SAFETY DATA SHEET OF CHEMICAL PRODUCT

Entered in Safety Data Sheet Register

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Association Non-commercial Partnership
Coordination and Information Centre of CIS member-states
for alignment of regulatory practices

Deputy Director _____ /N.M. Muratova /
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NAME

technical (as per regulatory document)	Pig iron of grades ПЛ1, ПЛ2, П1, П2
chemical (as per IUPAC)	Not available
commercial	Pig iron of grades ПЛ1, ПЛ2, П1, П2
synonyms	Not available

OKPD 2 Code 2 4 . 1 0 . 1 1 . 1 2 0

TN VED Code 7 2 0 1 1 0 3 0 0 0

Reference designation and name of the regulatory, technical or information document for the product (GOST, TU, OST, STO, (M)SDS)

GOST 805-95 Pig iron. Specification

HAZARD STATEMENT

Signal word: **Hazardous**

Brief (word) **description**: Pig iron is a low-hazard substance by effect on human body according to GOST 12.1.007. In contact with skin causes irritation. In contact with eyes causes express irritation. It can cause allergic reactions if inhaled. May damage fertility or the unborn child, cause damage to respiratory organs through prolonged or repeated exposure. It is a flammable substance. May contaminate environment.

Detailed description: in 16 sections of the enclosed Safety Data Sheet

MAIN HAZARDOUS COMPONENTS	MPC w.z.,mg/m^3	Hazard class	No. CAS	No. EC
Iron (Fe)	-/10	4	7439-89-6	231-096-4

APPLICANT: JSC Ural Steel (name of organization) Novotroitsk (city)

Applicant type: manufacturer, supplier, seller, exporter, ~~importer~~
(strike out whichever is not applicable)

OKPO Code: 1 3 6 5 7 8 4 2

Emergency telephone: (3537) 66-65-88

Managing Director

_____ / E.V. Maslov /
(signature) (full name)

Safety Data Sheet (SDS) complies with UN recommendations ST/SG/AC.10/30 «GHS»

IUPAC	–	International Union of Pure and Applied Chemistry
GHS (СГС)	–	UN recommendations ST/SG/AC.10/30 Globally Harmonized System of Classification and Labelling of Chemicals
OKPD 2	–	Russian Classification of Products by Economic Activities
OKPO	–	Russian Classifier of Enterprises and Organizations
TN VED	–	Product Nomenclature of foreign-economic activity
No. CAS	–	substance number in the Register of Chemical Abstracts Service
No. EC	–	substance number in the Register of European Chemicals Agency
MPC w.z.	–	maximum permissible concentration of chemical substance in the air of working zone, mg/m^3
Signal word	–	a word used for drawing attention to the hazardous level of the chemical product and chosen in accordance with GOST 31340-2013

1 Identification of the chemical product and information about manufacturer and/or supplier

1.1 Identification of chemical product

1.1.1 Technical name	Pig iron of grades ПЛ1, ПЛ2, П1, П2 (hereinafter referred to as the product) [1]
1.1.2 Brief application recommendations (including limitations on application)	For further steelmaking or for remelting in foundries to produce castings [1]

1.2 Information about the manufacturer and/or supplier

1.2.1 Full legal company name	Joint Stock Company Ural Steel (JSC Ural Steel)
1.2.2 Address (postal and legal)	1, Zavodskaya str., Novotroitsk, Orenburg region, 462353
1.2.3 Telephone, including for emergency consultations and hours of work	(3537) 66-65-88, 66-20-66, 66-65-82 from 06-15 to 15-15 o-clock (Moscow time)
1.2.4 Fax	(3537) 66-25-27 (round-the-clock)
1.2.5 E-mail	m.mishchenko@uralsteel.com; TK395@vuhin.ru

2 Hazard(s) identification

2.1 Hazard class of chemical product in general:
(information on hazard classification in accordance with RF legislation (GOST 12.1.007-76) and GHS)

Low-hazard product by effect on human body according to GOST 12.1.007, class 4 (by iron) [1,2].

Classification according to GHS:

Chemical product causing skin damage (necrosis)/irritation, class 2;
Chemical product causing serious eye damage/irritation, class 2A;
Chemical product which has sensitizing effect if inhaled;
Chemical product affecting reproductive function, class 1A;
Chemical product with selective toxicity which targets certain organs and/or systems in case of repeated/prolonged exposure, class 2 [3,4,5,6,7]

2.2 Information on the warning marking as per GOST 31340-2013

2.2.1 Signal word: **Danger** [7]

2.2.2 Danger symbols

Exclamation mark

Hazard for human health

2.2.3 Brief description of hazard (H-phrases)

H315: Causes skin irritation;
H319: Causes serious eye irritation;
H317: May cause an allergic reaction if inhaled;
H360: May damage fertility or the unborn child;
H373: May cause damage to organs through prolonged or repeated exposure [7].

3 Composition (information on ingredients)

3.1 Information on the product in general

3.1.1 Chemical name (as per IUPAC) — Not available [1,4]

3.1.2 Chemical formula — Not available [1]

3.1.3 General description of composition (taking into account the grade range; production method) — Pig iron is melted from copper-containing ore grades ПЛ1, ПЛ2, П1, П2 [1].

3.2 Ingredients

(name, CAS and EC numbers, mass fraction (must be 100% in total), MPC w.z. or ASLI w.z., hazard classes, references to information sources)

Table 1 [1,3,8]

Ingredients (name)	Mass fraction, %	Hygienic standards in the air of working zone		CAS No.	EC No.
		MPC w.z., mg/m^3	Hazard class		
Iron (Fe)	92,36 (min)	-/10 (a)	4 (F)	7439-89-6	231-096-4
Carbon (C)	4,50 (max)	not identified	not identified	7440-44-0	931-328-0
Silicon (Si)	1,20 (max)	not identified	not identified	7440-21-3	231-130-8
Manganese (Mn)	1,50 (max)	0,6/0,2 (a)	2	7439-96-5	231-105-1
Phosphorus (P)	0,30 (max)	not identified	not identified	7723-14-0	231-768-7
Sulphur (S)	0,05 (max)	-/6 (a)	4	7704-34-9	231-722-6
Chrome (Cr)	0,04 (max)	not identified	not identified	7440-47-3	231-157-5
Titanium (Ti)	0,05 (max)	-/10 (a)	4 (F)	7440-32-6	231-142-3

(a) – aerosol;
(F) – aerosols of mainly fibrogenic action

4 First aid measures

4.1 Symptoms

4.1.1 In case of inhalation — Throat irritation, cough, faintness, siderosis, bronchitis, early emphysema, dry pleuritis, pneumoconiosis [3,9,10,11].

4.1.2 In case of skin contact — Thermal burns are possible in contact with molten product [3,9,10,11].

4.1.3 In case of eye contact — Thermal burns, blindness are possible in contact with molten product [3,9,10,11].

4.1.4 In case of ingestion — Dizziness, gastrointestinal upset, pain, nausea, vomit [3,9,10,11].

4.2 First aid measures for the injured persons

4.2.1 In case of inhalation — Help the victim go out into fresh air, loosen tight clothing, ensure rest and warmth. Seek medical attention [9,10].

4.2.2 In case of skin contact — Remove contaminated clothes and wash the skin with running water/take a shower [9,10].

4.2.3 In case of eye contact — Immediately flush with large amount of water (remove contact lenses, if it is easy to do) keeping the eyelids wide open. Seek medical attention [9,10].

4.2.4 In case of ingestion — Flush mouth cavity with water. Drink a lot of water. Take activated charcoal, saline purgative. Hospital admission [9,10].

4.2.5 Contraindications — In case of thermal burn, do not try to separate clothes from the affected area, this may affect living tissue [9,10].

5 Measures and media for fire and explosion safety

5.1 General characteristic of fire and explosion hazards (as per GOST 12.1.044-2018)	Flammable, non-explosive substance. Small particles (powder) of the product can ignite spontaneously in the air without heating [12,13].
5.2 Indices of fire and explosion hazards (list of indices as per GOST 12.1.044-2018 and GOST 30852.0-2002)	Boiling point: 1,538 °C; Melting point: 1 538 °C at pressure of 10,1 kPa; Kindling point: 350 °C at pressure of 101,325 kPa [3,12,13,14].
5.3 Hazards caused by combustion products and/or thermal decomposition	Smoke. Body surface burns. When burning, exudes toxic products which cause poisoning (carbon and sulphur oxides; hydrogen). In case of poisoning: headache, pounding in the temples, dizziness, dry cough, chest pain, nausea, vomit; possible excitement accompanied by visual and auditory hallucinations. Skin redness [3,11].
5.4 Recommended fire-fighting media	Extinguish from a maximum distance using powders, dry sand; in case of total flooding, use carbon dioxide, argon. [13]
5.5 Prohibited fire-fighting media	Straight streams of water [13,15]
5.6 Personal protective equipment for fire-fighting (PPE of fire-fighters)	General service uniform (jacket and pants with removable heat-insulating lining) complete with a fire-fighting lifebelt, gauntlets or gloves, a fire hat, special protective footwear. [16]
5.7 Specific methods of extinguishing	Do not use water for extinguishing molten product, it can cause an explosion [13]

6 Emergency prevention and response

6.1 Measures to be undertaken to prevent harmful effect on people, environment, buildings, constructions, etc. in emergency situations

6.1.1 General measures to be taken in emergencies	Isolate the hazardous zone in a radius of no less than 200 m. Correct the above distance on the basis of the results of chemical monitoring. Keep unauthorized people away. Enter the hazardous zone using protective means. Follow the fire safety measures. No smoking. Eliminate flame and spark sources. Give first aid to the injured. Send the people from the affected area for medical check-up. [17]
6.1.2 Personal protective equipment in emergency situations (PPE of emergency response teams)	**For chemical monitoring** – PDU-3. **For emergency teams** insulating protective suit KIH-5 complete with insulating gas mask or breathing apparatus. **In case of fire** – a fireproof suit complete with SPI-20 self-rescuer. In the absence of these samples: an all-service protective suit L-1 or L-2 complete with an industrial gas mask and filter boxes. Oil-and-petrol resistant gloves, gloves made of butyl rubber dispersion, special clothes and footwear. [17]

6.2 Emergency procedures

6.2.1 Response to spillage, leakage, overflow (including response measures and precautions for environment protection)	**At the production sites:** collect the product into a container using dry means and return to the process cycle. Wash the area with water, send the contaminated water to the water treatment plant. Collect the spilled product in a marked container following the safety measures and using PPE.

	Outside production sites: report to regional Rospotrebnadzor offices and environmental authorities. Do not touch the spillage without using PPE. Avoid spillage getting into surface waters. Prevent contact with flammable materials. [9,17]
6.2.2 Response to fire	Call fire-fighters and remove people from the affected area, start extinguishing the fire using all available means. Enter the emergency area in protective clothes and breathing apparatus. After fire suppression, make MPC measurements, then people access can be permitted. [9,17]

7 Rules for handling and storage of chemical product

7.1 Safety measures for chemical product handling

7.1.1 Systems of engineering safety measures	General extract and input ventilation ensuring content of harmful substances in concentrations not higher than MPC. Air tightening of the production equipment. In case of emergency (accidental) shutdowns of ventilation and impossibility of stopping the production process, automatic switch on of backup fans. Use of dust suppression and dust catching means, mechanized removal of product spills, automation of processes. Regularly clean production areas of dust using pneumatic cleaning, water wash or other methods. Control dust content in the air. Use personal protective equipment during work (see section 8).[18,19]
7.1.2 Measures on environmental protection	Monitoring of established MPCs, waste disposal regulation. Arrangement of ventilation exhausts with further air purification in the places of possible product dust generation. Prevent product spills. Follow the regulations for sewage water treatment and discharge. In case of emergency sewage water discharge, use collecting tanks. Arrangement of a zero-discharge water system, environmental control systems with the use of modern equipment. Prevent sewage water from entering the drainage system. Landscaping and infrastructure development of the company premises. [19]
7.1.3 Recommendations on safe handling and transportation	Installation of air-tight dust suppression systems, automatic stop of transport process line. Regular function checks of safety interlocks, alarm systems and fire protection system. All communications should undergo annual inspection by a committee. Trackless mechanized transport (battery-driven trucks, autotrucks, forklifts) should be equipped with brakes, audio alarm, lighting devices. Mechanized handling. Handling should be mechanized as much as possible. [18,19,20,21,22,36]

7.2 Rules for chemical products storage

7.2.1 Safe storage life and conditions: (including guaranteed storage life, expiry date; substances and materials incompatible for storing)	Stored indoors. Guaranteed storage life of the product is not specified [1]

7.2.2 Containers and packing (including materials from which they are made)	The product has no packing. Transported and stored in bulk [1]
7.3 Safety measures and storage rules for household use	Pig iron is not used in the household. [1]

8 Exposure controls and personal protection

8.1 Working zone parameters subject to obligatory control (MPC w.z. or ASLI w.z.)	MPCw.z.: -/10 mg/m^3 (aerosol) [8]
8.2 Measures on keeping hazardous agents within permissible concentrations	Monitoring of content of harmful substances in the working zone air. General extract and input ventilation. Automation of processes. Air-tightness of equipment and units. Cleaning of rooms every shift. Following the rules for disposal and storage of wastes. [18,19]
8.3 Personal protective equipment for personnel	
8.3.1 General recommendations	Training personnel in safe handling, including first aid measures. Organization and furnishing of first aid centres. Having timely preliminary (when employed) and regular medical examinations. Provision of information to employees and newly employed people about hazardous product properties, use of PPE. Follow personal hygiene rules. It is prohibited to use labour of pregnant and breast-feeding women. [18,19]
8.3.2 Respiratory protection (types of respiratory protective equipment)	Respirators designed for protection of respiratory organs from different kinds of dust type. In emergency situations and in case of exceeding MPC more than 100 times, use compressed air breathing apparatuses (ASV-2, Dräger VDA, Spiromatic QS, etc.) [23]
8.3.3 Protective means (material, type) (working clothes, special footwear, hand protection, eye protection)	**Working clothes:** cotton or cloth suit, apron or robe. **Special footwear:** leather boots, or rubber boots, tarpaulin boot covers. **Hand and skin protection:** tarpaulin gauntlets or gloves with polymer covering. Protective cream, pastes. **Eye protection**: protective glasses of grades ZN 5, ZN 18 (V, G), ZN 9-F and others. In order to avoid misting on the glasses use washers made of NP film (inserted inside protective glasses), GEZhE type pencil or PK-10 type liquid. [24,25,26,27,28]
8.3.4 Personal protective equipment in household use	Pig iron is not used in the household. [1]

9 Physical and chemical properties

9.1 Physical state (aggregative state, colour, odour)	Hot metal is cast into pigs without narrows of metallic grey colour. [1,3]

9.2 Parameters characterizing the product basic properties (temperature parameters, pH, solubility, coefficient n-octanol/water and other parameters specific to the type of the product)	Boiling point: 2 861 °C at pressure of 101,3 KPa; Density: 7,87 g/cm at 20 °C. Insoluble in water. [3,13]

10 Stability and reactivity

10.1 Chemical stability (for unstable products specify decomposition products)	Stable when handling and storage rules are observed. [1,3]
10.2 Reactivity	Thermal oxidizing breakdown can cause generation of vapours containing iron and manganese oxides, and other alloying elements. [11,29]
10.3 Conditions to avoid (including those which may cause dangerous reactions upon contact with incompatible substances and materials)	In contact with acids emits hydrogen, iron oxide dust is created with calcium hypochlorite. [9,11,29]

11 Toxicological information

11.1 General description of effects (assessment of a level of hazardous (toxic) effects on a human body and the most typical hazardous consequences)	Low-hazard product by effect on human body according to GOST 12.1.007 (by iron) [1,2] General toxic action is determined by aggregative state and conditions of use. [3]
11.2 Routes of exposure (inhalation, ingestion, skin and eye contact)	Inhalation, ingestion, skin and eye contact. [3,11]
11.3 Affected organs, tissues and systems	Central nervous, cardiovascular and respiratory systems, gastrointestinal tract, liver, kidneys, spleen, hemic system, skin, conjunctivas. [9,10]
11.4 Information on dangerous to health effects from direct exposure to the product, as well as consequences of this exposure: (irritation of upper respiratory tract, eyes, skin, including skin resorptive and sensitizing effects)	In case of long-term or repeated exposure causes irritation of upper respiratory tract. Irritates conjunctivas and skin. Has skin resorptive and sensitizing effects when inhaled. [1,3,9,10]
11.5 Information on long-term dangerous to health effects from exposure to the product (influence on reproduction function, carcinogenicity, mutagenicity, cumulative and other long-lasting effects)	Has embryotropic and teratogenic effects. Slight cumulative effect. [30]

11.6 Values of acute toxicity:
(DL_{50} (LD_{50}), route of receipt (injected into stomach, external contact), type of an animal; CL_{50} (LC_{50}), exposure time (h), type of animal)

Experimental data about acute toxicity of product in general is absent. Values of acute toxicity are given based on computational method by ingredients:

Table 2 [3]

Substance	Effect	Value, mg/l	Exposure time, h.	Type of animal
Manganese	CL_{50}	5,14	4	rats
Phosphorus	CL_{50}	> 5,75	4	rats
Sulphur	CL_{50}	> 5,43	4	rats
Chrome	CL_{50}	5,41	4	rats

Table 3 [3]

Substance	Effect	Value, mg/kg	Route of entry	Type of animal
Iron	DL_{50}	5000	intragastric	rats
Manganese	DL_{50}	> 2 000	intragastric	rats
Phosphorus	DL_{50}	> 2 000	intragastric	rats
Sulphur	$DL_{50,}$	> 2 000	intragastric	rats
Chrome	$DL_{50,}$	5 000	intragastric	rats
Carbon (C)	DL_{50}	> 2 000	intragastric	rats
Silicon	$DL_{50,}$	> 5 000	intragastric	rats
Titanium	DL_{50}	> 5 000	intragastric	rats

DL_{50} = 100/0.040326 = 2 479,8 [5]

CL_{50} = 0,45 / 0,0468 = 9,615 mg/l = 9615 mg/m^3 [5]

12 Ecological information

12.1 General description of effects on environment
(air, water, soil including observable signs of exposure)

Can affect the environment only when handling rules are not observed. Product dust can be present in the air in the form of particles. If dust gets into atmospheric air, it can settle on leaves of plants inhibiting their growth. After dust catching, small amounts get into the air. The product is not dangerous for soils. In case of getting into water bodies can form a film on the water surface, make water turbid, cause changing of sanitary conditions of water bodies [11,29].

12.2 Environmental impact routes

Spills, violation of handling, storage, transportation rules, in case of unorganized disposal and incineration of wastes, as a result of emergency situations [10].

12.3 The most important characteristics of impact on environment

12.3.1 Hygienic regulations
(permissible concentrations in atmospheric air , water, incl. fishponds, soil)

Table 4 [31,32,33,34]

Ingredients	MPC in atm. air or SRLI in atm. air, mg/m^3 (LHI [1], hazard category)	MPC in water[2] or target concentration level in water, mg/l (LHI, hazard category)	MPC in fishery[3] or SRLI in fishery, mg/l (LHI, hazard category)	MPC or approximate permissible concentration in soil, mg/kg (LHI)
Iron	not specified	0,3(1) (org.col., 3)	0,1 (tox., 4) for sea water: 0,05 (tox., 2)	not specified
Silicon	not specified	10 (s.-t., 2)	not specified	not specified
Manganese	0,01/0,001 (res., 2)	0,1 (org. col., 3)	0,01 (san.-tox., 4) for sea water: 0,05 (tox.,4)	not specified
Phosphorus	not specified	0,0001 (s.-t., 1)	0,00001 (san., 1)	not specified
Sulphur	0,07	not specified	10 (tox., 4)	not specified
Chrome	0,0015 (res., 1)	0,05 (s.-t., 2)	not specified	not specified
Titanium	not specified	0,1 (gen., 3)	0,06 (tox., 4)	not specified

[1] LHI – limiting hazard index (tox. – toxicological; s.-t. – sanitary - toxicological; org. – organoleptic with indication of changes in organoleptic properties of water (od. – changes water odour, tur. – increases water turbidity, col. – colours water, foam – causes foaming, film – creates film on the water surface, taste – changes water flavour, op. – causes opalescence); refl. – reflective; res. - resorptive; refl.-res. - reflective-resorptive, fishery – fish industry (change of commercial qualities of aquatic organisms) ; gen. – general sanitary).

[2] Water of water bodies for household and community use

[3] Water of water bodies for fish industry (including seas)

12.3.2 Ecotoxicity values (CL, EC, NOEC for fish, daphnia magna, algae, etc.)

Table 5 [3]

Substance	Effect	Value, mg/l	Type	Expo ure time, h.
Manganese	CL_{50}	> 3,6	Fish	96
	EC_{50}	> 1,6	Daphnia Magna	48
Silicon	EC_{50}	250	Green alga	72
Phosphorus	CL_{50}	> 100	Salmon	72
Chrome	EC_{50}	17,7	Daphnia Magna	48
Titanium	CL_{50}	> 10 000	Fish	96

CL_{50} = 1,85 / 0,0001831 = 10 103, 8 mg/l

EC_{50} = 2,74 / 0,010122693 = 270,7 mg/l [6]

12.3.3 Migration and transformation in the environment due to biodegradation and other processes (oxidation, hydrolysis or similar) — Metallic dust can migrate into soil and subsoil waters. [3]

13 Waste (remains) disposal recommendations

13. Safety measures for handling of waste generated as a result of use, storage, transportation — Similar to those used for handling the main product and given in sections 7 and 8 of SDS. Use of PPE, minimum use of manual labour, exclusion of waste accumulation in the work places, observing limits of accumulation and criterion of maximum permissible waste accumulation. Use of mechanized motor transport. [35]

13.2 Information on locations and methods of neutralization, utilization or disposal of waste, including containers (packing) — Places of waste disposal should be agreed with sanitary and environmental protection services.
Wastes from spills of product mixed with absorbents should be collected in a sealed container, delivered to the waste collection site and temporary stored on site, then it is stored outside the site in the industrial waste landfill or in a sludge dump.[3,41]

13.3 Recommendations on removal of waste formed in household use — Pig iron is not used in the household. [1]

14 Transport information

14.1 UN number:
(according to UN recommendations on hazardous goods transportation) — None [37,40]

14.2 Proper shipping name and name while in shipment — Shipping name: Pig iron of grades ПЛ1, ПЛ2, П1, П2 [1]

14.3 Modes of transport used — By rail, truck [1]

14.4 Cargo hazard classification according to GOST 19433-88: [38]

- class — Not classified as hazardous cargo
- subclass
- classification code
(according to GOST 19433-88 and for railway transportation)
- danger sign(s) drawing(s) number(s)

14.5 Hazardous goods classification according to UN Recommendations on hazardous goods transportation: [20]

- class or subclass — Not classified as hazardous goods
- extra hazard
- UN packing group

14.6 Transport marking: (handling signs according to GOST 14192-96) — Handling sign KEEP DRY [39]

14.7 Emergency cards: (rail-, sea- and others types of transport) — None [1,17]

15 National and international legislation information

15.1 National legislation

15.1.1 Russian Federation laws — On Environmental Protection, On Protection of Atmospheric Air, On Sanitary and Epidemiological Well-Being of Population, On Technical Regulation, On Production and Consumption Wastes

15.1.2 Documentation regulating man safety and environmental protection requirements — Not required [1]

15.2 International conventions and agreements: (whether the product is regulated by Montreal Protocol, Stockholm Convention and others) — Not regulated by international conventions and agreements

16 Additional information

16.1 Information on SDS revision (re-edition) (the following is specified: "SDS is drawn up for the first time" or "SDS is re-registered upon expiry. Previous SDS registration number..." or "Amendments made in clauses…, amendment date…") — SDS is drawn up for the first time

16.2. List of information sources used to draw up the SDS [4]

1. GOST 805-95. Pig Iron. Specification. – M.: Standard Publishing. 1995;
2. GOST 12.1.007-76. Occupational safety standards system. Noxious substances. Classification and general safety requirements. – M. : Standard Publishing. 1976;
3. Data from information system ECHA (European Chemicals Agency). [Electronic resource]: Access – http://echa.europa.eu/;
   Data from information system (eChemPortal) [Electronic resource] : Access – http://www.echemportal.org/echemportal/.
4. GOST 32419-2013. Classification of chemicals. General requirements. – M. : Standartinform. 2014;
5. GOST 32423-2013. Mixtures classification of hazard for health. – M. : Standartinform. 2014;
6. GOST 32425-2013. Classification of chemicals for environmental hazards. – M. : Standartinform. 2014;
7. GOST 31340-2013 Labelling of chemicals. General requirements – M., : Standartinform. 2014;
8. MPC/SRLI of harmful substances in working zone air: Hygienic Regulations. GN 2.2.5.3532-18/ GN 2.2.5.2308-07 with amend. 1,2. – M: Russian Register of Potentially Hazardous Chemical and Biological Substances of Ministry of Health of the Russian Federation, 2018/2007;
9. International Chemical Safety Cards (ICSC):

[4] Ordinal numbers of data sources are given in each SDS clause in the form of references

Manganese. ICSC: 0174 of March, 1995;
Chrome. ICSC: 0029 of October, 1994;
Sulphur. ICSC: 1166 of April, 2000;
Phosphorus. ICSC: 0628 of November, 1998;

10. Information card of potentially hazardous chemical biological substance.
Sulphur. Certificate of registration AT No. 000001.– M., : RPOKhBV, 1993;
Chrome. Certificate of registration AT No. 001988.– M., : RPOKhBV, 2001;
Iron. Certificate of registration AT No. 000534.– M., : RPOKhBV, 1995;
Silicon. Certificate of registration AT No. 002015.– M., : RPOKhBV, 2001;
11. Hazardous substances in industry. Inorganic and elementorganic compounds. Guide for chemists, engineers and doctors. 7th edition. Revised under the editorship of N. V. Lazarev and I.D. Gadaskina. T. 3. – L.: Chemistry. 1977;
12. GOST 12.1.044-2018 Occupational Safety Standards System. Fire and Explosion Hazards of Substances and Materials. List of Values and Methods Used to Determine Them. – M. : Standard Publishing. 2019;
13. Korolchenko A. Ya. Fire and explosion hazard of substances and materials and means of their extinguishing. M,: Association Pozhnauka. 2000;
14. GOST 30852.0-2002 (МЭК 60079-0:1998) Explosion-proof electrical equipment. Part 0. General requirements. – M. : Standartinform. 2014;
15. Medvedeva V.S. Occupational safety and fire safety in chemical industry. 2nd edition updated and revised. – M.: Chemistry. 1989;
16. GOST R 53264-2009 Fire equipment. Special clothing for fire-fighter. General technical requirements. Test methods. – M. : Standartinform. 2009;
17. Transport emergency cards for goods transported via railways of CIS, Latvia, Lithuania, Estonia (by CIS Council on Railway Transport MoM of 30.05.2008 No. 48 (edition of 19.10.2018));
18. Federal Industrial Safety Regulations and Rules "Safety Rules for the Receipt, Transportation, Use of Melts of Ferrous and Non-ferrous Metals and Alloys Based on These Melts" of 30.12.2013 No. 656;
19. Sanitary rules for ferrous metallurgy companies No. 2527-82 Approved by Chief State Medical Officer of the USSR on 22.06.82;
20. UN Recommendations on the Transport of Dangerous Goods. Orange book. Model Regulations on the Transport of Dangerous Goods;
21. Regulations on the Transport of Dangerous Goods by Motor Vehicles approved by order of RF transport Minister of 08.08.95 No. 73 (edition of 1999) – Ekaterinburg : PH Uralyurizdat, 2010;
22. Regulations on the Transport of Dangerous Goods by Railway approved by CIS Council on Railway Transport. Edition of 22.10.2014 amended of 21.05.15;
23. GOST 12.4.034-2001 (EH 133-90) Occupational safety standards system. Respiratory protective equipment. Classification and marking;
24. Personal Protective Equipment. Reference Book under the editorship of S.L. Kaminsky M., : Chemistry, 1989;
25. GOST 12.4.103-80 Special protective clothes, personal means of hands and legs protection. Classification. – M.: Standard Publishing. 1981;
26. GOST 12.4.246-2008 Personal protective means of hands. Gloves. General technical requirements. Test methods – M. : Standartinform, 2008;
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