

Section 1. Product and Company Identification

Product Name SODIUM MOLYBDATE DIHYDRATE
CAS Number 10102-40-6

Parchem - fine & specialty chemicals

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Collect Calls Accepted

Section 2. Hazards Identification

Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 (CLP/GHS): Not classified.

Classification according to Directive 67/548/EEC: Not classified.

GHS Label Elements

Pictograms:



Signal word: WARNING

Hazard and precautionary statements

Hazard Statements: Harmful if inhaled.

Precautionary Statements: Avoid breathing dust. Use only in a well-ventilated area.

Response Statements: IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.

Storage: None.

Disposal: None.

Potential Health Effects

Eyes: May cause irritation to the eyes.

Skin: May cause skin irritation.

Inhalation: Do not inhale. May cause respiratory tract irritation.



Ingestion: Do not swallow. May be harmful if swallowed.

Other hazards: The substance does not meet the criteria for a PBT or vPvB substance.
No environmental, toxicological or physico-chemical hazards identified.

Section 3. Composition / Information on Ingredients

Common Name SODIUM MOLYBDATE DIHYDRATE
Synonym(s) Sodium Molybdate Dehydrate. Disodium Molybdate Dihydrate. Sodium Molybdate Crystals
Formula $\text{Na}_2\text{MoO}_4 \cdot 2 \text{H}_2\text{O}$
CAS Number 10102-40-6

| COMPONENT | CAS NUMBER | CONCENTRATION |
|----------------------------|------------|---------------|
| SODIUM MOLYBDATE DIHYDRATE | 10102-40-6 | 100% |

Section 4. First Aid Measures

Description of first aid measures

Note: Sodium Molybdate is not classified as a hazardous substance and no substance-specific toxicological hazards are expected. Nevertheless, the following generic first aid measures should be applied as usual when handling any chemical substance.

General Advice: First-aid responders should wear suitable personal protective equipment in case of insufficient ventilation or possible inhalation or eye contact.

Following Inhalation: Remove patient from exposure and bring to fresh air. If breathing has stopped, perform artificial respiration and get medical advice/attention immediately.

Following skin contact: Wash skin with water and soap, and rinse thoroughly. If skin irritation occurs, get medical advice/attention.

Following eye contact: Check for and remove and contact lenses. Immediately flush eyes with plenty of water, occasionally lifting upper and lower eyelids, for several minutes. If irritation occurs, get medical advice/attention.

After ingestion: Seek medical advice/attention if feeling unwell.

Most important symptoms and effects, both acute and delayed: Acute or delayed effects are not anticipated for Sodium Molybdate.

Indication of any immediate medical attention and special treatment needed: No specific treatment expected to be required.

PPE first responders: Dust mask, safety goggles and gloves and are recommended.

Section 5. Firefighting Measures

Note: Sodium Molybdate is not flammable/combustible and it does not support fires (no oxidizing properties). Nevertheless, below some general firefighting measures are given, which should be adjusted to the surroundings (e.g. other, hazardous chemicals involved, packaging materials).



Extinguishing media

Suitable extinguishing media: Standard extinguishing media such as water, sand, foam. Use firefighting measures that suit the location and surroundings. Sodium Molybdate is not considered flammable or combustible.

Unsuitable extinguishing media: None. Use firefighting measures that suit the location and surroundings.

Special hazards arising from the substance or mixture: None.

Advice for firefighters: Standard extinguishing media such as water, sand, foam. Use firefighting measures that suit the location and surroundings. Sodium Molybdate is not considered flammable or combustible.

Section 6. Accidental Release Measures

Note: Sodium Molybdate is not classified as a hazardous substance and no substance-specific toxicological or ecotoxicological hazards are expected. Nevertheless, the following generic accidental release measures should be applied as usual when handling any chemical substance.

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel: Avoid formation and inhalation of dust. Seek to ensure ventilation that maintains airborne concentrations below Occupational Exposure Limits. Keep unprotected persons away. Although the substance has no acute toxicity, it is advised to avoid contact with skin, eyes, and clothing - wear suitable protective equipment.

For emergency responders: Avoid formation and inhalation of dust. Seek to ensure ventilation that maintains airborne concentrations below Occupational Exposure Limits. Keep unprotected persons away. Although the substance has no acute toxicity, it is advised to avoid contact with skin, eyes, and clothing - wear suitable protective equipment.

Environmental precautions: Although the substance is not classified as dangerous to the environment, it is advised that in the event of an accidental release the product should be prevented from reaching the sewage system or any water course, and from penetrating the ground/soil. Dispose of spilled material in accordance with the relevant local regulations.

Methods and material for containment and cleaning up: Avoid formation and inhalation of dust. Use an appropriate industrial vacuum cleaner, equipped with ULPA or HEPA filters. Collect spilled material in suitable containers or bags for recovery or disposal.

Section 7. Handling and Storage

Note: Sodium Molybdate is not classified as a hazardous substance and no substance-specific toxicological or ecotoxicological hazards are expected. Nevertheless, the following generic advice on handling and storage should be followed as for any chemical substance.

Precautions for safe handling

Protective measures: Avoid formation of dust, inhalation and ingestion. General occupational



hygiene practice should always be followed.

Advice on general occupational hygiene: Avoid formation of dust, inhalation and ingestion. General occupational hygiene measures are required to ensure safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating, drinking and smoking at the workplace and wearing standard working clothes and shoes unless otherwise stated. Wash hands after contact with the powder or fume. Remove contaminated clothing and protective equipment before entering eating areas. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

Conditions for safe storage, including any incompatibilities: Store in closed container in a dry area. Do not store in open, inadequate or mislabeled packaging.

Section 8. Exposure Controls / Personal Protection

Control parameters/ Occupational Exposure Limits (OELS)

Exposure Limits: Soluble Molybdenum. 5 mg/m³ OSHA TWA; 5 mg/m³ ACGIH TWA; 5 mg/m³ DFG MAK TWA (total dust). 50 mg/m³ DFG MAK 30 minimum peak, average value, 1 time/shift.

Exposure Controls: Sodium Molybdate is not classified as a hazardous substance. High airborne dust concentrations require mechanical ventilation or a respirator mask.

Engineering Controls: Use appropriate engineering controls to minimize exposure to dust generated via routine use. Maintain adequate ventilation of workplace and storage areas.

Personal Protective Equipment

Skin: Wear protective clothing when handling this product to prevent prolonged skin contact.

Eyes and face: Wear safety glasses with side shields or goggles when handling this material.

Respiratory: Avoid breathing dust or mist. Use NIOSH approved respiratory protection equipment when air borne exposure is excessive.

Hygienic Practices: Facilities storing or using this material should be equipped with emergency eyewash, and a safety shower.

PNECs and DNELs

| Exposure Pattern | Route | Descriptor | DNEL/PNEC |
|------------------------------|------------|--|---|
| Long-term - systemic effects | Inhalation | DNEL (Derived No Effect Level) | 11.17 mg Mo/m ³ Corresponding to 28 mg Na ₂ MoO ₄ · 2 H ₂ O/m ³ |
| Long-term - chronic effects | Freshwater | PNEC (Predicted No Effect Concentration) | 12.7 mg Mo/L, equivalent to 32.0 mg Na ₂ MoO ₄ · 2 H ₂ O/L |
| Long-term - chronic effects | Marine | PNEC (Predicted No Effect Concentration) | 1.9 mg Mo/L, equivalent to 4.8 mg Na ₂ MoO ₄ · 2 H ₂ O/L |

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|-----------------------------|---------------------|--|---|
| Long-term - chronic effects | Freshwater sediment | PNEC (Predicted No Effect Concentration) | 22.6 g Mo/kg dw, equivalent to 57.0 g Na ₂ MoO ₄ · 2 H ₂ O/kg dw |
| Long-term - chronic effects | Marine sediment | PNEC (Predicted No Effect Concentration) | 1.98 g Mo/kg dw, equivalent to 4.99 g Na ₂ MoO ₄ · 2 H ₂ O/kg dw |
| Long-term - chronic effects | Soil | PNEC (Predicted No Effect Concentration) | 11.8-188 mg Mo/kg dw, equivalent to 29.8 - 474 mg Na ₂ MoO ₄ · 2 H ₂ O/ kg dw (dependent upon soil type) |
| Long-term - chronic effects | STP | PNEC (Predicted No Effect Concentration) | 21.7 mg Mo/L, equivalent to 54.7 mg Na ₂ MoO ₄ · 2 H ₂ O/L |

Exposure controls: This substance is not classified as a hazardous substance and no substance-specific toxicological or ecotoxicological hazards are expected. Nevertheless, in some circumstances high airborne dust concentrations may require local or general ventilation to control worker exposure in general. Where ventilation is unable to control the workplace dust levels to below the OEL, then respirator controls must be used. However, no exposure controls specific to this substance are required, other than good hygiene practice and adherence to national and regional provisions with regards to exposure to dusts in the workplace. National, regional or local provisions or limit values may also apply for emissions to air or water.

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| Section 9. Physical and Chemical Properties |
|---|

Appearance/Color: Solid, crystalline, colorless to white, odorless, inorganic.

Odor: Odorless.

Odor threshold: Not applicable as odorless.

pH (neat): 7.0 - 10.0

Melting point: Sodium Molybdate Dihydrate decomposes at ca. 100°C (loss of water of crystallization). For the anhydrous, a melting point of 687°C has been reported.

Boiling point and Range: Not available.

Flash point: Not applicable as only relevant for liquids or low melting point solids.

Evaporation rate: Negligible at ambient temperatures.

Flammability (solid, gas): Not flammable.

Upper/lower flammability or explosive limits: Not explosive.

Vapor pressure: Low to negligible.

Vapor density: Not applicable (there are no Sodium Molybdate vapors).

Relative density: 2.59 at 20°C.

Solubility: 654 g/L in water at 20°C.

Partition coefficient n-octanol/water: Not applicable for inorganic substances.

Auto-ignition temperature: Not applicable (Sodium Molybdate is not combustible/flammable and thus does not auto-ignite).



Decomposition temperature: Sodium Molybdate Dihydrate decomposes at ca. 100°C (loss of water of crystallization, formation of Anhydrous Sodium Molybdate).

Viscosity: Not applicable. (Solid).

Explosive properties: Non explosive.

Oxidizing properties: Not oxidizing. Read-across from study with pure molybdenum trioxide (MoO₃), which also contains molybdenum in its highest oxidation state (+VI).

Section 10. Stability and Reactivity

Reactivity: Stable under ambient temperatures and pressures.

Chemical stability: Stable under ambient temperatures and pressures.

Possibility of hazardous reactions: Molybdates react violently or explosively when reduced to molybdenum by heating with zirconium. Furthermore, in the preparation of dyestuffs from aniline, nitrobenzene (as oxidant), hydrochloric acid and sodium hydroxide, ferric chloride is often used as catalyst, but Sodium Molybdate was substituted as a more effective catalyst. The materials were charged into a 4.5 m³ reactor and heating was started after addition of nitrobenzene, but the temperature controller was mis-set, and overheating at a high rate ensued. The exothermic reaction was much higher than normal because of the more effective catalyst, and partial failure of the cooling water led to an uncontrollable exothermic reaction. Other hazardous reactions have not been identified.

Conditions to avoid: Avoid exposure to extreme temperatures, contact with incompatible chemicals, uncontrolled contact with accelerants. Sodium Molybdate will explode on contact with molten magnesium.

Incompatible materials: It is incompatible with oxidizing agents and alkali metals. Sodium Molybdate will violently react with interhalogens (e.g., bromine pentafluoride; chlorine trifluoride).

Hazardous decomposition products: No hazardous decomposition products have been identified.

Section 11. Toxicological Information

Information on toxicological effects

| Toxicity Endpoints | Description of Effects |
|---|---|
| Toxicokinetics: Absorption, Distribution, Metabolism and Excretion: | Molybdenum is an essential element. Uptaken Sodium Molybdate dissolves and exists predominantly in the form of the molybdate ion (MoO ₄ ²⁻). Oral absorption: Rapid and almost complete absorption through GI tract. Inhalation absorption: Well absorbed based on animal data. Absorption in humans dependent on particle size, deposition/clearance. Dermal absorption: Low to negligible. Metabolism: No metabolism. Molybdenum compounds transform quickly to molybdate anions (MoO ₄ ²⁻) upon dissolution. Excretion: Rapidly eliminated |

| | |
|------------------------------------|--|
| | from plasma predominantly via renal excretion (>80%), and faeces (<10%). |
| Acute toxicity: | Low acute toxicity LD50, oral, rat: between 2733 and 6556 mg/kg bw (male/female). LD50, dermal, rat: > 2000 mg/kg bw (male/female). LD50, inhalation, rat (4h): > 1.93 mg/L (male/female). |
| Skin corrosion/irritation: | Not irritating / not corrosive to the skin. |
| Serious eye damage/irritation: | Not irritant / not corrosive to the eyes. |
| Respiratory or skin sensitization: | Sodium Molybdate is not sensitizing to the skin. There is no data indicating respiratory sensitization. |
| Germ-cell mutagenicity: | Not a germ cell mutagen. Negative test results three tests with Sodium Molybdate for: Bacterial reverse mutation assay, in vitro micronucleus assay in human lymphocytes, and in vitro gene mutation assay (tk) in mouse lymphoma cells. Change inhibition capacity - Escherichia coli 16 mmol/L; sex chromosome Loss and non -disjunction - Saccharomyces cerevisiae 80 mmol/L. |
| Carcinogenicity: | Not a carcinogen. (Read-across for absence of systemic carcinogenicity, based on chronic toxicity and carcinogenicity studies with molybdenum trioxide. Local effects in the lung observed in these molybdenum trioxide studies are specific to molybdenum trioxide and not read-across to Sodium Molybdate). |
| Reproductive toxicity: | There are currently no reliable scientific data available indicating adverse effects on human reproduction or fertility. 16474 ug/kg intratesticular - mouse TDLo 1 day male. |
| STOT-single exposure: | There are no specific target organ effects after single exposure to Sodium Molybdate. |
| STOT-repeated exposure: | No reliable scientific data available indicating adverse systemic effects after repeated exposure to molybdenum substances. |
| Aspiration hazard: | Not applicable (not an aerosol/mist). |

Section 12. Ecological Information

Toxicity: Reliable acute aquatic toxicity test results (tests conducted with Sodium Molybdate; UV-spectra of aqueous solutions of Sodium Molybdate Dihydrate demonstrated that the only dissolved molybdenum species, originating directly from Sodium Molybdate Dihydrate is Molybdate); critical

values for classification are also expressed as mg Na₂MoO₄·2H₂O)

| Test Organisms | End-point | Range of values |
|---|-------------------------|---|
| Freshwater fish: Pimephales promelas | 96h-LC50 | 609 - 681.4 mg Mo/L (1,536-1,718 mg Na ₂ MoO ₄ ·2H ₂ O/L) |
| Freshwater fish: Oncorhynchus mykiss | 96h-LC50 | 7600 mg Mo/L |
| Freshwater fish: Oncorhynchus mykiss | 96h-LC50 | 781 - 1339 mg Mo/L (recalculated - logistic fit) |
| Invertebrates: Daphnia magna | 48h-LC50 | 1680.4 - 1776.6 mg Mo/L |
| Invertebrates: Daphnia magna | 48h-LC50 | 2729.4 mg Mo/L |
| Invertebrates: Daphnia magna | 48h-LC50 | 2847.5 mg Mo/L |
| Invertebrates: Daphnia magna | 48h-LC50 | 130.9 mg Mo/L (330.1 mg Na ₂ MoO ₄ ·2H ₂ O/L) |
| Invertebrates: Ceriodaphnia dubia | 48h-LC50 | 1005.5 - 1024.6 mg Mo/L |
| Invertebrate (aq. worm): Girardia dorocephala | 96h-LC50 | 1226 mg Mo/L |
| Algae: Pseudokirchneriella subcapitata | 72h-ErC50 (growth rate) | 295.0 - 390.9 mg Mo/L 289.2 - 369.6 mg Mo/L Geom. mean: 333.1 mg Mo/L (840 mg Na ₂ MoO ₄ ·2H ₂ O/L) |

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

Reliable chronic toxicity test results (read-across from tests with Sodium Molybdate; UV-spectra of aqueous solutions of Sodium Molybdate Dihydrate demonstrated that the only dissolved molybdenum species, originating directly from Sodium Molybdate Dihydrate is Molybdate)

| Test organisms | Range of values (EC10 or NOEC) |
|--|--------------------------------|
| Oncorhynchus mykiss, Pimephales promelas, Pseudokirchneriella subcapitata, Ceriodaphnia dubia, Daphnia magna, Chironomus riparius, Brachionus calyciflorus, Lymnaea stagnalis, Xenopus laevis, Lemna minor | 43.3-241.5 mg Mo/L |
| Mytilus edulis, Acartia tonsa, Phaeodactylus tricornutum, Cyprinodon variegatus, Americamysis bahia, Crassostrea gigas, Dendraster excentricus, Dunaliella tertiolecta, Ceramium tenuicorne, Strongylocentrotus purpuratus | 4.4-1,174 mg Mo/L |

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|--|------------------------------|
| Annelid worms: Enchytraeus crypticus, Eisenia andrei | 7.88-1661 mg Mo/kg dw (n=11) |
| Arthropod: Folsomia candida | 37.9- >3,395 mg Mo/kg dw |
| Plants: Hordeum vulgare, Brassica napus, Trifolium pratense, Lolium perenne, Lycopersicon esculentum | 4-3,476 mg Mo/kg dw |
| Soil micro-organisms (nitrification, glucose-induced respiration, plant residue mineralization) | 10-3,840 mg Mo/kg dw |

Tests were conducted according to international test guidelines (e.g., OECD, ASTM, ISO, EPA). Toxicity data for micro-organisms (for STP) (values were determined using molybdenum trioxide unless indicated otherwise; UV-spectra of aqueous solutions of molybdenum trioxide demonstrated that the only dissolved molybdenum species, originating directly from molybdenum trioxide is also the molybdate anion)

| Test Organisms | End-point | Range of values |
|--------------------------------------|--|-------------------|
| Domestic activated sludge population | 3h-EC50 (respiration inhibition) | 1,926 mg Mo/L |
| Domestic activated sludge population | 3h-EC50 (respiration inhibition) | 216.5 mg Mo/L |
| Domestic activated sludge population | 30 min-NOEC (O ₂ utilization) | > 950 mg Mo/L (1) |

Test conducted with Sodium Molybdate. Tests were conducted according to international accepted test guidelines or scientifically acceptable methods.

Conclusion on the environmental classification and labelling: Sodium Molybdate Dihydrate is not hazardous to the aquatic environment as: The lowest acute reference values for fish, invertebrates and algae are > 100 mg Mo/L. The lowest aquatic NOEC for these three trophic levels is > 1 mg Mo/L (i.e., 43. 2 mg Mo/L for the rainbow trout). There is no evidence for bioaccumulation or biomagnification in the environment.

Persistence and degradability: Sodium Molybdate - when released into the environment - will rapidly dissolve and will be present as the molybdate species under normal environmental conditions.

Bioaccumulative potential: Available BCF/BAF data for the aquatic environment show a distinct inverse relationship with the exposure concentration. This finding demonstrates that molybdenum is homeostatically controlled by these organisms, and this up to the milligram range of exposure. Available information on transfer of molybdenum through the food chain indicates that molybdenum does not biomagnify in aquatic food chains. Although not homeostatically controlled in terrestrial plants and invertebrates, molybdenum is not largely concentrated from soil into plants, or soil to invertebrates. There is no significant concentration increase from diet to mammals or birds. It is concluded that biomagnification is not significant in the terrestrial foodchain.

Mobility in soil: Molybdate originating from sodium molybdate dihydrate is soluble in water and with its relatively low K_d value, the molybdate ions are leachable through normal soil and are mobile



in sediment. Typical log Kd-values of 3.25 and 2.94 have been determined for sediment and soil, respectively.

Results of PBT and vPvB assessment: The PBT and vPvB criteria of Annex XIII to the REACH Regulation do not apply to inorganic substances, such as Sodium Molybdate. Therefore a PBT and vPvB assessment is not required.

Other adverse effects: Molybdate originating from Sodium Molybdate Dihydrate can contribute to the onset of molybdenosis (which is a molybdenum-induced copper deficiency) in ruminants such as cattle, deer, and sheep. The level and bio-availability of copper in the animal diet are critical factors in the onset of molybdenosis. The recommended minimum dietary Cu:Mo mass ratio threshold to prevent molybdenosis is 1.30, i.e. there should be 30% more copper than molybdenum in the (note: mass ratio, not molar ratio). Cu & Mo content in the diet can be monitored, and if the ratio is < 1.3 then provide Cu supplements such as copper sulfate enriched feeds or copper sulfate enriched salt blocks for ruminants to use ad libitum. If there are ruminants in the vicinity of the plant, identify direct and diffuse air emission sources at the plant and carry out and record emission minimization measures. Have an animal health check program in place (e.g. blood tests for copper) to verify that the measures are effective. Sodium Molybdate Dihydrate is not expected to contribute to ozone depletion, ozone formation, global warming or acidification.

Section 13. Disposal Considerations

Waste Treatment Methods: Dispose of product and contaminated packaging in accordance with all local, state, and federal environmental control regulations.

Section 14. Transport Information

Shipping Name: Not D.O.T regulated.

Hazard Class: Not Dangerous for Transport.

UN Number: None.

ADR: None

RID: None

IMDG: None

IATA: None

UN number: Not dangerous for transport.

UN proper shipping name: Not dangerous for transport.

Transport hazard class(es): Not dangerous for transport.

Packing group: Not dangerous for transport.

Environmental hazards: Not dangerous for transport.

Special precautions for user: Not dangerous for transport.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not dangerous for transport.



Section 15. Regulatory Information

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

U.S. Federal Regulations: TSCA Inventory Status: All components listed on the TSCA inventory.

TSCA 12b Export Notification: Not listed.

EINECS listed: 231-551-7

CERCLA Section 103: No

SARA TITLE III (EPCRA) Section 302/304: Not Listed.

SARA TITLE III (EPCRA) Section 311/312: Not Listed.

California Proposition 65: Not listed.

OSHA process Safety (29CFR1910.119): Not listed.

WHMIS: Non-controllable

Worldwide Chemical Inventories

Sodium Molybdate is listed in following international chemical inventories (Source: database CHEMLIST)

For CAS 10102-40-6 (Sodium Molybdate Dihydrate): EU/REACH list of pre-registered substances; AICS - Australian Inventory of Chemical Substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; ASIA-PAC; NZIoC: New Zealand Inventory of Chemicals. This substance has HSNO approval.

For CAS 7631-95-0 (Sodium Molybdate): EU/REACH list of pre-registered substances; EU EINECS (European Inventory of Existing Chemical Substances); AICS - Australian Inventory of Chemical Substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; ASIA-PAC; NZIoC: New Zealand Inventory of Chemicals. This substance has HSNO approval. DSL, Canada: Domestic Substances List; ENCS, Japan: Existing Notified Chemical Substances; ECL, Korean Existing Chemicals List; Sodium Molybdate is not a SEVESO substance, not an ozone-depleting substance and not a persistent organic pollutant.

Other regulatory information

Germany: Water Hazard class, WGK = 1 (low hazard to water)

Chemical safety assessment: A Chemical Safety Assessment has been carried out by the Molybdenum Consortium for its members for the purpose of GHS Compliance and REACH registration.

HMIS

Health: 1

Flammability: 0

Physical Hazard: 0

Personal Protection: D

NFPA

Health: 1

Flammability: 0

Reactivity: 0



Section 16. Other Information

Disclaimer: The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product.

REVISION DATE: 11/16/2017

