SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended by Commission Regulation (EU) 2020/878

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

1.1 Product identifier
Product Name: JM®-55II
Product Size: 1.6 mm (1/16")

Other means of identification
SDS number: 200000025800

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses: GMAW (Gas Metal Arc Welding)
Uses advised against: Not known. Read this SDS before using this product.

1.3 Details of the supplier of the safety data sheet
Manufacturer/Importer/Supplier/Distributor Information

Company Name:	LINCOLN ELECTRIC® (Tangshan) Welding Materials Co., Ltd
Address:	001, Riyuetan Road, Taiwan Industrial Zone, Luan County Tangshan, Hebei Province 063700 China
Telephone:	+86 315 5038 500
Contact Person:	SDS@lincolnelectric.com Safety Data Sheet Questions: www.lincolnelectric.com/sds Arc Welding Safety Information: www.lincolnelectric.com/safety

Company Name:	The Shanghai Lincoln Electric Co., Ltd.
Address:	No. 195, Lane 5008, Hu Tai Road Shanghai 201907 China
Telephone:	+86 21 6673 4530
Contact Person:	SDS@lincolnelectric.com Safety Data Sheet Questions: www.lincolnelectric.com/sds Arc Welding Safety Information: www.lincolnelectric.com/safety

Company Name:	Lincoln Electric Europe B.V.
Address:	Collse Heide 12 Nuenen 5674 VN The Netherlands
Telephone:	+31 243 522 911
Contact Person:	SDS@lincolnelectric.com Safety Data Sheet Questions: www.lincolnelectric.com/sds Arc Welding Safety Information: www.lincolnelectric.com/safety

1.4 Emergency telephone number:

USA/Canada/Mexico	+1 (888) 609-1762
Americas/Europe	+1 (216) 383-8962
Asia Pacific	+1 (216) 383-8966
Middle East/Africa	+1 (216) 383-8969

3E Company Access Code: 333988

BG (Bulgaria) България	+359 2 9154 233	IT (Italy) Italia	+39 055 794 7819
CH (Switzerland) Suisse, Schweiz, Svizzera	145	LV (Latvia) Latvija	+371 67042473
CZ (Czech Republic) Česká republika	+420 224 919 293	LT (Lithuania) Lietuva	+370 (5) 2362052
DE (Germany) Deutschland	+49 (0) 89 19240	NL (Netherlands) Holland	31(0)30 274 8888
DK (Denmark) Danmark	+45 8212 1212	NO (Norway) Norge	22 59 13 00
ES (Spain) España	+34 91 562 04 20	PL (Poland) Polska	+48 12 411 99 99
FI (Finland)	0800 147 111	PT (Portugal)	+351 800 250 250
FR (France)	+33 1 45 42 59 59	RO (Romania) România	+40 21 599 2300
GB (United Kingdom)	0344 892 0111	SE (Sweden) Sverige	112
GR (Greece) Ελλάδα	(0030) 2107793777	SI (Slovenia) Slovenija	112
HR (Croatia) Hrvatska	+3851 2348 342	SK (Slovakia) Slovensko	+421 2 5477 4166
HU (Hungary) Magyarország	+36-80-201-199	TR (Turkey) Türkiye	112

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

The product has not been classified as hazardous according to the legislation in force.

Classification according to Regulation (EC) No 1272/2008 as amended.

Not classified

2.2 Label Elements

Not applicable

Supplemental label information

EUH210: Safety data sheet available on request.

2.3 Other hazards

Electrical Shock can kill. If welding must be performed in damp locations or with wet clothing, on metal structures or when in cramped positions such as sitting, kneeling or lying, or if there is a high risk of unavoidable or accidental contact with work piece, use the following equipment: Semiautomatic DC Welder, DC Manual (Stick) Welder, or AC Welder with Reduced Voltage Control.

Arc rays can injure eyes and burn skin. Welding arc and sparks can ignite combustibles and flammable materials. Overexposure to welding fumes and gases can be hazardous. Read and understand the manufacturer's instructions, Safety Data Sheets and the precautionary labels before using this product. Refer to Section 8.

Substance(s) formed under the conditions of use: The welding fume produced from this welding electrode may contain the following constituent(s) and/or their complex metallic oxides as well as solid particles or other constituents from the consumables, base metal, or base metal coating not listed below. Fume from this product may contain low levels of copper, typically less than 1% by weight. Overexposure to copper may cause metal fume fever, as well as skin, eye and respiratory tract irritation.

Chemical name	CAS-No.
Carbon dioxide	124-38-9
Carbon monoxide	630-08-0
Nitrogen dioxide	10102-44-0
Ozone	10028-15-6
Manganese	7439-96-5
Nickel	7440-02-0

SECTION 3: Composition/information on ingredients

3.2 Mixtures

Chemical name	Concentration	CAS-No.	EC No.	Classification	Notes	REACH Registration No.
Iron	50 - <100%	7439-89-6	231-096-4	Not classified		01-2119462838-24;
Manganese	1 - <5%	7439-96-5	231-105-1	Not classified	#	01-2119449803-34;
Silicon	0,1 - <1%	7440-21-3	231-130-8	Not classified	#	01-2119480401-47;
Nickel	0,1 - <1%	7440-02-0	231-111-4	Carc.: 2: H351; STOT RE: 1: H372; Skin Sens.: 1: H317; Note 7, Note S	#	01-2119438727-29;
Copper and/or copper alloys and compounds (as Cu)	0,1 - <1%	7440-50-8	231-159-6	Aquatic Acute: 1: H400; Aquatic Chronic: 3: H412;	#	01-2119480154-42;
Chromium and chromium alloys or compounds (as Cr)	0,1 - <1%	7440-47-3	231-157-5	Not classified	#	01-2119485652-31;
Molybdenum	0,1 - <1%	7439-98-7	231-107-2	Not classified	#	01-2119472304-43;

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.
# This substance has workplace exposure limit(s).
This substance is listed as SVHC

The full text for all statements is displayed in section 16.

Composition Comments: The term “Hazardous Ingredients” should be interpreted as a term defined in Hazard Communication standards and does not necessarily imply the existence of a welding or allied process hazard. The product may contain additional non-hazardous ingredients or may form additional compounds under the condition of use. Refer to Sections 2 and 8 for more information.

SECTION 4: First aid measures

4.1 Description of first aid measures

Inhalation: Move to fresh air if breathing is difficult. If breathing has stopped, perform artificial respiration and obtain medical assistance at once.

Skin Contact: Remove contaminated clothing and wash the skin thoroughly with soap and water. For reddened or blistered skin, or thermal burns, obtain medical assistance at once.

Eye contact: Dust or fume from this product should be flushed from the eyes with copious amounts of clean, tepid water until transported to an emergency medical facility. Do not allow victim to rub or keep eyes tightly closed. Obtain medical assistance at once.

Arc rays can injure eyes. If exposed to arc rays, move victim to dark room, remove contact lenses as necessary for treatment, cover eyes with a padded dressing and rest. Obtain medical assistance if symptoms persist.

Ingestion: Avoid hand, clothing, food, and drink contact with fluxes, metal fume or powder which can cause ingestion of particulate during hand to mouth activities such as drinking, eating, smoking, etc. If ingested, do not induce vomiting. Contact a poison control center. Unless the poison control center advises otherwise, wash out mouth thoroughly with water. If symptoms develop, seek medical attention at once.

4.2 Most important symptoms and effects, both acute and delayed: Short-term (acute) overexposure to fumes and gases from welding and allied processes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to fumes and gases from welding and allied processes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects. Refer to Section 11 for more information.

4.3 Indication of any immediate medical attention and special treatment needed

Hazards: The hazards associated with welding and its allied processes such as soldering and brazing are complex and may include physical and health hazards such as but not limited to electric shock, physical strains, radiation burns (eye flash), thermal burns due to hot metal or spatter and potential health effects of overexposure to fumes, gases or dusts potentially generated during the use of this product. Refer to Section 11 for more information.

Treatment: Treat symptomatically.

SECTION 5: Firefighting measures

General Fire Hazards: As shipped, this product is nonflammable. However, welding arcs, sparks, open flames, and hot surfaces associated with welding, brazing, and soldering can ignite combustible and flammable materials. Implement fire protection measures according to the place of use risk assessment, local regulations, and all relevant safety standards. Read and understand the American National Standard Z49.1, "Safety in Welding, Cutting, and Allied Processes," and the National Fire Protection Association NFPA 51B, "Standard for Fire Prevention during Welding, Cutting, and Other Hot Work," before using this product.

5.1 Extinguishing media

Suitable extinguishing media:	As shipped, the product will not burn. In case of fire in the surroundings: use appropriate extinguishing agent.
Unsuitable extinguishing media:	Do not use water jet as an extinguisher, as this will spread the fire.
5.2 Special hazards arising from the substance or mixture:	Welding arc and sparks can ignite combustibles and flammable products.
5.3 Advice for firefighters	
Special fire-fighting procedures:	Use standard firefighting procedures and consider the hazards of other involved materials.
Special protective equipment for fire-fighters:	Selection of respiratory protection for fire fighting: follow the general fire precautions indicated in the workplace. Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:	If airborne dust and/or fume is present, use adequate engineering controls and, if needed, personal protection to prevent overexposure. Refer to recommendations in Section 8.
6.2 Environmental Precautions:	Avoid release to the environment. Prevent further leakage or spillage if safe to do so. Do not contaminate water sources or sewer. Environmental manager must be informed of all major spillages.
6.3 Methods and material for containment and cleaning up:	Absorb with sand or other inert absorbent. Stop the flow of material, if this is without risk. Clean up spills immediately, observing precautions in the personal protective equipment in Section 8. Avoid generating dust. Prevent product from entering any drains, sewers or water sources. Refer to Section 13 for proper disposal.
6.4 Reference to other sections:	For further specification, refer to section 8 of the SDS.

SECTION 7: Handling and storage:

7.1 Precautions for safe handling:	Prevent formation of dust. Provide appropriate exhaust ventilation at places where dust is formed. Read and understand the manufacturer's instruction and the precautionary label on the product. Refer to Lincoln Safety Publications at www.lincolnelectric.com/safety, ISO/TR 18786:2014, ISO/TR 13392:2014, American National Standard Z49.1, "Safety In Welding, Cutting and Allied Processes" published by the American Welding Society, http://pubs.aws.org and OSHA Publication 2206 (29CFR1910), U.S. Government Printing Office, www.gpo.gov.
7.2 Conditions for safe storage, including any incompatibilities:	Store in closed original container in a dry place. Store in accordance with local/regional/national regulations. Store away from incompatible materials.

7.3 Specific end use(s): No data available.

SECTION 8: Exposure controls/personal protection

8.1 Control Parameters

MAC, PEL, TLV and other exposure limit values may vary per element and form - as well as per country. All country-specific values are not listed. If no occupational exposure limit values are listed below, your local authority may still have applicable values. Refer to your local or national exposure limit values.

Occupational Exposure Limits: European Union

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Respirable fraction. - as Mn	TWA	0,05 mg/m3	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (02 2017) Indicative Indicative MANGANESE AND INORGANIC MANGANESE COMPOUNDS (AS MN) (RESPIRABLE FRACTION)
Manganese - Inhalable fraction. - as Mn	TWA	0,2 mg/m3	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (02 2017) Indicative Indicative MANGANESE AND INORGANIC MANGANESE COMPOUNDS (AS MN) (INHALABLE FRACTION)
Manganese - Respirable fraction.	TWA	0,050 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended (2014)
Manganese - Inhalable fraction.	TWA	0,200 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended (2014)
Nickel - Respirable fraction. - as Ni	TWA	0,005 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended (2014) NICKEL AND INORGANIC NICKEL COMPOUNDS (RESPIRABLE FRACTION) (AS NI)
Nickel - Respirable fraction.	TWA	0,005 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended (2014) NICKEL METAL (RESPIRABLE FRACTION)
Copper and/or copper alloys and compounds (as Cu) - Respirable fraction.	TWA	0,01 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended (2014)
Chromium and chromium alloys or compounds (as Cr)	TWA	2 mg/m3	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (12 2009) Indicative Indicative CHROMIUM METAL, INORGANIC CHROMIUM(II) COMPOUNDS AND INORGANIC CHROMIUM(III) COMPOUNDS (INSOLUBLE)
Chromium and chromium alloys or compounds (as Cr) - Total dust. - as Cr	TWA	2,0 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended (2014) CHROMIUM METAL, INORGANIC CHROMIUM (II) COMPOUNDS, AND INORGANIC CHROMIUM (III) COMPOUNDS (TOTAL DUST) (AS CR)

Occupational Exposure Limits: Austria

Chemical Identity	Type	Exposure Limit Values	Source
Silicon - Inhalable fraction.	MAK	10 mg/m3	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (09 2020)
Silicon - Respirable fraction.	MAK	5 mg/m3	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (09 2020)
	MAK STEL	10 mg/m3	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (09 2020)
Silicon - Inhalable fraction.	MAK STEL	20 mg/m3	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (09 2020)
Molybdenum - Inhalable fraction.	MAK STEL	20 mg/m3	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (09 2020)
Molybdenum - Inhalable fraction. - as Mo	MAK	10 mg/m3	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (09 2020)
Molybdenum - Respirable fraction.	MAK STEL	10 mg/m3	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (09 2020)

	MAK	5 mg/m3	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (09 2020)
Molybdenum - Inhalable fraction.	MAK	10 mg/m3	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (09 2020)
Molybdenum - Inhalable fraction. - as Mo	MAK STEL	20 mg/m3	Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001, as amended (09 2020)

Occupational Exposure Limits: Belgium

Chemical Identity	Type	Exposure Limit Values	Source
Silicon	TWA	10 mg/m3	Belgium. OELs. Exposure Limit Values to Chemical Substances at Work, Code of Well-being at work, Book VI, Title 1, as amended (06 2007)
Molybdenum - as Mo	TWA	10 mg/m3	Belgium. OELs. Exposure Limit Values to Chemical Substances at Work, Code of Well-being at work, Book VI, Title 1, as amended (06 2007)

Occupational Exposure Limits: Bulgaria

Chemical Identity	Type	Exposure Limit Values	Source
Molybdenum - as Mo	TWA	10,0 mg/m3	Bulgaria. OELs. Limit Values of Chemical Agents in Air at Work (Reg. No 13, Annex 1, D.V.8/2004), as amended (2004) Molybdenum and its compounds, as Mo
	TWA	5,0 mg/m3	Bulgaria. OELs. Limit Values of Chemical Agents in Air at Work (Reg. No 13, Annex 1, D.V.8/2004), as amended (2004) Molybdenem - soluble compounds, as Mo

Occupational Exposure Limits: Croatia

Chemical Identity	Type	Exposure Limit Values	Source
Silicon - Total dust.	GVI	10 mg/m3	Croatia. OELs (GVI). Regulation on Protection of Workers against Exposure to Dangerous Chemicals at Work, OELs and Biological Limit Values, Annex I (NN 91/2018), as amended (12 2023) Silicon [Total Dust]
Silicon - Respirable dust.	GVI	4 mg/m3	Croatia. OELs (GVI). Regulation on Protection of Workers against Exposure to Dangerous Chemicals at Work, OELs and Biological Limit Values, Annex I (NN 91/2018), as amended (12 2023) Silicon [Respirable Dust]

Occupational Exposure Limits: Czechia

Chemical Identity	Type	Exposure Limit Values	Source
Molybdenum	NPK-P	25 mg/m3	Czech Republic. OELs. Government Decree 361, as amended (12 2007) Molybdenum
	PEL	5 mg/m3	Czech Republic. OELs. Government Decree 361, as amended (12 2007) Molybdenum

Occupational Exposure Limits: Denmark

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Inhalable fume. - as Mn	GV	0,2 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (12 2019) Substance has an EU limit value.
Manganese - Respirable fume. - as Mn	GV	0,05 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (12 2019) Substance has an EU limit value.
Manganese - Dust. - as Mn	GV	0,2 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (12 2019) Substance has an EU limit value.
Manganese - Respirable.	GV	0,05 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for

			Substances & Materials - Order No. 507, WEA, as amended (12 2019) Substance has an EU limit value.
Manganese - Inhalable fume. - as Mn	STEL	0,4 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (06 2022) Substance has an EU limit value. Substance has an EU limit value. Manganese fumes, calculated as Mn, Inhalable
Manganese - Respirable fume. - as Mn	STEL	0,1 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (06 2022) Substance has an EU limit value. Substance has an EU limit value. Manganese fumes, calculated as Mn, Respirable
Silicon	GV	10 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (03 2008) silicon
	STEL	20 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (03 2024) silicon
Nickel - Dust. - as Ni	GV	0,05 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (03 2008)
	STEL	0,1 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (06 2022) Nickel, powder and dust, calculated as Ni
Copper and/or copper alloys and compounds (as Cu) - Dust.	GV	1,0 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (03 2008)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	GV	0,1 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (03 2008)
Copper and/or copper alloys and compounds (as Cu) - Dust.	STEL	2 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (06 2022) Copper, powder and dust
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	STEL	0,2 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (06 2022) Copper fumes, calculated as Cu
Chromium and chromium alloys or compounds (as Cr) - Dust. - as Cr	GV	0,5 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (12 2019) Substance has an EU limit value.
	STEL	1 mg/m3	Denmark. OELs. Annexes 2 & 3, Exposure Limits for Substances & Materials - Order No. 507, WEA, as amended (06 2022) Substance has an EU limit value. Substance has an EU limit value. Chromium, powder and soluble chromium and chromium salts, calculated as Cr

Occupational Exposure Limits: Estonia

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Fine dust, respiratory fraction - as Mn	TWA	0,05 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (04 2024) Manganese and inorganic manganese compounds (calculated as manganese), fine dust
Manganese - Total dust, respiratory fraction - as Mn	TWA	0,2 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (04 2024) Manganese and inorganic manganese compounds (calculated as manganese), total dust
Silicon - Respirable fraction.	TWA	10 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (10 2019) Silicon
Silicon - Fine dust, respiratory fraction	TWA	5 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (04 2024) Silicon, fine dust
Copper and/or copper alloys and compounds (as Cu) - Total dust. - as Cu	TWA	1 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (04 2024) Copper and inorganic compounds (calculated as copper), total dust
Copper and/or copper alloys and compounds (as Cu) - Fine dust. - as Cu	TWA	0,2 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (04 2024) Copper and inorganic compounds (calculated as copper), fine dust

Chromium and chromium alloys or compounds (as Cr) - as Cr	TWA	2 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (04 2024) Chromium, metal and its inorganic compounds, except chromic acid and chromates (calculated as chromium)
Molybdenum - Total dust.	TWA	10 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (03 2022) Dust, inorganic
Molybdenum - Fine dust, respiratory fraction	TWA	5 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (04 2024) Molybdenum, metal and sparingly soluble compounds, fine dust (respirable fraction)
	TWA	5 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (04 2024) Dust, inorganic, fine dust
Molybdenum - Total dust, respiratory fraction	TWA	10 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended (04 2024) Molybdenum, metal and sparingly soluble compounds, total dust (respirable fraction)

Occupational Exposure Limits: Finland

Chemical Identity	Type	Exposure Limit Values	Source
Nickel - Respirable fraction. - as Ni	HTP 8H	0,05 mg/m3	Finland. Regulation on Carcinogenic, Mutagenic and Toxic to Reproduction Substances at Work (113/2024) (03 2024)
Nickel - Alveolar fraction - as Ni	HTP 8H	0,01 mg/m3	Finland. Regulation on Carcinogenic, Mutagenic and Toxic to Reproduction Substances at Work (113/2024) (03 2024)
Molybdenum - as Mo	HTP 8H	0,5 mg/m3	Finland. Workplace Exposure Limits, as amended (10 2021) Molybdenum and its soluble compounds (as Mo)

Occupational Exposure Limits: France

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Inhalable fraction. - as Mn	VME	0,20 mg/m3	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (01 2022) Regulatory indicative (VRI)
Manganese - Respirable fraction. - as Mn	VME	0,05 mg/m3	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (01 2022) Regulatory indicative (VRI)
Silicon - Total dust.	TWA	4 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective Date: 01 July 2023 Effective Date: 01 July 2023 Dust known to have no specific effect
Silicon - Alveolar dust.	TWA	0,9 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective Date: 01 July 2023 Effective Date: 01 July 2023 Dust known to have no specific effect
	TWA	5 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective date: 01 May 2008 Effective date: 01 May 2008 Dust known to have no specific effect
Silicon - Total dust.	TWA	7 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective date: 01 Jan 2022 Effective date: 01 Jan 2022 Dust known to have no specific effect
Silicon - Alveolar dust.	TWA	3,5 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective date: 01 Jan 2022 Effective date: 01 Jan 2022 Dust known to have no specific effect
Silicon - Total dust.	TWA	10 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective date: 01 May 2008 Effective date: 01 May 2008 Dust known to have no specific effect
Silicon	VME	10 mg/m3	France. OELs. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France according to INRS, ED 984, as amended (04 2024) Silicon

Nickel	VME	1 mg/m3	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (01 2008) Indicative limit (VL)
	VME	1 mg/m3	France. OELs. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France according to INRS, ED 984, as amended (04 2024)
Copper and/or copper alloys and compounds (as Cu) - Dust. - as Cu	VME	1 mg/m3	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (01 2008) Indicative limit (VL)
Copper and/or copper alloys and compounds (as Cu) - Fume.	VME	0,2 mg/m3	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (01 2008) Indicative limit (VL)
Copper and/or copper alloys and compounds (as Cu) - Dust. - as Cu	VLE	2 mg/m3	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (03 2020) Indicative limit (VL)
Copper and/or copper alloys and compounds (as Cu) - Fume.	VME	0,2 mg/m3	France. OELs. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France according to INRS, ED 984, as amended (04 2024) Copper (fumes)
Copper and/or copper alloys and compounds (as Cu) - Dust. - as Cu	VME	1 mg/m3	France. OELs. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France according to INRS, ED 984, as amended (04 2024) Copper (dust), Cu
	VLE	2 mg/m3	France. OELs. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France according to INRS, ED 984, as amended (04 2024) Copper (dust), Cu
Chromium and chromium alloys or compounds (as Cr)	VME	2 mg/m3	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (01 2022) Regulatory indicative (VRI)
Molybdenum - Alveolar dust.	TWA	3,5 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective date: 01 Jan 2022 Effective date: 01 Jan 2022 Dust known to have no specific effect
	TWA	5 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective date: 01 May 2008 Effective date: 01 May 2008 Dust known to have no specific effect
Molybdenum - Total dust.	TWA	7 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective date: 01 Jan 2022 Effective date: 01 Jan 2022 Dust known to have no specific effect
	TWA	10 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective date: 01 May 2008 Effective date: 01 May 2008 Dust known to have no specific effect
	TWA	4 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective Date: 01 July 2023 Effective Date: 01 July 2023 Dust known to have no specific effect
Molybdenum - Alveolar dust.	TWA	0,9 mg/m3	France. Dust OELs in premises with specific pollution, Art. R. 4222-10 of Labor Code, as amended (12 2021) Effective Date: 01 July 2023 Effective Date: 01 July 2023 Dust known to have no specific effect

Occupational Exposure Limits: Germany

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Inhalable fraction.	MAK	0,2 mg/m3	Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG), as amended (2013) Listed Listed MANGANESE AND ITS INORGANIC COMPOUNDS (INHALABLE FRACTION)
Manganese - Respirable fraction.	MAK	0,02 mg/m3	Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG), as amended (2013) Listed Listed MANGANESE AND ITS INORGANIC COMPOUNDS (RESPIRABLE FRACTION)
Manganese - Inhalable fraction. - as Mn	AGW	0,2 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (11 2015) If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).

Manganese - Respirable fraction. - as Mn	AGW	0,02 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (11 2015) If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).
Silicon - Inhalable dust.	MAK	4 mg/m3	Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG), as amended (2020) Listed Listed Dust, general threshold limit value (inhalable fraction)
Silicon - Respirable dust.	AGW	1,25 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (06 2023) If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).
Silicon - Inhalable dust.	AGW	10 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (06 2023) If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).
Nickel - Inhalable fraction. - as Ni	AGW	0,030 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (06 2018) If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).
Nickel - Respirable fraction.	AGW	0,006 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (10 2017) If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).
Copper and/or copper alloys and compounds (as Cu) - Respirable fraction.	MAK	0,01 mg/m3	Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG), as amended (2013) Listed Listed COPPER AND ITS INORGANIC COMPOUNDS (RESPIRABLE FRACTION)
Chromium and chromium alloys or compounds (as Cr) - Inhalable fraction. - as Cr	AGW	2 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (06 2018)
Molybdenum - Inhalable dust.	MAK	4 mg/m3	Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG), as amended (2021) Listed Listed Dust, general threshold limit value (inhalable fraction)
	AGW	10 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (06 2023) If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).
Molybdenum - Respirable dust.	AGW	1,25 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (06 2023) If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).

Occupational Exposure Limits: Greece

Chemical Identity	Type	Exposure Limit Values	Source
Silicon - Inhalable	TWA	10 mg/m3	Greece. OELs, Presidential Decree No. 307/1986, as amended (09 2001) Silicon (inhalable)
Silicon - Respirable.	TWA	5 mg/m3	Greece. OELs, Presidential Decree No. 307/1986, as amended (09 2001) Silicon (respirable)

Occupational Exposure Limits: Italy

Chemical Identity	Type	Exposure Limit Values	Source
Silicon - Respirable particles.	TWA	3 mg/m3	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended (05 2020) Source of Limit value: ACGIH Source of Limit value: ACGIH Particles (insoluble or poorly soluble) not otherwise specified, respirable particles
Silicon - Inhalable particles.	TWA	10 mg/m3	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended (05 2020) Source of Limit value: ACGIH Source of Limit value: ACGIH Particles (insoluble or poorly soluble) not otherwise specified, inhalable particles
Molybdenum - Inhalable fraction. - as Mo	TWA	10 mg/m3	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended (08 2012) Source of Limit value: ACGIH Source of Limit value: ACGIH Molybdenum, metal and

			insoluble compounds, as Mo, inhalable fraction
Molybdenum - Respirable fraction. - as Mo	TWA	3 mg/m3	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended (08 2012) Source of Limit value: ACGIH Source of Limit value: ACGIH Molybdenum, metal and insoluble compounds, as Mo, respirable fraction
Molybdenum - Inhalable particles.	TWA	10 mg/m3	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended (05 2020) Source of Limit value: ACGIH Source of Limit value: ACGIH Particles (insoluble or poorly soluble) not otherwise specified, inhalable particles
Molybdenum - Respirable particles.	TWA	3 mg/m3	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended (05 2020) Source of Limit value: ACGIH Source of Limit value: ACGIH Particles (insoluble or poorly soluble) not otherwise specified, respirable particles

Occupational Exposure Limits: Latvia

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Respirable fraction. - Manganese	TWA	0,05 mg/m3	Latvia. OELs. Occupational exposure limit values of chemical substances in work environment, as amended (04 2024) Manganese and its inorganic compounds, respirable fraction (as Mn)
Manganese - Inhalable fraction. - Manganese	TWA	0,2 mg/m3	Latvia. OELs. Occupational exposure limit values of chemical substances in work environment, as amended (04 2024) Manganese and its inorganic compounds, Inhalable fraction (as Mn)
Manganese - Condensation aerosol	TWA	0,1 mg/m3	Latvia. OELs. Occupational exposure limit values of chemical substances in work environment, as amended (04 2024) Manganese and its inorganic compounds, condensation aerosol (as Mn)

Occupational Exposure Limits: Lithuania

Chemical Identity	Type	Exposure Limit Values	Source
Silicon - Respirable fraction.	IPRV	5 mg/m3	Lithuania. OELs. Occupational Exposure Limit Values for Chemical Substances (Hygiene Norm HN 23:2011; Order No. V-824/A1-389, Annex 1, tbl. 1), as amended (10 2019) Dust: respirable fraction
Silicon - Inhalable fraction.	IPRV	10 mg/m3	Lithuania. OELs. Occupational Exposure Limit Values for Chemical Substances (Hygiene Norm HN 23:2011; Order No. V-824/A1-389, Annex 1, tbl. 1), as amended (10 2019) Dust: inhalable fraction
Molybdenum - Inhalable fraction.	IPRV	10 mg/m3	Lithuania. OELs. Occupational Exposure Limit Values for Chemical Substances (Hygiene Norm HN 23:2011; Order No. V-824/A1-389, Annex 1, tbl. 1), as amended (07 2022) Dust: inhalable fraction
Molybdenum - Respirable fraction.	IPRV	5 mg/m3	Lithuania. OELs. Occupational Exposure Limit Values for Chemical Substances (Hygiene Norm HN 23:2011; Order No. V-824/A1-389, Annex 1, tbl. 1), as amended (07 2022) Dust: respirable fraction

Occupational Exposure Limits: The Netherlands

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Respirable fraction. - as Mn	TGG 15	0,05 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended (06 2020) MANGANESE AND INORGANIC MANGANESE COMPOUNDS (AS MANGANESE) (RESPIRABLE)
Manganese - Inhalable fraction. - as Mn	TGG	0,2 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended (06 2020) Manganese and inorganic manganese compounds
Manganese - Inhalable - as Mn	TGG	0,2 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended (05 2024) Manganese and inorganic manganese compounds
Manganese - Respirable. - as	TGG	0,05 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working

Mn			Conditions Regulation, as amended (05 2024) Manganese and inorganic manganese compounds
Copper and/or copper alloys and compounds (as Cu) - Inhalable fraction.	TGG	0,1 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended (02 2016) COPPER AND INORGANIC COPPER COMPOUNDS (INHALABLE)
Copper and/or copper alloys and compounds (as Cu) - Inhalable	TGG	0,1 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended (05 2024) Copper and inorganic copper compounds
Chromium and chromium alloys or compounds (as Cr)	TGG	0,5 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended (04 2010)

Occupational Exposure Limits: Norway

Chemical Identity	Type	Exposure Limit Values	Source
Silicon	NORMEN	10 mg/m3	Norway. Occupational Limit Values: Annex 1, Regulation No. 1358 (Forskrift om tiltaks- og grenseverdier), as amended (12 2022) Silicon
Nickel - Respirable. - as Ni	NORMEN	0,01 mg/m3	Norway. Occupational Limit Values: Annex 1, Regulation No. 1358 (Forskrift om tiltaks- og grenseverdier), as amended (04 2024) The EU has set a binding limit for the substance. The EU has set a binding limit for the substance. Nickel and its compounds (calculated as Ni)
Nickel - Inhalable - as Ni	NORMEN	0,05 mg/m3	Norway. Occupational Limit Values: Annex 1, Regulation No. 1358 (Forskrift om tiltaks- og grenseverdier), as amended (04 2024) The EU has set a binding limit for the substance. The EU has set a binding limit for the substance. Nickel and its compounds (calculated as Ni)
Molybdenum - as Mo	NORMEN	10 mg/m3	Norway. Occupational Limit Values: Annex 1, Regulation No. 1358 (Forskrift om tiltaks- og grenseverdier), as amended (12 2022) Molybdenum, insoluble compounds

Occupational Exposure Limits: Poland

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - as Mn	NDS	0,3 mg/m3	Poland. Maximum permissible concentrations and intensities of harmful factors in the work environment (Dz.U.Poz. 1286/2018, Annex 1), as amended (07 2010) Manganese and inorganic compounds, as Mn
Nickel - as Ni	NDS	0,25 mg/m3	Poland. Maximum permissible concentrations and intensities of harmful factors in the work environment (Dz.U.Poz. 1286/2018, Annex 1), as amended (07 2010) Nickel and compounds, except tetracarbonyl nickel (nickel carbonyl), as Ni
Copper and/or copper alloys and compounds (as Cu) - as Cu	NDS	0,2 mg/m3	Poland. Maximum permissible concentrations and intensities of harmful factors in the work environment (Dz.U.Poz. 1286/2018, Annex 1), as amended (06 2014) Copper and its inorganic compounds, as Cu
Chromium and chromium alloys or compounds (as Cr)	NDS	0,5 mg/m3	Poland. Maximum permissible concentrations and intensities of harmful factors in the work environment (Dz.U.Poz. 1286/2018, Annex 1), as amended (07 2010) Chromium metal
Molybdenum - as Mo	NDS	4 mg/m3	Poland. Maximum permissible concentrations and intensities of harmful factors in the work environment (Dz.U.Poz. 1286/2018, Annex 1), as amended (09 2007) Molybdenum and compounds, as Mo
	NDSCh	10 mg/m3	Poland. Maximum permissible concentrations and intensities of harmful factors in the work environment (Dz.U.Poz. 1286/2018, Annex 1), as amended (09 2007) Molybdenum and compounds, as Mo

Occupational Exposure Limits: Portugal

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Respirable	TWA	0,02 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical

fraction. - as Mn			agents (NP 1796), as amended (11 2014)
Manganese - Inhalable fraction. - as Mn	TWA	0,1 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended (11 2014)
Manganese - Inhalable fraction. - Manganese	TWA	0,2 mg/m3	Portugal. OELs. Decree-Law No. 24/2012, as amended (06 2018)
Manganese - Respirable fraction. - Manganese	TWA	0,05 mg/m3	Portugal. OELs. Decree-Law No. 24/2012, as amended (01 2021) Manganese and inorganic manganese compounds
Manganese - Inhalable fraction. - Manganese	TWA	0,2 mg/m3	Portugal. OELs. Decree-Law No. 24/2012, as amended (01 2021) Manganese and inorganic manganese compounds
Nickel - Inhalable fraction. - as Ni	TWA	1,5 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended (2004)
Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu	TWA	1 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended (2004)
Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu	TWA	0,2 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended (11 2014)
Chromium and chromium alloys or compounds (as Cr) - as Cr	TWA	0,5 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended (2004)
Chromium and chromium alloys or compounds (as Cr)	TWA	2 mg/m3	Portugal. OELs. Decree-Law No. 24/2012, as amended (01 2021) Chromium Metal, Chromium (II) and (III) inorganic insoluble compounds
Molybdenum - Inhalable fraction. - as Mo	TWA	10 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended (2004)
Molybdenum - Respirable fraction. - as Mo	TWA	3 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended (2004)

Occupational Exposure Limits: Slovakia

Chemical Identity	Type	Exposure Limit Values	Source
Iron	TWA	6 mg/m3	Slovakia. OELs. Maximum permissible exposure limits for chemical factors in workplace air (Regulation No 355/2006, Annex 1, Tables 1-7), as amended (09 2020) Maximum exposure limits for stable aerosols; Table 5. Stable aerosols with mostly irritant effects. Maximum exposure limits for stable aerosols; Table 5. Stable aerosols with mostly irritant effects. Iron and iron alloys
Silicon - Respirable fraction.	TWA	4 mg/m3	Slovakia. OELs. Maximum permissible exposure limits for chemical factors in workplace air (Regulation No 355/2006, Annex 1, Tables 1-7), as amended (12 2011) Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1. Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1. Silicon, respirable fraction
Silicon - Inhalable fraction.	TWA	10 mg/m3	Slovakia. OELs. Maximum permissible exposure limits for chemical factors in workplace air (Regulation No 355/2006, Annex 1, Tables 1-7), as amended (12 2011) Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1. Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1. Silicon, inhalable fraction
Molybdenum - Inhalable fraction. - as Mo	TWA	10 mg/m3	Slovakia. OELs. Maximum permissible exposure limits for chemical factors in workplace air (Regulation No 355/2006, Annex 1, Tables 1-7), as amended (12 2011) Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1. Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1. Molybdenum and its insoluble compounds (as Mo), inhalable fraction
Molybdenum - Respirable fraction. - as Mo	TWA	5 mg/m3	Slovakia. OELs. Maximum permissible exposure limits for chemical factors in workplace air (Regulation No 355/2006, Annex 1, Tables 1-7), as amended (12 2011) Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1. Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1. Molybdenum and its insoluble compounds (as Mo), respirable fraction

Molybdenum - as Mo	TWA	5 mg/m3	Slovakia. OELs. Maximum permissible exposure limits for chemical factors in workplace air (Regulation No 355/2006, Annex 1, Tables 1-7), as amended (12 2011) Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1. Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1. Molybdenum and its soluble compounds (as Mo)

Occupational Exposure Limits: Slovenia

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Inhalable fraction. - as Mg	KTV	1,6 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (04 2024) Manganese and inorganic compounds (calculated as Mg) [inhalable fraction]
Manganese - Respirable fraction. - as Mg	TWA	0,05 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (04 2024) If in compliance with the OEL and BEL values, then there should be no risk of reproductive damage. If in compliance with the OEL and BEL values, then there should be no risk of reproductive damage. Manganese and inorganic compounds (calculated as Mg) [respirable fraction]
	KTV	0,4 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (04 2024) Manganese and inorganic compounds (calculated as Mg) [respirable fraction]
Manganese - Inhalable fraction. - as Mg	TWA	0,2 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (04 2024) If in compliance with the OEL and BEL values, then there should be no risk of reproductive damage. If in compliance with the OEL and BEL values, then there should be no risk of reproductive damage. Manganese and inorganic compounds (calculated as Mg) [inhalable fraction]
Silicon - Respirable fraction.	KTV	2,5 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (12 2019) Dust [respirable fraction]
Silicon - Inhalable fraction.	TWA	10 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (12 2019) Dust [inhalable fraction]
Silicon - Respirable fraction.	TWA	1,25 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (12 2019) Dust [respirable fraction]
Silicon - Inhalable fraction.	KTV	20 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (12 2019) Dust [inhalable fraction]
Nickel - Inhalable fraction. - as Ni	MV	0,1 mg/m3	Slovenia. Occupational Exposure Limit Values for Carcinogens, Mutagens and Reprotoxic Substances (Reg. on Protection from Exposure to CMR Substances, 29/2024, Annex III, Table 3.1), as amended (04 2024) Nickel compounds
Nickel - Alveolar fraction - as Ni	MV	0,01 mg/m3	Slovenia. Occupational Exposure Limit Values for Carcinogens, Mutagens and Reprotoxic Substances (Reg. on Protection from Exposure to CMR Substances, 29/2024, Annex III, Table 3.1), as amended (04 2024) Nickel compounds
Nickel - Inhalable fraction. - as Ni	MV	0,05 mg/m3	Slovenia. Occupational Exposure Limit Values for Carcinogens, Mutagens and Reprotoxic Substances (Reg. on Protection from Exposure to CMR Substances, 29/2024, Annex III, Table 3.1), as amended (04 2024) Nickel compounds
Chromium and chromium	KTV	2 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals

alloys or compounds (as Cr) - Inhalable fraction.			at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (04 2024) Chromium-metal, inorganic chrome (II) compounds, and inorganic chrome (III) compounds, (insoluble) [inhalable fraction]
	TWA	2 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (04 2024) Chromium-metal, inorganic chrome (II) compounds, and inorganic chrome (III) compounds, (insoluble) [inhalable fraction]
Molybdenum - Inhalable fraction.	TWA	10 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (12 2019) Dust [inhalable fraction]
Molybdenum - Respirable fraction.	TWA	1,25 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (12 2019) Dust [respirable fraction]
	KTV	2,5 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (12 2019) Dust [respirable fraction]
Molybdenum - Inhalable fraction.	KTV	20 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (12 2019) Dust [inhalable fraction]

Occupational Exposure Limits: Spain

Chemical Identity	Type	Exposure Limit Values	Source
Silicon - Respirable fraction.	VLA-ED	3 mg/m3	Spain. Occupational Exposure Limits, as amended (2023) This value is for the particulated matter that is free from asbestos and crystalline silica. This value is for the particulated matter that is free from asbestos and crystalline silica. Particles (insoluble or poorly soluble) not otherwise specified, respirable fraction
Silicon - Inhalable fraction.	VLA-ED	10 mg/m3	Spain. Occupational Exposure Limits, as amended (2023) This value is for the particulated matter that is free from asbestos and crystalline silica. This value is for the particulated matter that is free from asbestos and crystalline silica. Particles (insoluble or poorly soluble) not otherwise specified, inhalable fraction
Molybdenum - Respirable fraction.	VLA-ED	3 mg/m3	Spain. Occupational Exposure Limits, as amended (2017)
Molybdenum - Inhalable fraction.	VLA-ED	10 mg/m3	Spain. Occupational Exposure Limits, as amended (2017)

Occupational Exposure Limits: Sweden

Chemical Identity	Type	Exposure Limit Values	Source
Silicon - Inhalable dust.	NGV	5 mg/m3	Sweden. Occupational Exposure Limit Values, as amended (11 2022) Dust, inorganic, inhalable dust
Silicon - Respirable dust.	NGV	2,5 mg/m3	Sweden. Occupational Exposure Limit Values, as amended (11 2022) Dust, inorganic, respirable dust
Molybdenum - Respirable dust. - as Mo	NGV	5 mg/m3	Sweden. Occupational Exposure Limit Values, as amended (11 2022)
Molybdenum - Total dust. - as Mo	NGV	10 mg/m3	Sweden. Occupational Exposure Limit Values, as amended (11 2022)

Occupational Exposure Limits: Switzerland

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Inhalable fraction.	TWA	0,5 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (01 2018) Provisional value. Provisional value. MANGANESE

			AND ITS INORGANIC COMPOUNDS, INHALABLE FRACTION
Silicon - Respirable fraction.	TWA	3 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (08 2023) Silicon, respirable fraction
Nickel - Inhalable fraction.	TWA	0,5 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (01 2018) NICKEL (METAL), INHALABLE FRACTION
Copper and/or copper alloys and compounds (as Cu) - Inhalable fraction.	STEL	0,2 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (01 2018) COPPER AND ITS INORGANIC COMPOUNDS, INHALABLE FRACTION
	TWA	0,1 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (01 2018) COPPER AND ITS INORGANIC COMPOUNDS, INHALABLE FRACTION
Chromium and chromium alloys or compounds (as Cr) - Inhalable fraction.	TWA	0,5 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (01 2018) CHROME (METAL), INHALABLE FRACTION
Molybdenum - Inhalable fraction.	TWA	10 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (01 2018) MOLYBDENUM AND ITS INSOLUBLE COMPOUNDS, INHALABLE FRACTION
Molybdenum - Respirable dust.	TWA	3 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (08 2023) Dust, granular, bio-reistant, respirable fraction
Molybdenum - Inhalable dust.	TWA	10 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (08 2023) Dust, inhalable fraction
Molybdenum - Inhalable fraction.	TWA	10 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (08 2023) Molybdenum and its insoluble compounds, inhalable fraction

Occupational Exposure Limits: Türkiye

Chemical Identity	Type	Exposure Limit Values	Source
Silicon - Respirable dust.	TWA	5 mg/m3	Turkiye. Workplace Dust Exposure Limit Values (Annex 1), Regulation on Dust Control, No. 28812, as amended (11 2013) Silicon (Respirable)
Silicon - Total dust.	TWA	15 mg/m3	Turkiye. Workplace Dust Exposure Limit Values (Annex 1), Regulation on Dust Control, No. 28812, as amended (11 2013) Silicon (Total Dust)
Chromium and chromium alloys or compounds (as Cr)	TWA	2 mg/m3	Turkiye. OELs. Regulation on Health and Safety Measures while Working with Chemical Substances, Annex I, Occupational Exposure Limit Values, RG No. 28733, as amended (08 2013) CHROMIUM METAL, INORGANIC CHROMIUM (II) COMPOUNDS AND INORGANIC CHROMIUM (III) COMPOUNDS (INSOLUBLE)
Molybdenum - Respirable dust.	TWA	15 mg/m3	Turkiye. Workplace Dust Exposure Limit Values (Annex 1), Regulation on Dust Control, No. 28812, as amended (11 2013) Molybdenum (Respirable)

If member state not listed, refer to the European Union value.

Biological Limit Values

European Union biological limit value is not available.

Additional exposure limits under the conditions of use

Additional exposure limits under the conditions of use: European Union

Chemical Identity	Type	Exposure Limit Values	Source
Carbon dioxide	TWA	5.000 ppm	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (Indicative)
Carbon monoxide	STEL	100 ppm	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (Indicative)
	TWA	20 ppm	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (Indicative)

	STEL	100 ppm	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended
	TWA	20 ppm	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended
	TWA	20 ppm	EU. OELs, Directive 2004/37/EC on carcinogen and mutagens from Annex III, Part A
	STEL	100 ppm	EU. OELs, Directive 2004/37/EC on carcinogen and mutagens from Annex III, Part A
	STEL	117 mg/m3	EU. OELs, Directive 2004/37/EC on carcinogen and mutagens from Annex III, Part A
Nitrogen dioxide	TWA	0,5 ppm	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (Indicative)
	STEL	1 ppm	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (Indicative)
	STEL	1 ppm	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended
	TWA	0,5 ppm	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended
Manganese - Respirable fraction. - as Mn	TWA	0,05 mg/m3	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (Indicative)
Manganese - Inhalable fraction. - as Mn	TWA	0,2 mg/m3	EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU (Indicative)
Manganese - Respirable fraction.	TWA	0,050 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended
Manganese - Inhalable fraction.	TWA	0,200 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended
Nickel - Respirable fraction. - as Ni	TWA	0,005 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended
Nickel - Respirable fraction.	TWA	0,005 mg/m3	EU. Scientific Committee on Occupational Exposure Limit Values (SCOELs), European Commission - SCOEL, as amended

Additional exposure limits under the conditions of use: Bulgaria

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	STEL	100 ppm	Bulgaria. Occupational Exposure Limit Values of Carcinogens, Mutagens and Toxic for Reproduction Substances at Work (Reg. No 10, Annex 1, D.V.94/2003), as amended
	TWA	20 ppm	Bulgaria. Occupational Exposure Limit Values of Carcinogens, Mutagens and Toxic for Reproduction Substances at Work (Reg. No 10, Annex 1, D.V.94/2003), as amended

Additional exposure limits under the conditions of use: Estonia

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	TWA	20 ppm	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended
	STEL	100 ppm	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended
Nitrogen dioxide	STEL	5 ppm	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended
	TWA	2 ppm	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended
Manganese - Fine dust,	TWA	0,05 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous

respiratory fraction - as Mn			Substances (Regulation No. 105/2001, Annex), as amended
Manganese - Total dust, respiratory fraction - as Mn	TWA	0,2 mg/m3	Estonia. OELs. Occupational Exposure Limits of Hazardous Substances (Regulation No. 105/2001, Annex), as amended

Additional exposure limits under the conditions of use: Finland

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	HTP 15MIN	100 ppm	Finland. Regulation on Carcinogenic, Mutagenic and Toxic to Reproduction Substances at Work (113/2024)
	HTP 8H	20 ppm	Finland. Regulation on Carcinogenic, Mutagenic and Toxic to Reproduction Substances at Work (113/2024)
Nickel - Respirable fraction. - as Ni	HTP 8H	0,05 mg/m3	Finland. Regulation on Carcinogenic, Mutagenic and Toxic to Reproduction Substances at Work (113/2024)
Nickel - Alveolar fraction - as Ni	HTP 8H	0,01 mg/m3	Finland. Regulation on Carcinogenic, Mutagenic and Toxic to Reproduction Substances at Work (113/2024)

Additional exposure limits under the conditions of use: France

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	VLE	100 ppm	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (Regulatory binding (VRC))
	VME	20 ppm	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (Regulatory binding (VRC))
Nitrogen dioxide	VME	0,5 ppm	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (Regulatory binding (VRC))
	VLE	1 ppm	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (Regulatory binding (VRC))
	VME	0,5 ppm	France. OELs. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France according to INRS, ED 984, as amended (Binding regulatory limit values (article R. 4412-149 of the Labor Code))
	VLE	1 ppm	France. OELs. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France according to INRS, ED 984, as amended (Binding regulatory limit values (article R. 4412-149 of the Labor Code))
Ozone	VLE	0,2 ppm	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (Indicative limit (VL))
	VME	0,1 ppm	France. OELs. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France according to INRS, ED 984, as amended
	VLE	0,2 ppm	France. OELs. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France according to INRS, ED 984, as amended
Manganese - Inhalable fraction. - as Mn	VME	0,20 mg/m3	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (Regulatory indicative (VRI))
Manganese - Respirable fraction. - as Mn	VME	0,05 mg/m3	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (Regulatory indicative (VRI))
Nickel	VME	1 mg/m3	France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984, as amended (Indicative limit (VL))
	VME	1 mg/m3	France. OELs. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France according to INRS, ED 984, as amended

Additional exposure limits under the conditions of use: Germany

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	AGW	20 ppm	Germany. TRGS 900, Occupational Exposure Limits (AGW),

			as amended (Even if the AGW and BGW values are complied with, there still may be a risk of reproductive damage (see Number 2.7).)
Nitrogen dioxide	AGW	0,5 ppm	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended
Manganese - Inhalable fraction.	MAK	0,2 mg/m3	Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG), as amended (Listed)
Manganese - Respirable fraction.	MAK	0,02 mg/m3	Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG), as amended (Listed)
Manganese - Inhalable fraction. - as Mn	AGW	0,2 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).)
Manganese - Respirable fraction. - as Mn	AGW	0,02 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).)
Nickel - Inhalable fraction. - as Ni	AGW	0,030 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).)
Nickel - Respirable fraction.	AGW	0,006 mg/m3	Germany. TRGS 900, Occupational Exposure Limits (AGW), as amended (If the AGW and BGW values are complied with, there should be no risk of reproductive damage (see Number 2.7).)

Additional exposure limits under the conditions of use: Italy

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	TWA	20 ppm	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended
	STEL	100 ppm	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended
	TWA	20 ppm	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended
	STEL	100 ppm	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended
Nitrogen dioxide	STEL	1 ppm	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended
	TWA	0,5 ppm	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended
	TWA	0,5 ppm	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended
	STEL	1 ppm	Italy. Occupational Exposure Limits, (OELs), Legislative Decree n.81, as amended

Additional exposure limits under the conditions of use: Latvia

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - Respirable fraction. - Manganese	TWA	0,05 mg/m3	Latvia. OELs. Occupational exposure limit values of chemical substances in work environment, as amended
Manganese - Inhalable fraction. - Manganese	TWA	0,2 mg/m3	Latvia. OELs. Occupational exposure limit values of chemical substances in work environment, as amended
Manganese - Condensation aerosol	TWA	0,1 mg/m3	Latvia. OELs. Occupational exposure limit values of chemical substances in work environment, as amended

Additional exposure limits under the conditions of use: Lithuania

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	IPRV	20 ppm	Lithuania. OELs. Occupational Exposure Limit Values for Chemical Substances (Hygiene Norm HN 23:2011; Order No. V-824/A1-389, Annex 1, tbl. 1), as amended (Expiration date: 20 Feb 2023)

Nitrogen dioxide	IPRV	1 ppm	Lithuania. OELs. Occupational Exposure Limit Values for Chemical Substances (Hygiene Norm HN 23:2011; Order No. V-824/A1-389, Annex 1, tbl. 1), as amended (Expiration date: 20 Feb 2023)

Additional exposure limits under the conditions of use: The Netherlands

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	TGG 15	100 ppm	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended
	TGG	20 ppm	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended
Nitrogen dioxide	TGG	0,96 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended
	TGG 15	1,91 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended
Manganese - Respirable fraction. - as Mn	TGG 15	0,05 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended
Manganese - Inhalable fraction. - as Mn	TGG	0,2 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended
Manganese - Inhalable - as Mn	TGG	0,2 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended
Manganese - Respirable. - as Mn	TGG	0,05 mg/m3	Netherlands. OELs (binding) per Annex XIII of Working Conditions Regulation, as amended

Additional exposure limits under the conditions of use: Norway

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	NORMEN	25 ppm	Norway. Occupational Limit Values: Annex 1, Regulation No. 1358 (Forskrift om tiltaks- og grenseverdier), as amended (The EU has an indicative threshold for the substance.)
	STEL	100 ppm	Norway. Occupational Limit Values: Annex 1, Regulation No. 1358 (Forskrift om tiltaks- og grenseverdier), as amended (The EU has an indicative threshold for the substance.)
Nitrogen dioxide	NORMEN	0,6 ppm	Norway. Occupational Limit Values: Annex 1, Regulation No. 1358 (Forskrift om tiltaks- og grenseverdier), as amended (The EU has an indicative threshold for the substance.)
Nickel - Respirable. - as Ni	NORMEN	0,01 mg/m3	Norway. Occupational Limit Values: Annex 1, Regulation No. 1358 (Forskrift om tiltaks- og grenseverdier), as amended (The EU has set a binding limit for the substance.)
Nickel - Inhalable - as Ni	NORMEN	0,05 mg/m3	Norway. Occupational Limit Values: Annex 1, Regulation No. 1358 (Forskrift om tiltaks- og grenseverdier), as amended (The EU has set a binding limit for the substance.)

Additional exposure limits under the conditions of use: Poland

Chemical Identity	Type	Exposure Limit Values	Source
Manganese - as Mn	NDS	0,3 mg/m3	Poland. Maximum permissible concentrations and intensities of harmful factors in the work environment (Dz.U.Poz. 1286/2018, Annex 1), as amended
Nickel - as Ni	NDS	0,25 mg/m3	Poland. Maximum permissible concentrations and intensities of harmful factors in the work environment (Dz.U.Poz. 1286/2018, Annex 1), as amended

Additional exposure limits under the conditions of use: Portugal

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	TWA	20 ppm	Portugal. OELs. Decree-Law No. 24/2012, as amended
	STEL	100 ppm	Portugal. OELs. Decree-Law No. 24/2012, as amended
Nitrogen dioxide	TWA	0,2 ppm	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended
	TWA	0,5 ppm	Portugal. OELs. Decree-Law No. 24/2012, as amended
	STEL	1 ppm	Portugal. OELs. Decree-Law No. 24/2012, as amended

Ozone	TWA	0,20 ppm	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended
Manganese - Respirable fraction. - as Mn	TWA	0,02 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended
Manganese - Inhalable fraction. - as Mn	TWA	0,1 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended
Manganese - Inhalable fraction. - Manganese	TWA	0,2 mg/m3	Portugal. OELs. Decree-Law No. 24/2012, as amended
Manganese - Respirable fraction. - Manganese	TWA	0,05 mg/m3	Portugal. OELs. Decree-Law No. 24/2012, as amended
Manganese - Inhalable fraction. - Manganese	TWA	0,2 mg/m3	Portugal. OELs. Decree-Law No. 24/2012, as amended
Nickel - Inhalable fraction. - as Ni	TWA	1,5 mg/m3	Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796), as amended

Additional exposure limits under the conditions of use: Slovakia

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	TWA	20 ppm	Slovakia. OELs. Maximum permissible exposure limits for chemical factors in workplace air (Regulation No 355/2006, Annex 1, Tables 1-7), as amended (Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1.)
	STEL	100 ppm	Slovakia. OELs. Maximum permissible exposure limits for chemical factors in workplace air (Regulation No 355/2006, Annex 1, Tables 1-7), as amended (Maximum exposure limits for gases, vapors and aerosols in workplace air (NPEL);Table 1.)

Additional exposure limits under the conditions of use: Slovenia

Chemical Identity	Type	Exposure Limit Values	Source
Carbon monoxide	MV	20 ppm	Slovenia. Occupational Exposure Limit Values for Carcinogens, Mutagens and Reprotoxic Substances (Reg. on Protection from Exposure to CMR Substances, 29/2024, Annex III, Table 3.1), as amended
	KTV	100 ppm	Slovenia. Occupational Exposure Limit Values for Carcinogens, Mutagens and Reprotoxic Substances (Reg. on Protection from Exposure to CMR Substances, 29/2024, Annex III, Table 3.1), as amended
Manganese - Inhalable fraction. - as Mg	KTV	1,6 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended
Manganese - Respirable fraction. - as Mg	TWA	0,05 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (If in compliance with the OEL and BEL values, then there should be no risk of reproductive damage.)
	KTV	0,4 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended
Manganese - Inhalable fraction. - as Mg	TWA	0,2 mg/m3	Slovenia. OELs. Occupational Exposure Limits of Chemicals at Work (Reg. on Protection of Workers from Risks due to Exp. to Chemicals at Work, Annex 1, 72/2021), as amended (If in compliance with the OEL and BEL values, then there should be no risk of reproductive damage.)
Nickel - Inhalable fraction. - as Ni	MV	0,1 mg/m3	Slovenia. Occupational Exposure Limit Values for Carcinogens, Mutagens and Reprotoxic Substances (Reg. on Protection from Exposure to CMR Substances, 29/2024, Annex III, Table 3.1), as amended
Nickel - Alveolar fraction - as Ni	MV	0,01 mg/m3	Slovenia. Occupational Exposure Limit Values for Carcinogens, Mutagens and Reprotoxic Substances (Reg. on Protection from Exposure to CMR Substances, 29/2024, Annex III, Table 3.1), as amended
Nickel - Inhalable fraction. - as Ni	MV	0,05 mg/m3	Slovenia. Occupational Exposure Limit Values for Carcinogens, Mutagens and Reprotoxic Substances (Reg. on Protection from Exposure to CMR Substances, 29/2024,

			Annex III, Table 3.1), as amended

Additional exposure limits under the conditions of use: Spain

Chemical Identity	Type	Exposure Limit Values	Source
Nitrogen dioxide	VLA-ED	1,5 ppm	Spain. Occupational Exposure Limits, as amended
	VLA-EC	3 ppm	Spain. Occupational Exposure Limits, as amended

Additional exposure limits under the conditions of use: Switzerland

Chemical Identity	Type	Exposure Limit Values	Source
Carbon dioxide	TWA	5.000 ppm	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended
Carbon monoxide	STEL	60 ppm	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended
	TWA	30 ppm	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended
Nitrogen dioxide	STEL	3 ppm	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended
	TWA	3 ppm	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended
Ozone	TWA	0,1 ppm	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended
	STEL	0,1 ppm	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended
Manganese - Inhalable fraction.	TWA	0,5 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended (Provisional value.)
Nickel - Inhalable fraction.	TWA	0,5 mg/m3	Switzerland. SUVA Grenzwerte am Arbeitsplatz, as amended

Additional exposure limits under the conditions of use: Türkiye

Chemical Identity	Type	Exposure Limit Values	Source
Carbon dioxide	MAK	5.000 ppm	Turkey. MAK (Ordinance No. 1475 on Precautions Required in Workplaces Working with Flammable, Explosive, Dangerous and Harmful Substances, Annexes 1-3 (1973))
	TWA	5.000 ppm	Turkiye. OELs. Regulation on Health and Safety Measures while Working with Chemical Substances, Annex I, Occupational Exposure Limit Values, RG No. 28733, as amended

Additional exposure limits under the conditions of use: United Kingdom

Chemical Identity	Type	Exposure Limit Values	Source
Carbon dioxide	TWA	5.000 ppm	UK. EH40 Workplace Exposure Limits (WELs)
	STEL	15.000 ppm	UK. EH40 Workplace Exposure Limits (WELs)
Carbon monoxide	STEL	200 ppm	UK. EH40 Workplace Exposure Limits (WELs)
	TWA	30 ppm	UK. EH40 Workplace Exposure Limits (WELs)
	STEL	100 ppm	UK. EH40 Workplace Exposure Limits (WELs)
	TWA	20 ppm	UK. EH40 Workplace Exposure Limits (WELs)
	TWA	30 ppm	UK. EH40 Workplace Exposure Limits (WELs) (The expiration date of this limit: 21 August 2023)
	STEL	200 ppm	UK. EH40 Workplace Exposure Limits (WELs) (The expiration date of this limit: 21 August 2023)
Nitrogen dioxide	TWA	0,5 ppm	UK. EH40 Workplace Exposure Limits (WELs)
	STEL	1 ppm	UK. EH40 Workplace Exposure Limits (WELs)
Ozone	STEL	0,2 ppm	UK. EH40 Workplace Exposure Limits (WELs)
Manganese - Respirable fraction. - as Mn	TWA	0,05 mg/m3	UK. EH40 Workplace Exposure Limits (WELs)
Manganese - Inhalable fraction. - as Mn	TWA	0,2 mg/m3	UK. EH40 Workplace Exposure Limits (WELs)
Nickel - as Ni	TWA	0,5 mg/m3	UK. EH40 Workplace Exposure Limits (WELs)

No data is available if not listed.

Note: the substances contained in the materials being joined, as well as the ones on their surface, may form other air contaminants. Refer to the relevant SDS or to emission samplings by a qualified professional, to determine applicable exposure limits.

8.2 Exposure controls

Appropriate Engineering Controls

Ventilation: Use enough ventilation and local exhaust at the arc, flame or heat source to keep the fumes and gases from the worker's breathing zone and the general area. Train the operator to keep their head out of the fumes. **Keep exposure as low as possible.**

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

General information:

Exposure Guidelines: To reduce the potential for overexposure, use controls such as adequate ventilation and personal protective equipment (PPE). Overexposure refers to exceeding applicable local limits, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) or the Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limits (PELs). Workplace exposure levels should be established by competent industrial hygiene assessments. Unless exposure levels are confirmed to be below the applicable local limit, TLV or PEL, whichever is lower, respirator use is required. Absent these controls, overexposure to one or more compound constituents, including those in the fume or airborne particles, may occur resulting in potential health hazards. According to the ACGIH, TLVs and Biological Exposure Indices (BEIs) "represent conditions under which ACGIH believes that nearly all workers may be repeatedly exposed without adverse health effects." The ACGIH further states that the TLV-TWA should be used as a guide in the control of health hazards and should not be used to indicate a fine line between safe and dangerous exposures. See Section 10 for information on constituents which have some potential to present health hazards. Welding consumables and materials being joined may contain chromium as an unintended trace element. Materials that contain chromium may produce some amount of hexavalent chromium (CrVI) and other chromium compounds as a byproduct in the fume. In 2018, the American Conference of Governmental Industrial Hygienists (ACGIH) lowered the Threshold Limit Value (TLV) for hexavalent chromium from 50 micrograms per cubic meter of air (50 µg/m³) to 0.2 µg/m³. At these new limits, CrVI exposures at or above the TLV may be possible in cases where adequate ventilation is not provided. CrVI compounds are on the IARC and NTP lists as posing a lung cancer and sinus cancer risk. Workplace conditions are unique and welding fume exposures levels vary. Workplace exposure assessments must be conducted by a qualified professional, such as an industrial hygienist, to determine if exposures are below applicable limits and to make recommendations when necessary for preventing overexposures.

Eye/face protection:

Wear helmet or use face shield with filter lens shade number 12 or darker for open arc processes – or follow the recommendations as specified in ANSI Z49.1, Section 4; ISO/TR 18786:2014, based on your process and settings. No specific lens shade recommendation for submerged arc or electroslag processes. Shield others by providing appropriate screens and flash goggles.

Skin protection

Hand Protection:

Wear protective gloves. Suitable gloves can be recommended by the glove supplier.

Other:	**Protective Clothing:** Wear hand, head, and body protection which help to prevent injury from radiation, open flames, hot surfaces, sparks and electrical shock. See Z49.1, ISO/TR 18786:2014, ISO/TR 13392:2014. At a minimum, this includes welder's gloves and a protective face shield when welding, and may include arm protectors, aprons, hats, shoulder protection, as well as dark substantial clothing when welding, brazing and soldering. Wear dry gloves free of holes or split seams. Train the operator not to permit electrically live parts or electrodes from contacting the skin . . . or clothing or gloves if they are wet. Insulate yourself from the work piece and ground using dry plywood, rubber mats or other dry insulation.
Respiratory Protection:	Keep your head out of fumes. Use enough ventilation and local exhaust to keep fumes and gases from your breathing zone and the general area. An approved respirator should be used unless exposure assessments are below applicable exposure limits. Workplace exposure levels should be established by competent industrial hygiene assessments. Unless exposure levels are confirmed to be below the applicable local limit, TLV or PEL, whichever is lower, respirator use is required.
Hygiene measures:	Do not eat, drink or smoke when using the product. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Determine the composition and quantity of fumes and gases to which workers are exposed by taking an air sample from inside the welder's helmet if worn or in the worker's breathing zone. Improve ventilation if exposures are not below limits. See ISO 10882-1:2024; ANSI/AWS F1.1, F1.2, F1.3 and F1.5, available from the American Welding Society, www.aws.org.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance:	Solid welding wire or rod.
Physical state:	Solid
Form:	Solid
Color:	No data available.
Odor:	No data available.
Odor Threshold:	No data available.
pH:	No data available.
Melting Point:	No data available.
Boiling Point:	No data available.
Flash Point:	No data available.
Evaporation Rate:	No data available.
Flammability (solid, gas):	No data available.
Flammability Limit - Upper (%):	No data available.
Flammability Limit - Lower (%):	No data available.
Vapor pressure:	No data available.
Relative vapor density:	No data available.
Density:	No data available.
Relative density:	No data available.

Solubility(ies)	
Solubility in Water:	No data available.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition Temperature:	No data available.
SADT:	No data available.
Viscosity:	No data available.
Explosive properties:	No data available.
Oxidizing properties:	No data available.

9.2 Other information

VOC Content:	Not available.
Bulk density:	Not available.
Dust Explosion Limit, Upper:	Not available.
Dust Explosion Limit, Lower:	Not available.
Dust Explosion Description Number Kst:	Not available.
Minimum ignition energy:	Not available.
Minimum ignition temperature:	Not available.
Metal Corrosion:	Not available.

SECTION 10: Stability and reactivity

10.1 Reactivity:	The product is non-reactive under normal conditions of use, storage and transport.
10.2 Chemical Stability:	Material is stable under normal conditions.
10.3 Possibility of hazardous reactions:	None under normal conditions.
10.4 Conditions to avoid:	Avoid heat or contamination.
10.5 Incompatible Materials:	Strong acids. Strong oxidizing substances. Strong bases.

10.6 Hazardous Decomposition Products:

Fumes and gases from welding and its allied processes such as brazing and soldering cannot be classified simply. The composition and quantity of both are dependent upon the metal to which the joining or hot work is applied, the process, procedure - and where applicable - the electrode or consumable used. Other conditions which also influence the composition and quantity of the fumes and gases to which workers may be exposed include: coatings on the metal being welded or worked (such as paint, plating, or galvanizing), the number of operators and the volume of the work area, the quality and amount of ventilation, the position of the operator's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities.)

In cases where an electrode or other applied material is consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 3. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the materials shown in Section 3, plus those from the base metal and coating, etc., as noted above. Reasonably expected fume constituents produced during arc welding and brazing include the oxides of iron, manganese and other metals present in the welding consumable or base metal. Hexavalent chromium compounds may be in the welding or brazing fume of consumables or base metals which contain chromium. Gaseous and particulate fluoride may be in the fume of consumables or flux materials which contain fluoride. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from the arc associated with welding.

SECTION 11: Toxicological information

General information:

The International Agency for Research on Cancer (IARC) has determined welding fumes and ultraviolet radiation from welding are carcinogenic to humans (Group 1). According to IARC, welding fumes cause cancer of the lung and positive associations have been observed with cancer of the kidney. Also according to IARC, ultraviolet radiation from welding causes ocular melanoma. IARC identifies gouging, brazing, carbon arc or plasma arc cutting, and soldering as processes closely related to welding. Read and understand the manufacturer’s instructions, Safety Data Sheets and the precautionary labels before using this product.

Information on likely routes of exposure

Inhalation:

Potential chronic health hazards related to the use of welding consumables are most applicable to the inhalation route of exposure. Refer to Inhalation statements in Section 11.

Skin Contact:

Arc rays can burn skin. Skin cancer has been reported.

Eye contact:

Arc rays can injure eyes.

Ingestion:

Health injuries from ingestion are not known or expected under normal use.

Symptoms related to the physical, chemical and toxicological characteristics

Inhalation:	Short-term (acute) overexposure to fumes and gases from welding and allied processes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to fumes and gases from welding and allied processes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects.

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008

Acute toxicity (list all possible routes of exposure)

Oral

Product:	Not classified
Specified substance(s):	
Iron	LD 50 (Rat): 98,6 g/kg
Copper and/or copper alloys and compounds (as Cu)	LD 50 (Rat): 481 mg/kg

Dermal

Product:	Not classified

Inhalation

Product:	Not classified

Repeated dose toxicity

Product:	Not classified

Skin Corrosion/Irritation

Product:	Not classified

Serious Eye Damage/Eye Irritation

Product:	Not classified

Respiratory or Skin Sensitization

Product:	Not classified
Specified substance(s):	
Iron	Skin sensitization:, in vivo (Guinea pig): Not sensitising
Copper and/or copper alloys and compounds (as Cu)	Skin sensitization:, in vivo (Guinea pig): Not sensitising
Chromium and chromium alloys or compounds (as Cr)	Skin sensitization:, in vivo (Guinea pig): Not Classified
Molybdenum	Skin sensitization:, in vivo (Guinea pig): Not sensitising Skin sensitization:, in vivo (Guinea pig): Not Classified

Carcinogenicity

Product:	Arc rays: Skin cancer has been reported.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:

Specified substance(s):	
Nickel	Overall evaluation: 2B. Possibly carcinogenic to humans.
Chromium and chromium alloys or compounds (as Cr)	Overall evaluation: 3. Not classifiable as to carcinogenicity to humans.

Germ Cell Mutagenicity

In vitro

Product: Not classified

In vivo
Product: Not classified

Reproductive toxicity
Product: Not classified

Specific Target Organ Toxicity - Single Exposure
Product: Not classified

Specific Target Organ Toxicity - Repeated Exposure
Product: Not classified

Aspiration Hazard
Product: Not classified

11.2 Information on other hazards

Endocrine disrupting properties
Product: The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.;

Other information
Product: Organic polymers may be used in the manufacture of various welding consumables. Overexposure to their decomposition byproducts may result in a condition known as polymer fume fever. Polymer fume fever usually occurs within 4 to 8 hours of exposure with the presentation of flu like symptoms, including mild pulmonary irritation with or without an increase in body temperature. Signs of exposure can include an increase in white blood cell count. Resolution of symptoms typically occurs quickly, usually not lasting longer than 48 hours.;

Symptoms related to the physical, chemical and toxicological characteristics under the condition of use

Inhalation:
Specified substance(s):

Manganese	Overexposure to manganese fumes may affect the brain and central nervous system, resulting in poor coordination, difficulty speaking, and arm or leg tremor. This condition can be irreversible.
Nickel	Nickel and its compounds are on the IARC and NTP lists as posing respiratory cancer risk, and are skin sensitizers with symptoms ranging from slight itch to severe dermatitis.

Additional toxicological Information under the conditions of use:
Acute toxicity

Inhalation
Specified substance(s):

Carbon dioxide	LC Lo (Human, 5 min): 90000 ppm
Carbon monoxide	LC 50 (Rat, 4 h): 1300 ppm
Nitrogen dioxide	LC 50 (Rat, 4 h): 88 ppm
Ozone	LC Lo (Human, 30 min): 50 ppm

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
Specified substance(s):

Nickel	Overall evaluation: 2B. Possibly carcinogenic to humans.

Other effects:

Specified substance(s):

Carbon dioxide	Asphyxia
Carbon monoxide	Carboxyhemoglobinemia
Nitrogen dioxide	Lower respiratory tract irritation
Nickel	Dermatitis
Nickel	Pneumoconiosis

SECTION 12: Ecological information

12.1 Toxicity

Acute hazards to the aquatic environment:

Fish

Product: Not classified.

Specified substance(s):

Nickel	LC 50 (Fathead minnow (Pimephales promelas), 96 h): 2,916 mg/l
Copper and/or copper alloys and compounds (as Cu)	LC 50 (Fathead minnow (Pimephales promelas), 96 h): 1,6 mg/l
Molybdenum	LC 50 (Rainbow trout,donaldson trout (Oncorhynchus mykiss), 96 h): 800 mg/l

Aquatic Invertebrates

Product: Not classified.

Specified substance(s):

Manganese	EC 50 (Water flea (Daphnia magna), 48 h): 40 mg/l
Nickel	EC 50 (Water flea (Daphnia magna), 48 h): 1 mg/l
Copper and/or copper alloys and compounds (as Cu)	EC 50 (Water flea (Daphnia magna), 48 h): 0,102 mg/l

Chronic hazards to the aquatic environment:

Fish

Product: Not classified.

Aquatic Invertebrates

Product: Not classified.

Specified substance(s):

Iron	NOEC (Daphnia magna): 2 mg/l NOEC (Arrenurus manubriator): 800 mg/l NOEC (Chironomus attenuatus): 200 mg/l NOEC (Daphnia pulex): 0,63 mg/l NOEC (Haliotis rubra): 1,28 mg/l
Manganese	NOEC (Ceriodaphnia dubia): 1,7 mg/l NOEC (Daphnia magna): < 1,1 mg/l
Copper and/or copper alloys and compounds (as Cu)	NOEC (Tisbe furcata): 19,1 µg/l NOEC (Neanthes arenaceodentata): 13,5 µg/l NOEC (Ceriodaphnia sp.): 24,1 µg/l NOEC (Ceriodaphnia dubia): 10,2 µg/l NOEC (Rotifer (Brachionus calyciflorus)): 47,8 µg/l
Molybdenum	NOEC (Daphnia magna): 112 mg/l NOEC (Hyalella azteca): >= 345,1 mg/l NOEC (Daphnia magna): 368,3 mg/l NOEC (Hyalella azteca): 103,6 mg/l NOEC (Chironomus riparius): > 1.564 mg/l

Toxicity to Aquatic Plants

Product: Not classified.

Specified substance(s):

Copper and/or copper alloys and compounds (as Cu)	LC 50 (Green algae (Scenedesmus dimorphus), 3 d): 0,0623 mg/l

12.2 Persistence and Degradability

Biodegradation

Product: No data available.

12.3 Bioaccumulative potential

Bioconcentration Factor (BCF)

Product: No data available.

Specified substance(s):

Nickel	Zebra mussel (Dreissena polymorpha), Bioconcentration Factor (BCF): 5.000 - 10.000 (Lotic) Bioconcentration factor calculated using dry weight tissue conc
Copper and/or copper alloys and compounds (as Cu)	Blue-green algae (Anacystis nidulans), Bioconcentration Factor (BCF): 36,01 (Static)

12.4 Mobility in soil: No data available.

12.5 Results of PBT and vPvB assessment:

Product: This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Endocrine disrupting properties:

Product: The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

12.7 Other adverse effects:

Other hazards

Product: No data available.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

General information: The generation of waste should be avoided or minimized whenever possible. When practical, recycle in an environmentally acceptable, regulatory compliant manner. Dispose of non-recyclable products in accordance with all applicable Federal, State, Provincial, and Local requirements.

Disposal instructions: Disposal of this product may be regulated as a Hazardous Waste. The welding consumable and/or by-product from the welding process (including, but not limited to slag, dust, etc.) may contain levels of leachable heavy metals such as Barium or Chromium. Prior to disposal, a representative sample must be analyzed in accordance with local laws to determine if any constituents exist above regulated threshold levels. Discard any product,

residue, disposable container, or liner in an environmentally acceptable manner according to Federal, State and Local Regulations. Waste codes must be assigned by the user in accordance with the European Waste Catalogue.

Contaminated Packaging: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

SECTION 14: Transport information

ADR

14.1 UN number or ID number:	
14.2 UN Proper Shipping Name:	NOT DG REGULATED
14.3 Transport Hazard Class(es)	
Class:	NR
Label(s):	–
Hazard No. (ADR):	–
Tunnel restriction code:	
14.4 Packing Group:	–
Limited quantity	
Excepted quantity	
14.5 Environmental hazards	No
14.6 Special precautions for user:	None.

ADN

14.1 UN number or ID number:	
14.2 UN Proper Shipping Name:	NOT DG REGULATED
14.3 Transport Hazard Class(es)	
Class:	NR
Label(s):	–
Hazard No. (ADR):	–
14.4 Packing Group:	–
Limited quantity	
Excepted quantity	
14.5 Environmental hazards	No
14.6 Special precautions for user:	None.

RID

14.1 UN number or ID number:	
14.2 UN Proper Shipping Name	NOT DG REGULATED
14.3 Transport Hazard Class(es)	
Class:	NR
Label(s):	–
14.4 Packing Group:	–
14.5 Environmental hazards	No
14.6 Special precautions for user:	None.

IMDG

14.1 UN number or ID number:	
14.2 UN Proper Shipping Name:	NOT DG REGULATED
14.3 Transport Hazard Class(es)	
Class:	NR
Label(s):	–
EmS No.:	

14.4 Packing Group:	–
Limited quantity	
Excepted quantity	
14.5 Environmental hazards	No
14.6 Special precautions for user:	None.

IATA

14.1 UN number or ID number:	
14.2 Proper Shipping Name:	NOT DG REGULATED
14.3 Transport Hazard Class(es):	
Class:	NR
Label(s):	–
14.4 Packing Group:	–
Cargo aircraft only :	
Passenger and cargo aircraft :	
Limited quantity:	
Excepted quantity	
14.5 Environmental hazards	No
14.6 Special precautions for user:	None.
Cargo aircraft only:	Allowed.

14.7 Maritime transport in bulk according to IMO instruments: Not applicable

SECTION 15: Regulatory information

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

EU Regulations

Regulation 1005/2009/EC on substances that deplete the ozone layer, Annex I, Controlled Substances: None present or none present in regulated quantities.

EU. REACH Annex XIV, Substances Subject to Authorization: None present or none present in regulated quantities.

EU. Regulation 2019/1021/EU on persistent organic pollutants (POPs) (recast), as amended: None present or none present in regulated quantities.

EU. Directive 2010/75/EU on Industrial Emissions (IPPC), Annex II, L 334/17: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 1 as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 2 as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 3 as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex V as amended: None present or none present in regulated quantities.

EU. REACH Candidate List of Substances of Very High Concern for Authorization (SVHC): None present or none present in regulated quantities.

Regulation (EC) No. 1907/2006 Annex XVII Substances subject to restriction on marketing and use:

Chemical name	CAS-No.	Number on list
Nickel	7440-02-0	27, 75, 75, 75, 75, 3
Chromium and chromium alloys or compounds (as Cr)	7440-47-3	75, 75
Copper and/or copper alloys and compounds (as Cu)	7440-50-8	75, 75, 75, 3

Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens and mutagens at work.: None present or none present in regulated quantities.

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breast feeding.:

Chemical name	CAS-No.	Concentration
Nickel	7440-02-0	0,1 - 1,0%

EU. Directive 2012/18/EU (SEVESO III) on major accident hazards involving dangerous substances, Annex I: None present or none present in regulated quantities.

EU. Regulation No. 166/2006 PRTR (Pollutant Release and Transfer Registry), Annex II: Pollutants:

Chemical name	CAS-No.	Concentration
Molybdenum	7439-98-7	0,1 - 1,0%
Nickel	7440-02-0	0,1 - 1,0%
Silicon	7440-21-3	0,1 - 1,0%
Chromium and chromium alloys or compounds (as Cr)	7440-47-3	0,1 - 1,0%
Copper and/or copper alloys and compounds (as Cu)	7440-50-8	0,1 - 1,0%

Directive 98/24/EC on the protection of workers from the risks related to chemical agents at work:

Chemical name	CAS-No.	Concentration
Nickel	7440-02-0	0,1 - 1,0%
Copper and/or copper alloys and compounds (as Cu)	7440-50-8	0,1 - 1,0%

EU. Restricted Explosives Precursors: Annex I, Regulation 2019/1148/EU on Explosives Precursors (EUEXPL1D): None present or none present in regulated quantities.

EU. Reportable (Annex II) Explosives Precursors, Regulation 2019/1148/EU on Explosives Precursors (EUEXPL2D): None present or none present in regulated quantities.

EU. Reportable (Annex II) Explosives Precursors, Regulation 2019/1148/EU on Explosives Precursors (EUEXPL2L): None present or none present in regulated quantities.

National Regulations

Water Hazard Class (WGK): WGK 3: severely water-endangering.

TA Luft, Technical Guidance Air:

Manganese	Number 5.2.2 Class III, Inorganic dust-forming substance
Nickel	Number 5.2.2 Class II, Inorganic dust-forming substance

Chromium and chromium alloys or compounds (as Cr)	Number 5.2.2 Class III, Inorganic dust-forming substance
Copper and/or copper alloys and compounds (as Cu)	Number 5.2.2 Class III, Inorganic dust-forming substance
Vanadium alloys (as V)	Number 5.2.2 Class III, Inorganic dust-forming substance

INRS, maladies professionelles, table of work-related illnesses

Listed: 44 bis
44
A

International regulations

Montreal protocol	Not applicable
Stockholm convention	Not applicable
Rotterdam convention	Not applicable
Kyoto protocol	Not applicable

15.2 Chemical safety assessment: No Chemical Safety Assessment has been carried out.

Inventory Status:

Australia Industrial Chem. Act (AIIC):	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
Canada NDSL Inventory:	One or more components are not listed or are exempt from listing.
Ontario Inventory:	On or in compliance with the inventory
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Japan (ENCS) List:	One or more components are not listed or are exempt from listing.
Japan ISHL Listing:	One or more components are not listed or are exempt from listing.
Japan Pharmacopoeia Listing:	One or more components are not listed or are exempt from listing.
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Mexico INSQ:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Philippines PICCS:	On or in compliance with the inventory
Taiwan Chemical Substance Inventory:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
Switzerland New Subs Notified/Registered:	One or more components are not listed or are exempt from listing.
Thailand Existing Chemical Inv. List:	One or more components are not listed or are exempt from listing.
Vietnam National Chemical Inventory:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory

SECTION 16: Other information

Definitions:

References

PBT	PBT: persistent, bioaccumulative and toxic substance.
vPvB	vPvB: very persistent and very bioaccumulative substance.

Abbreviations and acronyms:

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; ADR - Agreement concerning the International Carriage of Dangerous Goods by Road; AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECHA - European Chemicals Agency; EC-Number - European Community number; ECx - Concentration associated with x% response; EIGA - European Industrial Gases Association; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RID - Regulations concerning the International Carriage of Dangerous Goods by Rail; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; SVHC - substance of very high concern; TCSI - Taiwan Chemical Substance Inventory; TECI - Thailand Existing Chemicals Inventory; TRGS - Technical Rule for Hazardous Substances; TSCA - Toxic Substances Control Act (United States); UN - United Nations; vPvB - Very Persistent and Very Bioaccumulative

Notes:

Note 7	Alloys containing nickel are classified for skin sensitisation when the release rate of 0,5 µg Ni/cm2/week, as measured by the European Standard reference test method EN 1811, is exceeded.

Key literature references and sources for data: According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended.

Wording of the statements in section 2 and 3

H317	May cause an allergic skin reaction.
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H412	Harmful to aquatic life with long lasting effects.

EUH210	Safety data sheet available on request.

Training information: Read and understand all product instructions, labels, and warnings. Follow all applicable local laws and regulations, as well as all internal process procedures and instructions.

Other information: Additional information is available by request.

Issue Date: 30.05.2025

Disclaimer: The Lincoln Electric Company urges each end user and recipient of this SDS to study it carefully. See also www.lincolnelectric.com/safety. If necessary, consult an industrial hygienist or other expert to understand this information and safeguard the environment and protect workers from potential hazards associated with the handling or use of this product. This information is believed to be accurate as of the revision date shown above. However, no warranty, expressed or implied, is given. Because the conditions or methods of use are beyond Lincoln Electric's control, we assume no liability resulting from the use of this product. Regulatory requirements are subject to change and may differ between various locations. Compliance with all applicable Federal, State, Provincial, and local laws and regulations remain the responsibility of the user.

Annex to the extended Safety Data Sheet (eSDS)
Exposure Scenario:

Read and understand the **"Recommendations for Exposure Scenarios, Risk Management Measures and to identify Operational Conditions under which metals, alloys and metallic articles may be safely welded"**, which is available from your supplier and at http://european-welding.org/health-safety.

Welding/Brazing produces fumes which can affect human health and the environment. Fumes are a varying mixture of airborne gases and fine particles which, if inhaled or swallowed, constitute a health hazard. The degree of risk will depend on the composition of the fume, concentration of the fume and duration of exposure. The fume composition is dependent upon the material being worked, the process and consumables being used, coatings on the work such as paint, galvanizing or plating, oil or contaminants from cleaning and degreasing activities. A systematic approach to the assessment of exposure is necessary, taking into account the particular circumstances for the operator and ancillary worker that can be exposed.

Considering the emission of fumes when welding, brazing or cutting of metals, it is recommended to (1) arrange risk management measures through applying general information and guidelines provided by this exposure scenario and (2) using the information provided by the Safety Data Sheet, issued in accordance with REACH, by the welding consumable manufacturer.

The employer shall ensure that the risk from welding fumes to the safety and health of workers is eliminated or reduced to a minimum. The following principle shall be applied:
1- Select the applicable process/material combinations with the lowest class, whenever possible.
2- Set welding process with the lowest emission parameter.
3- Apply the relevant collective protective measure in accordance with class number. In general, the use of PPE is taken into account after all other measures is applied.
4- Wear the relevant personal protective equipment in accordance with the duty cycle.

In addition, compliance with the National Regulations regarding the exposure to welding fumes of welders and related personnel shall be verified.