

# SAFETY DATA SHEET

## 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

**Trade Designation:** SF-65A  
**Manufacturer/Supplier:** NIPPON STEEL WELDING & ENGINEERING CO., LTD.  
**Address:** Shingu Bldg. 4-2, Toyo 2-chome, Koto-ku, Tokyo 135-0016 JAPAN  
**Telephone number:** +81-3-6388-9093  
**Fax number:** +81-3-6388-9088  
**Emergency telephone number:** +81-3-6388-9093

## 2. HAZARDS IDENTIFICATION

GHS classification and Label elements

GHS classification

|  |   |
|--|---|
| Respiratory sensitization                          | Category 1                                      |
| Skin sensitization                                 | Category 1                                      |
| Carcinogenicity                                    | Category 2                                      |
| Reproductive toxicity                              | Category 1B                                     |
| Specific target organ toxicity (single exposure)   | Category 2 (respiratory organs, kidneys)        |
| Specific target organ toxicity (repeated exposure) | Category 2 (respiratory organs, nervous system) |

\* Hazard classifications not listed above, are not classified.

Label elements

Pictogram



Signal word

Danger

Hazard statement

May cause an allergic skin reaction  
May cause allergy or asthma symptoms or breathing difficulties if inhaled  
Suspected of causing cancer  
May damage fertility or the unborn child  
May cause damage to organs  
May cause damage to organs through prolonged or repeated exposure

Precautionary statements

Prevention

Do not handle until all Safety Data Sheet (SDS) have been read and understood.  
Wear protective equipment (eye protection, respiratory protection, protective shoes) as required.  
Do not eat, drink or smoke when using this product.  
Wash hands thoroughly after handling.  
Use only outdoors or in a well-ventilated area.

Response

- IF SWALLOWED:** Immediately call a POISON CENTER or doctor/physician.  
Rinse mouth.
- IF ON SKIN:** Wash with plenty of soap and water.  
Call a POISON CENTER or doctor/physician if you feel unwell.  
Wash contaminated clothing before reuse.  
If skin irritation or rash occurs: Get medical advice/attention.
- IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.  
If eye irritation persists: Get medical advice/attention.
- IF INHALED:** Remove victim to fresh air and keep at rest in a position comfortable for breathing.  
Call a POISON CENTER or doctor/physician if you feel unwell.  
If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician.
- IF exposed or if you feel unwell:** Call a POISON CENTER or doctor/physician.
- Disposal**  
Dispose of contents/container in accordance with local/regional/national/international regulation.

Hazard statement of arc welding

Avoid eye contact or inhalation of dust from the product. Skin contact is normally not hazardous but should be avoided to prevent possible allergic reaction. Occupational exposure limits of components are described in section 3. When this product is used in a welding process the most significant hazards are electric shock, fumes, gases, radiation, spatter, slag and heat.

- Shock:** Electric shock can kill.
- Fumes:** Overexposure to welding fumes may result in symptoms like dizziness, nausea, dryness or irritation of the nose, throat or eyes. Chronic overexposure to welding fumes may affect pulmonary function. This product contains substances that are suspected of being cancer-causing agents and may affect the nervous system.
- Gases:** Gases may cause gas poisoning.
- Radiation:** Arc rays can severely damage eyes or skin.
- Spatter, slag and heat:** Spatter and slag can damage eyes. Spatter, slag, melting metal, arc rays and hot welds can cause burn injuries and start fires.

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

Substance/mixture: mixture

| Chemical name              | CAS No.    | Concentration range (%) |
|----------------------------|------------|-------------------------|
| Aluminium oxide            | 1344-28-1  | <1                      |
| Copper                     | 7440-50-8  | <1                      |
| Iron                       | 7439-89-6  | Bal.                    |
| Magnesium                  | 7439-95-4  | <1                      |
| Manganese                  | 7439-96-5  | <5                      |
| Nickel                     | 7440-02-0  | <5                      |
| Silicon                    | 7440-21-3  | <1                      |
| Silicon dioxide            | --         | <1                      |
| Titanium dioxide           | 13463-67-7 | <10                     |
| Zirconium compounds, as Zr | --         | <1                      |

**4. FIRST-AID MEASURES**

In case of emergency, call for medical aid. Employ first aid technique recommended by the Red Cross.

- General:** Move to fresh air and call for medical aid.
- Inhalation:** If breathing is difficult, provide fresh air.
- Skin contact:** Cool area with ice or cold water.
- Eye contact:** Do not rub eyes. Rinse eyes with clean water.

**Electric shock:** Disconnect and turn off power. If the victim is semi- or unconscious, open the airway. If the victim cannot breathe, give artificial respiration. If there is no pulse, massage the chest and apply artificial respiration.

## 5. FIRE-FIGHTING MEASURES

No specific recommendations for welding consumables. Welding arcs and sparks can ignite combustible and flammable materials. Use the extinguishing media recommended for the burning materials and fire situation. Wear self-contained breathing apparatus as fumes or vapors may be harmful.

## 6. ACCIDENTAL RELEASE MEASURES

**Personal precautions:** Refer to section 8  
**Environmental precautions:** Refer to section 12 and 13  
**Method for cleaning up:** Refer to section 13

## 7. HANDLING AND STORAGE

### Prevention of electric shock:

Do not touch live electrical parts such as the welding wire and welding machine terminals. Wear insulated gloves and safety boots.

### Prevention of fire and explosion:

Remove flammable and combustible materials and liquids.

### Prevention of harm when handling welding consumables:

Handle with care to avoid stings and cuts. Hold the welding wire manually when loosening the wire.

### Caution for storage:

Store welding consumables inside a room without humidity. Do not store welding consumables directly on the ground or beside a wall. Keep welding consumables away from chemical substances like acids which could cause chemical reactions.

## 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

### Ventilation:

Use enough ventilation, local exhaust at the arc, or both, to keep the fumes and gases below the TLVs in the worker's breathing zone and the general area. Use extra ventilation when welding galvanized plate or coated plate.

### Respiratory protection:

Use respirable fume respirator or air supplied respirator when welding in confined space or where local exhaust or ventilation does not keep exposure below TLV. Keep head out of the fumes and gases.

### Eye protection:

Wear helmet or use face shield with filter lens. As a rule of thumb, start with a shade which is too dark to see the weld zone. Then go to the next lighter shade which gives sufficient view of the weld zone. Provide protective screens and flash goggles, if necessary, to shield others.

### Protective clothing:

Wear head, hand, and body protection which help to prevent injury from radiation, sparks and electric shock. At a minimum, this includes welder's gloves and a protective face shield and may include arm protectors, aprons, hats, shoulder protection, as well as dark substantial clothing. Train the welder not to touch live electrical parts and to insulate himself from work and ground.

### Ear protection:

Wear earplugs or earmuffs when using engine driven arc welding machine or pulsed arc welding machine that generates high-level noise.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

**Appearance:** Solid, non-volatile  
**Odor:** Odorless  
**Color:** Copper  
**Form:** Wire

## 10. STABILITY AND REACTIVITY

**General:** This product is intended only for normal welding purposes.  
**Stability:** This product is stable under normal conditions.  
**Reactivity:** Contact with chemical substances like acids could cause generation of gas.

Hazardous decomposition products includes those from the volatilization, reaction or oxidation of the materials listed in section 2 and those from the base metal and coating.

Reasonably expected fume constituents of this product would include oxides of metals as iron and manganese.

A significant amount of the chromium in the fumes can be hexavalent chromium, which has a very low exposure limit in some countries. Manganese and nickel have low exposure limits, in some countries, that may be easily exceeded.

Reasonably expected gaseous products would include carbon oxides, nitrogen oxides and ozone.

## 11. TOXICOLOGICAL INFORMATION

Inhalation of welding fumes and gases can be dangerous to your health. The composition and quantity of both are dependent upon the material being worked, the process, procedures, and consumables used.

### Acute toxicity:

Overexposure to the gases, fumes and dusts may include irritation of the eyes, lungs, nose and throat. Some toxic gases associated with welding may cause pulmonary edema, asphyxiation, and death. Acute overexposure may include signs and symptoms such as watery eyes, nose and throat irritation, headache, dizziness, difficulty in breathing, frequent coughing, or chest pain. The presence of chromium/chromate in fume can cause irritation of nasal membranes and skin. The presence of nickel compounds in fume can cause metallic taste, nausea, tightness of chest, fever, and allergic reaction. Exposure to the fluoride ion may cause hypocalcemia-calcium deficiency in the blood that can result in muscle cramps and inflammation and necrosis of mucous membranes.

### Chronic toxicity:

Overexposure to air contaminants may lead to their accumulation in the lungs, a condition which may be seen as dense areas on chest X-rays. The severity of the change is proportional to the length of the exposure. The changes may be caused by non-work factors such as smoking, etc. Long term exposure to welding and allied processes gasses, dusts and fumes may contribute to pulmonary irritation or pneumoconiosis. Nickel and chromium (in some forms) are considered carcinogenic. Long term overexposure to nickel fumes may also cause pulmonary fibrosis and edema. Chromium compounds have a corrosive action on the skin and mucous membranes, lesions form on exposed skin and the nasal septum. Liver damage and allergic skin rash have also been reported. Overexposure to manganese compounds may affect the central nervous system, symptoms of which are languor, sleepiness, muscular weakness, emotional disturbances and spastic gait. The effect of manganese on the nervous system is irreversible. Overexposure to copper fumes may lead to copper poisoning, resulting in hemolytic anemia and liver, kidney and spleen damage. Inhalation of too much iron oxide fume over a long time can cause siderosis, sometimes called "iron pigmentation" of the lung, which can be seen on a chest x-ray but causes little or no disability. Chronic overexposure to iron (>50-100mg Fe per day) can result in pathological deposition of iron in body tissues, symptoms of which are fibrosis of the pancreas, diabetes mellitus, and liver cirrhosis. Overexposure to respirable crystalline silica may result in silicosis, a disabling lung disease; overexposure to respirable crystalline silica is a known cause of carcinogenicity in humans. Welding fumes (not otherwise specified) are possibly carcinogenic to humans. Chronic fluoride absorption can result in osseous fluorosis, increased radiographic density of the bones and mottling of the teeth.

## 12. ECOLOGICAL INFORMATION

Welding consumables and materials could degrade/weather into components originating from the consumables or from the materials used in the welding process. Avoid exposure to conditions that could lead to accumulation in soils or groundwater.

## 13. DISPOSAL CONSIDERATIONS

Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with federal and local regulations. Use recycling procedures if available. Residues from welding consumables and processes could degrade and accumulate in soils and groundwater.

## 14. TRANSPORT INFORMATION

No international regulations or restrictions are applicable.

## 15. REGULATORY INFORMATION

### Warning text on label:

PROTECT yourself and others. Read and understand this information.

FUMES AND GASES can be hazardous to your health.

ARC RAYS can injure eyes and burn skin.

ELECTRIC SHOCK can KILL.

- Before use, read and understand the manufacturer's instructions, Safety Data Sheets (SDSs), and your employer's safety practices.
- Keep your head out of the fumes.
- Use enough ventilation, exhaust at the arc, or both, to keep fumes and gases from your breathing zone and the general area.
- Wear correct eye, ear, and body protection.
- Do not touch live electrical parts.

## 16. OTHER INFORMATION

Refer to:

**UK:** WMA Publication 236 and 237, "Hazards from Welding fume", "The arc welder at work, some general aspects of health and safety"

**Germany:** Unfallverhütungsvorschrift "Schweissen, Schneiden und verwandte Verfahren" (VBG 15)

This Safety Data Sheet (SDS) describes the products with respect to safety requirements. This SDS is prepared in accordance with ISO 11014, Safety data sheet for chemical products – Content and order of sections. The information given in this SDS is based on the present level of our knowledge and experience. Nippon Steel Welding & Engineering Co., Ltd. requests the users of this product to study the SDS and become aware of product hazards and safety information. The data given is not intended as a confirmation of product properties and does not constitute a legal contractual relationship, nor should it be used as basis for ordering these products.

Annex

OCCUPATIONAL EXPOSURE VALUES <sup>1)</sup> TWA<sup>11)</sup> (mg/m<sup>3</sup>)

| SUBSTANCE [CAS No.] <sup>2)</sup>   | ACGIH <sup>3)</sup> /TLVs <sup>4)</sup>                        | OSHA <sup>5)</sup> /PELs <sup>6)</sup>   | NIOSH <sup>7)</sup> /RELs <sup>8)</sup> | DFG <sup>9)</sup> /MAKS <sup>10)</sup>                |
|---|--|--|---|---|
| Aluminum [7429-90-5] metal and insoluble compounds  | 1 <sup>12)</sup>   | 5 <sup>12)</sup> , [15 <sup>19)</sup>  | 5 <sup>12)</sup> , [10 <sup>19)</sup>   | 4 <sup>13)</sup> , [1.5 <sup>12)</sup>                |
| Aluminum [7429-90-5] pyro powders and welding fumes, as Al                                | ---  | ---  | 5                                       | ---   |
| Aluminum oxide [1344-28-1]  | ---  | 5 <sup>12)</sup> , [15 <sup>19)</sup>  | ---                                     | 4 <sup>13)</sup> , [1.5 <sup>12)</sup>                |
| Boron oxide [1303-86-2]   | 10   | 15 <sup>19)</sup>  | 10                                      | ---   |
| Barium [7440-39-3] and soluble compounds, as Ba   | 0.5  | 0.5  | 0.5                                     | ---   |
| Barium compounds, soluble, as Ba  | ---  | ---  | ---                                     | 0.5 <sup>15)</sup>                                    |
| Calcium oxide [1305-78-8]   | 2  | 5  | 2                                       | 1 <sup>13)</sup>                                      |
| Calcium carbonate [1317-65-3] (NIOSH : includes [471-34-1])                               | ---  | 5 <sup>12)</sup> , [15 <sup>19)</sup>  | 5 <sup>12)</sup> , [10 <sup>19)</sup>   | ---   |
| Cobalt [7440-48-4] and inorganic compounds, as Co   | 0.02 <sup>17)</sup>  | ---  | ---                                     | ---   |
| Cobalt [7440-48-4] and inorganic compounds, metal dust and fume, as Co                    | ---  | 0.1  | 0.05                                    | ---   |
| Hard metals containing Cobalt [7440-48-4] and Tungsten Carbide [12070-12-1], as Co        | 0.005 <sup>18)</sup>   | ---  | ---                                     | ---   |
| Chromium [7440-47-3] metal  | ---  | 1  | 0.5                                     | ---   |
| Chromium [7440-47-3] metal, as Cr(0)  | 0.5 <sup>13)</sup>   | ---  | ---                                     | ---   |
| Chromium [7440-47-3] (II) inorganic compounds, as Cr                                      | ---  | 0.5  | 0.5                                     | ---   |
| Chromium [7440-47-3] (III) inorganic compounds, as Cr                                     | ---  | 0.5  | 0.5                                     | ---   |
| Chromium [7440-47-3] (III) inorganic compounds, as Cr(III)                                | 0.003 <sup>13)</sup>   | ---  | ---                                     | ---   |
| Chromium [7440-47-3] (VI) inorganic compounds, water-soluble, as Cr (VI)                  | 0.0002 <sup>13)</sup><br>[0.0005 <sup>13)</sup> <sup>14)</sup> | 0.005  | 0.0002                                  | ---   |
| Chromium [7440-47-3] (VI) inorganic compounds, water-insoluble, as Cr (VI)                | 0.0002 <sup>13)</sup><br>[0.0005 <sup>13)</sup> <sup>14)</sup> | 0.005  | 0.0002                                  | ---   |
| Copper [7440-50-8], fume, as Cu   | 0.2  | 0.1  | 0.1                                     | ---   |
| Copper [7440-50-8], dusts and mists, as Cu  | 1  | 1  | 1                                       | ---   |
| Copper [7440-50-8] and its inorganic compounds  | ---  | ---  | ---                                     | 0.01 <sup>12)</sup>                                   |
| Fluorides, as F   | 2.5  | 2.5  | 2.5                                     | 1 <sup>13)</sup>                                      |
| Iron oxide (Fe <sub>2</sub> O <sub>3</sub> ) [1309-37-1]                                  | 5 <sup>12)</sup>   | ---  | ---                                     | ---   |
| Iron oxide (Fe <sub>2</sub> O <sub>3</sub> ) [1309-37-1], fume                            | ---  | 10   | ---                                     | ---   |
| Iron oxide (Fe <sub>2</sub> O <sub>3</sub> ) [1309-37-1], dust and fume, as Fe            | ---  | ---  | 5                                       | ---   |
| Magnesium oxide [1309-48-4]   | 10 <sup>13)</sup>  | ---  | ---                                     | 4 <sup>13)</sup> , [0.3 <sup>12)</sup> <sup>23)</sup> |
| Magnesium oxide [1309-48-4], fume, total particulate                                      | ---  | 15   | ---                                     | ---   |
| Manganese [7439-96-5] and inorganic compounds, as Mn                                      | 0.1 <sup>13)</sup> , [0.02 <sup>12)</sup>                      | ---5 <sup>20)</sup>  | 1, [3 <sup>14)</sup>                    | 0.2 <sup>13)</sup> , [0.02 <sup>12)</sup>             |
| Manganese [7439-96-5], fume, as Mn  | 0.1 <sup>13)</sup> , [0.02 <sup>12)</sup>                      | ---5 <sup>20)</sup>  | 1, [3 <sup>14)</sup>                    | 0.2 <sup>13)</sup> , [0.02 <sup>12)</sup>             |
| Molybdenum [7439-98-7] and soluble compounds, as Mo                                       | 0.5 <sup>12)</sup>   | 5  | ---                                     | ---   |
| Molybdenum [7439-98-7] and insoluble compounds, as Mo                                     | 10 <sup>13)</sup> , [3 <sup>12)</sup>                          | 15 <sup>19)</sup>  | ---                                     | ---   |
| Nickel [7440-02-0], elemental   | 1.5 <sup>13)</sup>   | 1  | 0.015                                   | ---   |
| Nickel [7440-02-0] soluble compounds, as Ni (ACGIH: inorganic only)                       | 0.1 <sup>13)</sup>   | 1  | 0.015                                   | ---   |
| Nickel [7440-02-0] insoluble compounds, as Ni (ACGIH: inorganic only)                     | 0.2 <sup>13)</sup>   | 1  | 0.015                                   | ---   |
| Nickel [7440-02-0] compounds, as Ni   | ---  | ---  | 0.015                                   | ---   |
| Antimony [7440-36-0] and compounds, as Sb   | 0.5  | 0.5  | 0.5                                     | ---   |
| Silica, amorphous, fused (DFG: includes [7699-41-4])                                      | ---  | [C <sup>21)</sup>  | ---                                     | 0.3 <sup>12)</sup>                                    |
| Silica, crystalline, α-quartz   | 0.025 <sup>12)</sup>   | ---  | ---                                     | ---   |
| Silica, crystalline, α-quartz, dust   | ---  | 0.05 <sup>12)</sup> , [A <sup>12)</sup> <sup>15)</sup> ,<br>[B <sup>16)</sup> <sup>19)</sup> | 0.05 <sup>12)</sup>                     | ---   |
| Silicon [7440-21-3]   | ---  | 5 <sup>12)</sup> , [15 <sup>19)</sup>  | 5 <sup>12)</sup> , [10 <sup>19)</sup>   | ---   |
| Tin [7440-31-5], metal  | 2  | 2  | 2                                       | ---   |
| Tin [7440-31-5], oxide, as Sn   | 2 <sup>17)</sup>   | ---  | 2                                       | ---   |
| Tin [7440-31-5], oxide and inorganic compounds, except SnH <sub>4</sub> , as Sn           | 2 <sup>17)</sup>   | ---  | ---                                     | ---   |
| Tin [7440-31-5], oxide and inorganic compounds, except oxide and SnH <sub>4</sub> , as Sn | ---  | 2  | 2                                       | ---   |
| Tin [7440-31-5], organic compounds, as Sn (NIOSH: except Cyhexatin)                       | 0.1, [0.2 <sup>14)</sup>                                       | 0.1  | 0.1                                     | 0.1 <sup>13)</sup>                                    |
| Tantalum [7440-25-7], metal   | ---  | 5  | 5, [10 <sup>14)</sup>                   | 4 <sup>13)</sup>                                      |
| Tantalum [7440-25-7] oxide, dust, as Ta   | ---  | 5  | 5, [10 <sup>14)</sup>                   | ---   |
| Titanium dioxide [13463-67-7]   | 10   | 15 <sup>19)</sup>  | ---                                     | ---   |
| Vanadium pentoxide [1314-62-1], as V (NIOSH: except Vanadium metal and Vanadium carbide)  | 0.05 <sup>13)</sup>  | ---  | 0.05 <sup>20)</sup> <sup>22)</sup>      | ---   |
| Vanadium pentoxide [1314-62-1] dust, as V <sub>2</sub> O <sub>5</sub>                     | ---  | 0.5 <sup>20)</sup>   | ---                                     | ---   |
| Vanadium pentoxide [1314-62-1] fume, as V <sub>2</sub> O <sub>5</sub>                     | ---  | 0.1 <sup>20)</sup>   | ---                                     | ---   |
| Ferrovandium [12604-58-9] dust  | 1, [3 <sup>14)</sup>   | 1  | ---                                     | ---   |
| Ferrovandium [12604-58-9] dust (applies to Vanadium metal and Vanadium carbide)           | ---  | ---  | 1, [3 <sup>14)</sup>                    | ---   |
| Tungsten [7440-33-7] and insoluble compounds, as W  | ---  | ---  | 5, [10 <sup>14)</sup>                   | ---   |
| Tungsten [7440-33-7], soluble compounds, as W   | ---  | ---  | 1, [3 <sup>14)</sup>                    | ---   |
| Tungsten [7440-33-7] and compounds, in the absence of Cobalt, as W                        | 3 <sup>12)</sup>   | ---  | ---                                     | ---   |
| Zinc oxide [1314-13-2]  | 2 <sup>12)</sup> , [10 <sup>12)</sup> <sup>14)</sup>           | 5 <sup>12)</sup> , [15 <sup>19)</sup>  | ---                                     | 0.1 <sup>12)</sup> , [2 <sup>13)</sup>                |
| Zinc oxide [1314-13-2], dust only   | ---  | ---  | 5 [15 <sup>20)</sup>                    | ---   |
| Zinc oxide [1314-13-2], fume  | ---  | 5  | 5, [10 <sup>14)</sup>                   | 0.1 <sup>12)</sup> , [2 <sup>13)</sup>                |
| Zirconium [7440-67-7], elemental  | 5, [10 <sup>14)</sup>  | ---  | ---                                     | 1 <sup>13)</sup>                                      |
| Zirconium [7440-67-7] compounds, as Zr (NIOSH: except Zirconium tetrachloride)            | 5, [10 <sup>14)</sup>  | 5  | 5, [10 <sup>14)</sup>                   | ---   |
| Zirconium [7440-67-7] insoluble compounds (NIOSH: except Zirconium tetrachloride)         | ---  | ---  | 5, [10 <sup>14)</sup>                   | 1 <sup>13)</sup>                                      |
| Zirconium [7440-67-7] soluble compounds (NIOSH: except Zirconium tetrachloride)           | ---  | ---  | 5, [10 <sup>14)</sup>                   | ---   |

(Continued) OCCUPATIONAL EXPOSURE VALUES <sup>1)</sup> TWA<sup>11)</sup> (ppm)

| SUBSTANCE [CAS No.] <sup>2)</sup>                    | ACGIH <sup>3)</sup> TLVs <sup>4)</sup> | OSHA <sup>5)</sup> PELs <sup>6)</sup> | NIOSH <sup>7)</sup> RELs <sup>8)</sup> | DFG <sup>9)</sup> MAKs <sup>10)</sup> |
|--|--|---------------------------------------|--|---------------------------------------|
| Phenol [108-95-2]                                    | 5                                      | 5                                     | 5 [15.6 <sup>20) 22)</sup>             | ---                                   |
| Carbon monoxide [630-08-0]                           | 25                                     | 50                                    | 35 [200 <sup>20)</sup>                 | 30                                    |
| Carbon dioxide [124-38-9]                            | 5000, [30000 <sup>14)</sup>            | 5000                                  | 5000, [30000 <sup>14)</sup>            | 5000                                  |
| Phosgene [75-44-5]                                   | 0.1                                    | 0.1                                   | 0.1 [0.2 <sup>20) 22)</sup>            | 0.1                                   |
| Hydrogen fluoride [7664-39-3] as F                   | 0.5, [2 <sup>20)</sup>                 | 3                                     | 3 [6 <sup>20) 22)</sup>                | 1                                     |
| Nitric oxide [10102-43-9]                            | 25                                     | 25                                    | 25                                     | 0.5                                   |
| Nitrogen dioxide [10102-44-0]                        | 0.2                                    | 5 <sup>20)</sup>                      | 1 <sup>14)</sup>                       | 0.5                                   |
| Ozone [10028-15-6]                                   | ---                                    | 0.1                                   | 0.1 <sup>20)</sup>                     | ---                                   |
| Heavy work   | 0.05                                   | ---                                   | ---                                    | ---                                   |
| Moderate work  | 0.08                                   | ---                                   | ---                                    | ---                                   |
| Light work   | 0.1                                    | ---                                   | ---                                    | ---                                   |
| Light, moderate, or heavy workload ( $\leq 2$ hours) | 0.2                                    | ---                                   | ---                                    | ---                                   |
| Phosphine [7803-51-2]                                | 0.05, [0.15 <sup>20)</sup>             | 0.3                                   | 0.3, [1 <sup>14)</sup>                 | 0.1                                   |

- 1) 2018 Guide to Occupational Exposure Values, ACGIH
- 2) Chemical Abstract Service Registry Number
- 3) American Conference of Governmental Industrial Hygienists
- 4) ACGIH Threshold Limit Values
- 5) U.S. Occupational Safety and Health Administration
- 6) OSHA Permissible Exposure Limits
- 7) U.S. National Institute for Occupational Safety and Health
- 8) NIOSH Recommended Exposure Limits
- 9) Deutsche Forschungsgemeinschaft
- 10) DFG Maximum Concentrations at the Workplace
- 11) Time-weighted average exposure concentration for a conventional 8-hour (TLV, PEL) or up to a 10-hour (REL) workday and a 40-hour workweek
- 12) Measured as respirable fraction of the aerosol.
- 13) Measured as inhalable fraction of the aerosol.
- 14) Short-Term Exposure Limit
- 15) A:  $\frac{250\text{mppcf}}{\%SiO_2+5}$  or  $\frac{10\text{mg}/\text{m}^3}{\%SiO_2+2}$  This standard applies to any operation or sectors for which the respirable crystalline silica standard, 1910.1053, is stayed or is otherwise not in effect.
- 16) B:  $\frac{30\text{mg}/\text{m}^3}{\%SiO_2+2}$  This standard applies to any operation or sectors for which the respirable crystalline silica standard, 1910.1053, is stayed or is otherwise not in effect.
- 17) Notice of intended changes
- 18) Measured as thoracic fraction of the aerosol.
- 19) Total dust
- 20) Ceiling limit
- 21) C: 20mppcf or  $\frac{80\text{mg}/\text{m}^3}{\%SiO_2+2}$
- 22) 15-min.
- 23) Multiplied with the material density