
Cleaning & maintenance	Mask type: FFP2 (low - medium dusty materials)	APF=10	
	Mask type: powered filtering device incorporating a hood or a helmet, TH3 (high dusty materials)	APF=40	
2.2 Control of environmental exposure			
Amounts used			
51 tonnes Co/annum/site			
Frequency and duration of use/exposure			
Continuous use/release. Days/year to the air and water compartment: >236			
Environment factors not influenced by risk management			
The dilution capacity of the receiving surface water (calculated as the ratio between the flow rate of the river/lake/estuary/sea to the effluent discharge rate): <ul style="list-style-type: none"> - Dilution factor for the freshwater environment (Fresh water-STP ES): 100 - Dilution factor for the freshwater environment (Fresh water-direct discharge ES): 200 - Dilution factor for the marine environment: 100 			
Other given operational conditions affecting environmental exposure			
Not applicable.			

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
<p>Water: One or more of the following measures (as set out in the BAT Reference Document on Non-Ferrous Metal Processes), to be taken for emissions to water:</p> <ul style="list-style-type: none"> - Chemical precipitation: used primarily to remove the metal ions - Sedimentation - Filtration: used as final clarification step - Electrolysis: for low metal concentration - Reverse Osmosis (OR): extensively used for the removal of dissolved metals - Ion exchange: final cleaning step in the removal of heavy metal from process wastewater <p>Air: One or more of the following measures (as set out in the BAT Reference Document on Non-Ferrous Metal Processes), to be taken for emissions to air:</p> <ul style="list-style-type: none"> - Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm³ - Wet electrostatic precipitators: < 5 mg/Nm³ - Cyclones, but as primary collector: < 50 mg/Nm³ - Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values < 5 mg/Nm³. Membrane filtration techniques can achieve < 1 mg/Nm³ - Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm³ - Wet scrubbers: < 4 mg/Nm³
<p>Soil: No measures to reduce emissions to soil</p> <p>The release factors to both the water and air compartments after on-site treatment are:</p> <ul style="list-style-type: none"> - Estimated fraction released to water (g Co/tonne): 200 (SPERC use) - Estimated fraction released to air (g Co/tonne): 30 (SPERC use)
Organisational measures to prevent/limit release from site
Please see section 8 SDS for more details.
Conditions and measures related to municipal sewage treatment plant
Two different exposure scenarios (ES) for the freshwater environment were considered. As default exposure scenario, an offsite municipal STP is included and sludge is applied to agricultural soil. As a second exposure scenario, no off-site municipal STP (direct discharge) is included and no sludge is applied to agricultural soil. For the marine environment, the ES considers no off-site municipal STP (direct discharge) treatment and no sludge application to agricultural soil. The assumption by default for the off site municipal sewage treatment plant is 2,000 m ³ /day. The fraction of Co removed by the municipal STP is set at 40 %.
Conditions and measures related to external treatment of waste for disposal
<p>Suitable disposal: Wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants (Council Directive 2008/98/EC, Directive 2000/76/EC and BAT Reference Document 2006) or hazardous waste landfills as hazardous waste (Directive 1999/31/EC). Releases to the floor, water and soil are to be prevented. If the cobalt content of the waste is elevated enough, internal or external recovery/recycling might be considered. Fraction of daily/annual use expected in waste: 0.001 or 0.1%</p> <p>Appropriate waste codes: 01 03 07*; 11 02 07*; 06 05 02*; 15 01 10*; 10 08 04; 10 10 11*; 12 01 03; 12 01 04; 06 03 13*; 06 03 15*; 06 04 05*; 10 10 03; 10 10 05*; 10 10 07*; 16 06 05; 16 08 02* 16 08 03</p>
3. Exposure estimation and reference to its source
Occupational exposure
Cobalt: The risk characterisation ratio (RCR) is the quotient of the exposure estimate. The respective Derived No Effect Level (DNEL) has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL of: 40µg/m ³

Workplace	Method used for inhalation exposure assessment	Inhalation exposure estimate (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate (RCR)
Raw material handling	Analogous data	21 µg/m ³ (0.53)	Since cobalt has sensitising properties, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.	
Wet processes	MEASE	11 µg/m ³ (0.275)		
Hot (metallurgical) processes	Analogous data	16 µg/m ³ (0.4)		
Mechanical finishing processes	Analogous data	20 µg/m ³ (0.5)		
Packaging	Analogous data	9 µg/m ³ (0.225)		
Cleaning & maintenance	Analogous data	21 µg/m ³ (0.53) (low - medium dusty materials)		
		24 µg/m ³ (0.61) (high dusty materials)		
Environmental emissions				
The risk characterisation ratio (RCR) is the quotient of the local Predicted Environmental Concentration (PEC) and the respective PNEC (Predicted No Effect Concentration) and has to be below 1 to demonstrate a safe use.				
Compartment	Predicted Environmental Concentration	Predicted No Effect Concentration	Risk characterisation ratio	
Fresh water – STP	0.18 µg/l	0.51 µg/l	0.36	
Fresh water – direct discharge	0.17 µg/l	0.51 µg/l	0.33	
Sea water	0.11 µg/l	2.36 µg/l	0.05	
Freshwater sediment – STP	7.41 mg/kg	9.5 mg/kg dw	0.78	
Freshwater sediment – direct discharge	6.88 mg/kg	9.5 mg/kg dw	0.72	
Marine water sediment	8.71 mg/kg	9.5 mg/kg dw	0.92	
Terrestrial – sludge application	0.42 mg/kg	10.9 mg/kg dw	0.04	
Terrestrial – no sludge application	0.01 mg/kg	10.9 mg/kg dw	0.001	
Sewage treatment plant	0.013 mg/l	0.37 mg/l	0.04	

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

Occupational and Environmental 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. For human health, 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. For the environment, this has to be done by showing that they limit the PEC below the PNEC for the respective environmental compartment. If measured data are not available, the DU may make use of an appropriate scaling tool such as the DU-Scaling tool (<http://www.arche-consulting.be/Metal-CSA-toolbox/duscaling-tool>) to estimate PEC values.

Professional use of diamond tools and other cobalt-containing tools			
Systematic title based on use descriptor	SU22 (Professional use) AC2, AC7, ERC10b, ERC11b (appropriate PROCs are given in Section 2 below)		
2. Operational conditions and risk management measures			
Task	Involved task	Involved PROCs	
Automated use of diamond tools with confined and/or extracted machines	Milling/shaping, sawing, grinding	3 (or PROC 1, 2, 4, 24)	
Manual tasks using diamond tools	Abrasive cutting, sawing, grinding, drilling	21, 24	
2.1 Control of workers exposure			
Product characteristics			
Task	Amount of substance in article	Release potential	
Automated use of diamond tools with confined and/or extracted machines	< 25 % (cobalt as binder, the use of cobalt in hard metal is not considered in the scenario)	medium	
Manual tasks using diamond tools			
Amounts used			
No restriction.			
Frequency and duration of use/exposure			
Automated use of diamond tools with confined and/or extracted machines: No restriction. Manual tasks using diamond tools: <60 min.			
Human factors not influenced by risk management			
The shift breathing volume 10 m ³ /8 h (full shift).			
Other given operational conditions affecting workers exposure			
Room volume not restricted. Process temperature or pressure not considered relevant. Indoor and outdoor use.			
Technical conditions and measures at process level (source) to prevent release			
Automated use of diamond tools with confined and/or extracted machines is automated process. Other workplace level of containment/segregation not required.			
Technical conditions and measures to control dispersion from source towards the worker			
Task	Level of separation	Type of ventilation	Efficiency of LC (according to MEASE)
Automated use of diamond tools with confined and/or extracted machines	Level of separation if required see frequency and duration of exposure section. Installation of ventilated (positive pressure) control rooms can also reduce exposure.	Integrated extraction/wet suppression	95 %
Manual tasks using diamond tools		Not required/wet suppression	Not applicable
Organisational measures to prevent/limit releases, dispersion and exposure			
Additional information See Section: 7, 8, 11 (SDS).			
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 and further personal protective equipment (PPE)
Automated use of diamond tools with confined and/or extracted machines	No measures required	Not applicable	Since cobalt has sensitising properties, the use of suitable chemical resistant gloves (EN 374) providing protection for the duration of activity (e.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm) is a prerequisite for all process steps in which direct contact to cobalt substances is possible. In cases where direct contact with cobalt cannot be avoided, a protective suit conforming to EN13982 should be worn. As a general requirement for the conducted processes: standard working clothes (long-sleeve overall) and safety shoes.
Manual tasks using diamond tools	Mask type: FFP3	APF=20	

2.2 Control of environmental exposure
Product characteristics
Cobalt can be in any form in an article.
Amounts used
Not applicable.
Frequency and duration of use/exposure
Continuous use/release: 365 days/year.
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 (Water/Sedimentation).
Other given operational conditions affecting environmental exposure
Indoor or outdoor use of products containing cobalt is possible. There are no intended Co releases due to wide dispersive use and the non-intended releases are negligible and pose no threat to the environment.
Conditions and measures related to municipal sewage treatment plant
Presence of municipal sewage treatment plant.
Conditions and measures related to external treatment of waste for disposal
Fraction of daily/annual use expected in waste: 60% of all articles, 40% is recycled. (EC, 2010) Appropriate waste codes: 20 01 34; 20 01 33; 20 01 40; 20 03 01; 20 03 07 Suitable Disposal: Waste from end-of-life articles can be disposed of as municipal waste, except when they are separately regulated, like electronic devices, batteries, vehicles, etc. Disposal of wastes is possible via incineration (Directive 2000/76/EC) or landfilling (BAT Reference Document 2006, Council Directive 1999/31/EC and Council Decision 19/12/2002).
Conditions and measures related to external recovery of waste
Shredders pre-treating metal wastes maximum release factors to air of 0.0015 after RMM and no releases to water and soil.
3. Exposure estimation and reference to its source
Occupational exposure
Cobalt: The risk characterisation ratio (RCR) is the quotient of the exposure estimate. The respective Derived No Effect Level (DNEL) has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL of: 40µg/m ³

Task	Method used for inhalation exposure assessment	Inhalation exposure estimate (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate (RCR)
Automated use of diamond tools with confined and/or extracted machines	MEASE (PROC 3)	30 µg/m ³ (0.75)		Since cobalt has sensitising properties, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.
Manual tasks using diamond tools	MEASE (PROC 24)	18 µg/m ³ (0.45)		
Environmental emissions				
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.				
4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES				
The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. For human health, 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.				

Annex 4

Discussion at IMO (CCC and E&T)

CCC 1/13 September 2014 (Final report)

“Transport of flammable, toxic powdered metals

6.25 The Sub-Committee considered document CCC 1/6/2 (France), providing information on the regulatory and technical difficulties faced in the transport (maritime and intermodal) of cobalt powder and informing that, in order to solve such difficulties, France, under provision 7.9.1.1 of the Code, had provisionally authorized the transport of cobalt powder through an exemption covering non-compliance with SP 915. The Sub-Committee noted that the document proposed three options in order to permanently solve the issue:

- 1 Modify SP 915 as follows:
"915 This entry shall not be used for wetted explosives or self-reactive substances.";
- 2 Ignore the newly demonstrated risks (toxicity by inhalation), and continue to transport cobalt powder under entry UN 3089; or
- 3 Refer the matter to the competent bodies under the aegis of the United Nations with a view to creating a new entry applicable to flammable, toxic powdered metals and identifying appropriate transport conditions.

6.26 Having considered the above document, the Sub-Committee referred it to E&T 23 for further consideration with regard to issues such as classification, packaging and SP 915 and agreed that the preferred long-term solution was for a dedicated UN number to be issued. The Sub-Committee encouraged interested Member States to submit proposals to the UN TDG Sub-Committee, requesting a dedicated UN number for cobalt powder.

E&T 23/WP.1 de May 2015 (Draft report)

“Transport of flammable, toxic powdered metals

3.29 The group considered documents CCC 1/6/2 (France) informing about some the regulatory and technical difficulties posed by the transport (maritime and intermodal) of cobalt powder. The group noted that, in order to solve such difficulties, France, under provision 7.9.1 .1 of the Code, has provisionally authorized the transport of cobalt powder through an exemption covering non-compliance with special provision 915.

3.30 In document E&T 23/INF.3, France proposed to create new entries for metal powders. France informed that an additional draft proposai in this regard will be submitted to the next session of the UN TDG Sub-Committee in view to amend in future the IMDG Code and other modal dangerous goods regulations.

3.31 Incidentally, the group noted that UN 3179 is the most appropriate entry for the shipment for cobalt powder until new entries are available and agreed to delete special provision 915.”