

SAFE HANDLING OF RUBBER CHEMICALS

REQUIREMENTS

- All statutory requirements laid down by the Local Authorities must be complied with to ensure that all chemicals are handled in a safe manner and that adequate data on their physical, chemical and toxicological properties are available and provided to all concerned.
- The employer is expected to provide working environment free from unacceptable risks that could cause harm to the employees.
- Each employee as a part of his duty must comply with the requirements of Occupational Health and Safety Standards.
- Any person who imports or supplies any substance for use at work must ensure that it is safe when properly used, the necessary tests have been carried out and adequate safety & handling precautions data is available.
- Any person actually handling chemical substances should be aware of safety precautions, hazard warnings and handling procedures associated with them.

PERSONAL HYGIENE

- Good personal hygiene at work depends on :
 - An appreciation of potential sources of industrial health hazards,
 - Careful application of recommended procedures,
 - A planned, clean and well organized working routine,
 - The provision of appropriate facilities including adequate washing, showering and Changing rooms, clean and dirty clothes storage lockers and suitable arrangements for consumption of food,
 - Special attention to location of drinking water facilities.

PRODUCT HANDLING AND STORAGE

- Rubber Chemicals should be stored in a different room (other than the rooms used for storage of Rubber, Carbon Black, Solvents or any other compounding ingredients).
- The store room should be well ventilated and extremes of humidity and temperatures should be avoided. (Select a dry & cool room for storage of rubber chemicals.)
- The ideal temperature for rubber chemicals storage is between 20 – 25°C and humidity levels between 40 – 60%. However, temperatures below 40°C and humidity levels below 70% may be acceptable for normal storage periods (e.g. 30 days) during which the storage stability is largely unaffected.
- Rubber Chemicals should never be exposed to direct sun-light, heat, moisture, vapors of any other chemicals, gases, solvents, oxidizing chemicals / atmosphere, acid / alkali or their fumes etc. to avoid

creation of any unsafe conditions, possibility of rapid degradation, changes in the physical form, loss of activity etc.

- For stocks stored above six months, it is strongly recommended that all QC-Tests be conducted to ascertain its suitability for final use.
- Free Amine can be liberated and may cause Health Hazards in case of Sulfenamide Accelerators (CBS, TBBS, MBS, DCBS, etc.) in confined or poorly ventilated places.
- Rubber Chemicals of NOCIL Product Range have a storage stability of 12 months from the date of manufacture when stored under prescribed conditions. Although most products except the sulfenamides are stable and can be stored for two years without any significant change in their activity level. Sulfenamide accelerators are prone to degradation on prolonged storage and hence should be tested before use for Methanol Insoluble % & free amine% when stored beyond 12 months under prescribed conditions.
- If a chemical is transferred to another appropriate container, it should be clearly labeled with the name / code and the hazard warning /code.
- Containers should be stacked neatly with adequate free space for easy accessibility.
- Storage should be arranged so that ingredients of the same functional type are next to each other and all containers should be kept closed when not in use.
- All Rubber Chemicals should be handled using individual and appropriate utensils (e.g. scoops, pans, trays, buckets, etc) provided and reserved for this purpose.
- 'First In-First Out' concept should be followed in case of all Rubber Chemicals.
- Storage locations must take account of all locations with respect to Fire Regulations. The storage site should be planned in such a way as to minimize the risk of Fire or Combustion of products spreading in other areas.

SPILLAGES AND DISPOSAL OF WASTE MATERIAL

- Disposal of spillage and waste must be according to Local and National Regulations (Notification to Local Authority may be necessary).
- Disposal is generally carried out either by burial on an approved site or by burning under carefully controlled conditions.
- Disposal instructions are normally provided in the MSDS.
- Spillages of Rubber Chemicals in transit, storage, during weighing or during the process of mixing in the rubber compounds should be cleaned up immediately and preferably using vacuum method to avoid dusting.
- Deposits of solids and dust should not be allowed to accumulate since they may create polluting atmosphere and a risk of Fire Hazard.
- Spillages of liquid Rubber Chemicals should be absorbed on sand or earth (for burial) or saw dust (for burning).



- After sweeping up the spillages, the contaminated area should be washed with soap and water.
- All partly used or empty packaging materials containing residues of chemicals may be subject to all procedures described here.
- For hazardous materials extra care must be taken to prevent damage to containers and the disposal of unused material, empty bags / drums etc. must be put into suitable containers to await proper disposal.
- Toxicity, fire & explosion hazards apply to mixed residues as well !!

General & Local Exhaust Ventilation

- Inhalation of chemical products in the form of mists, fine dusts, powder or fumes should always be minimized by good general ventilation.
- At specific operating points local exhaust ventilation may be provided to control the level of fumes, vapor or air borne dust at the source of emission.
- In some circumstances and as a temporary measure, breathing apparatus or dust masks may have to be provided and worn to avoid excessive exposure.

Precautions in case of fire.

- None of NOCIL Range of Rubber Chemicals is flammable but most will burn if ignited.
- Since most Rubber Chemicals contain Nitrogen and / or Sulphur; on burning, they will emit Oxides of Nitrogen and / or Sulphur which are Toxic.
- Morpholine based products (e.g. Pilcure MOR, DTDM) when heated above 130°C liberate Morpholine Vapors which are harmful. (TLV = 20 ppm.) and irritating to skin and eyes. Hence the fire fighters are recommended to wear breathing apparatus.
- For most Rubber Chemicals water, foam or carbon dioxide may be employed as firefighting medium.
- The fire hazards from Rubber Chemicals are given in individual MSDS sheets.
- The Rubber Chemicals Stores should carry posters indicating that fire fighters should wear breathing apparatus and what restrictions are there on firefighting media as well as any other special precautions.

First Aid & Medical Facilities.

- Simple First – Aid facilities should be kept readily and conveniently available with trained / qualified personnel in attendance.
- When needed, further skilled medical assistance should be sought immediately
- Medical, nursing and first aid personnel should be thoroughly familiar with specific hazards and the first aid treatments which may be required in connection with the use of any hazardous materials.



- The general advice to physicians is to treat by observation and supportive measures as indicated by the patient's condition.

First Aid

- Skin : Flush the contaminated skin with running water for 5 -10 minutes. Use soap if available. If the skin irritation persists obtain medical attention.
- Eye : Flush eye with water at least for 15 minutes. If irritation persists, obtain medical assistance.
- Inhalation: Remove the affected person to fresh air. If there is respiratory distress, give oxygen. If breathing stops or shows sign of failing, apply artificial respiration. Obtain Medical attention
- Ingestion: Owing to risk of aspiration into lungs, DO NOT INDUCE VOMITING. Obtain Medical attention.

Do's & Don'ts

- Industrial protective clothing should be worn to avoid contact with skin and eyes.
- Inhalation of dust and vapor should be avoided.
- Hands should be washed before eating, smoking, drinking or using toilet.
- No food or drink should be taken into or consumed in working areas.
- Smoking should not be allowed in handling area to avoid possible accidental ingestion or ignition of flammable materials.
- Everyone should be familiar with eye wash facilities and how to use them.
- Take a wash under shower at the end of the shift /day especially if working in atmosphere containing dust or vapor.
- For products which are eye irritants, safety spectacles should be worn.
- Safety spectacles should be worn while handling all liquid chemical substances.
- For products which are skin sensitizers, Vinyl Coated or Nitrile Rubber gloves extending over the cuffs should be used.
- If entry into or working in a dusty atmosphere is required, a suitable dust mask should be worn.
- Suppliers of safety equipments should be consulted for appropriate Personal Safety Equipments for handling toxic materials.
- Demand, read and understand the Material Safety Data Sheets (MSDS) provided by the supplier before handling chemical substances.

GENERAL INFORMATION

TOXICITY

- Toxicity is defined as the potential of a chemical substance to cause adverse effect in human beings on exposure.
- Exposure is the actual physical contact with the chemical substance.
- Hazard is the inherent ability of the chemical substance to cause harm to human being.
- Exposure to toxic hazards is from atmospheric contamination or physical contact.
- The Mode Of Entry into human body is through : Inhalation, Skin contact, Ingestion and Injection.
- Risk is the possibility that some adverse effect will occur with given exposure.
- All chemical substances (even salt, sugar etc.) are toxic at some level of exposure.
- All activities involving chemical substances involve some level of Exposure and potential Risk.
- Acute Toxicity means toxicity effects appearing immediately or shortly after exposure.

POTENTIAL HAZARDS

- Chemicals exhibit harmful effects on human beings only when they enter the body by inhalation, skin contact. Inhalation, ingestion or injection.
- Harmful effects of a chemical substance depend on its basic toxicity and the *ease with which it may be absorbed into the body.*
- Substances with low volatility or of fine particle size (prone to excessive dusting) may be more harmful to human body (than those which do not exhibit such properties but may be more toxic!)
- To prevent entry of chemical substances in to the body any risks of inhalation or physical contact have to be minimized or eliminated by using *proper handling techniques, selecting a suitable physical form and providing adequate ventilation.*
- Protection should be provided to the individual in the form of *eye and face protection, dust masks and protective clothing*
- *Everyone involved should be adequately trained* to ensure that he has a thorough understanding of each procedure and its purpose.
- Chronic Toxicity means toxicity effects appearing only after repeated exposures of short / long durations.
- LD₅₀ for acute oral toxicity is that dose of chemical substance administered which is most likely to cause death within 14 days in half the population of male and female young adult albino rats. The results are expressed in mg / kg body weight (of rat).



- LD₅₀ for acute dermal toxicity is that dose of chemical substance administered by continuous contact for 24 hr. with the bare skin albino rabbits, which is most likely to cause death within 14 days in half the population of animals tested. The results are expressed in mg / kg body weight (of rabbit).
- LD₅₀ of blends = LD₅₀ of active substance x 100 B % of active substance byweight.
- LC₅₀ for Acute Toxicity by Inhalation is the concentration of vapor, fumes, mist or dust which, when administered by continuous inhalation to both male and female young adult albino rats for one hour, causes death within 14 days in half of the animal population tested. The result is expressed in mg / lit. of air dusts and mists or ml / m³ of air (ppm) of vapors.
- The European Union (EU) has adopted following classification for assessing the toxicity of chemical substances.

| Oral LD (Rat) 50 | Rating |
|-----------------------|---------------------------------------|
| Less than 25 mg / kg | Highly Toxic. |
| 25 – 200 mg / kg | Toxic. |
| 200 – 2000 mg / kg | Harmful. |
| Over 2000 mg / kg | Unlikely to present any acute hazard. |

- This scale provides only a useful guide which indicates how much poisonous a substance may be if ingested in a single dose on a single occasion (and does not indicate the possible long term effects on exposure to lower levels).
- LCL₀ Lethal Concentration – Low is the lowest concentration of a substance in air, other than LC₅₀ , which has been reported to have caused death in humans or animals.
- IDLH Value (Immediately Dangerous to Life or Health Value) represents the maximum concentration of air borne contamination from which escape due to respiratory failure would be possible within 30 minutes without suffering permanent or escape –impairing health effects.
- For concentrations above ILDH value, a self-contained breathing apparatus (SCBA) should be used. (Below IDLH value, other type of breathing apparatus can be used)

OCCUPATIONAL EXPOSURE LIMITS (OELs)

- OEL is defined as air born concentration limit of chemical substance and provides guide to its toxicity. (This is updated time to time.)
- Maximum Exposure Limit (MEL) is a 'risk based' limit which should not be exceeded.
- Occupational Exposure Standard (OES) is 'health based' limit to ensure that the level of exposure is below the specified standard.
- These limits are used by HSE Inspectors to determine if adequate control is being achieved.
- Threshold Limit Values (TLVs) refer to air borne concentration of chemical substances and represent conditions under which nearly all workers may be repeatedly exposed day after day, five days a week, over a long period of time without any adverse effects on their health.

(A small number of workers may experience discomfort because of wide variation in individual susceptibility.)

- TLVs are laid down by American Conference of Governmental Industrial Hygienists (ACGIH) as guide lines for good practices and are not for use as relative index of hazards or toxicity.
- There are three categories of TLVs viz.:

TLV-TWA (Threshold Limit Value-Time Weighted Avg.),
 TLV-STEL (Threshold Limit Value-Short Term Exposure Limit)
 TLV-C (Threshold Limit Value-Ceiling.)

- TLV-TWA is a time weighted average concentration for a normal 8-hr shift work per day and a 40-hr work week to which all workers may be repeatedly exposed, day after day, without any adverse effect on their health.
- TLV-STEL is the concentration to which workers can be exposed continuously for a short period of time with suffering from irritation, chronic or irreversible tissue change or narcosis of sufficient degree to increase the likely hood of accidental injury, impair self-rescue or materially reduce work efficiency and also provided that the daily TLV-TWA is not exceeded.
- TLV-STEL supplements TLV-TWA where recognized acute effects from a chemical substance whose toxic effects are of a chronic nature and are reported from short term exposure in either human beings or animals.
- TLV-STEL is defined as a 15 minute time-weighted average exposure which should not be exceeded at any time during a work-day even if 8-hr time weighted average is within the prescribed TLV.
- Exposures at TLV-STEL should not exceed 15 minutes and should not repeat more than 4 times a day. There should be at least 60 minutes gap between successive exposures.
- TLV-C is the concentration of air borne contaminants that should never be exceeded even instantaneously.
- TLVs are expressed in ppm (parts per million) or in mg / m³ @ 25°C & 760 mm Hg pressure.

$$\text{mg / m}^3 = \frac{\text{ppm} \times \text{Mol.wt}}{24.45} \quad , \quad \text{ppm} = \frac{\text{mg / m}^3 \times 24.45}{\text{Mol.wt.}}$$

(At 760mm Hg, 1 kg mole = 24.45 lit @ 25°C, or 24.04 lit @ 20°C, or 22.4 lit @ 0°C)

- OELs are not dividing lines between 'Safe' & 'Dangerous' concentrations.
- The best working practice is to reduce concentrations of all air borne contaminants as far below the OEL (Target 50 % of OEL)
- The absence of particular substance from the list of OELs does not indicate that it is 'Safe'.

Carcinogenicity

- Carcinogenicity is the capacity of some agent or chemical substance to induce cancer in human beings or other animals.



- The International Agency for Research on Cancer (IARC) funded by World Health Organization carries out ongoing research to evaluate carcinogenic hazards of several materials & chemicals and classifies them as follows:

| <u>Group</u> | <u>Classification</u> |
|---------------------|---|
| Group 1 | Carcinogenic to humans. |
| Group 2A | Probably carcinogenic to humans. |
| Group 2B | Possibly carcinogenic to humans. |
| Group 3 | Not classifiable for carcinogenicity to humans. |
| Group 4 | Probably not carcinogenic to humans. |

- The European Union's system for classification of Carcinogenicity.

| <u>Category</u> | <u>Classification</u> |
|------------------------|---|
| Category 1 | Substances known to be carcinogenic to humans. Sufficient evidence of human exposure and development of cancer. |
| Category 2 | Substances which should be regarded as if they are carcinogenic to human based on appropriate long term animal studies and other relevant information. |
| Category 3 | Substances which cause concern for human beings due to possible carcinogenic effects. Provisional classification or human inducing effect insufficient for Category 2 classification. |

Mutagenecity

- Mutagenecity is the capacity of chemical substance to induce genetic changes resulting from chromosomal alterations which may be transmitted from parent to off-spring.
- The EU criteria for classification are :

| <u>Category</u> | <u>Classification</u> |
|------------------------|--|
| Category 1 | Substances known to be mutagenic to humans. There is sufficient evidence to establish a causal association between human exposure to the substance and heritable genetic damage. |
| Category 2 | Substances which should be regarded as if they are mutagenic to human beings. There is sufficient evidence to provide strong presumption that human exposure to the substance may result in development of heritable genetic damage generally on the basis of appropriate animal studies and other relevant information. |
| Category 3 | Substances which cause concern for human beings owing to mutagenic effects. There is evidence from appropriate mutagenicity studies but this is insufficient to place the substance in category 2. |

Substances Toxic to Reproduction.

- The EU criteria for classification are :

| <u>Category</u> | <u>Classification</u> |
|------------------------|--|
| Category 1 | 1) Substances known to impair fertility in humans. There is sufficient evidence to establish a causal relationship between human exposure to the substance and impaired fertility. 2) Substances known to cause developmental toxicity in human beings. There is sufficient evidence to establish a causal relationship between human exposure to the substance and subsequent development of toxic effects in the progeny. |
| Category 2 | 1) Substances which should be regarded as if they impair fertility in humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in impaired fertility on the basis of : <ul style="list-style-type: none"> - Clear evidence in animal studies of impaired fertility in the absence of toxic effects, or evidence of impaired fertility occurring at around the same dosage as other toxic effects but which is not a secondary non-specific consequence of the other toxic effects. - Other relevant information. 2) Substances which should be regarded as if they cause developmental toxicity to humans. There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in developmental toxicity on the basis of : <ul style="list-style-type: none"> - Clear results in the appropriate animal studies where effects have been observed in the absence of marked material toxicity or at around the same dosage as other toxic effects but which is not a secondary non-specific consequence of the other toxic effects. - Other relevant information. |



| | |
|-------------------|--|
| Category 3 | <p>1) Substances which cause concern for human fertility on the basis of</p> <ul style="list-style-type: none"> - Results in appropriate animal studies which provide sufficient evidence to cause a strong suspicion of impaired fertility occurring at around same dose levels as other toxic effects, but which is not a secondary non-specific consequence of other toxic effects, but where the evidence is insufficient to place the substance in category 2. - Other relevant information. <p>2) Substances which cause concern for humans owing to possible developmental toxic effects generally on the basis of :</p> <ul style="list-style-type: none"> - Results in appropriate animal studies which provide sufficient evidence to cause a strong suspicion of developmental toxicity in the absence of signs of marked material toxicity or at around same dose levels as other toxic effects, but which are not secondary non-specific consequence of other toxic effects, but where the evidence is insufficient to place the substance in category 2. - Other relevant information. |
| | <ul style="list-style-type: none"> • Carcinogenicity, mutagenicity and Toxic to Reproduction properties of a substance are not directly related to and must be considered separately from toxicity. • Source of information relating to carcinogenicity, mutagenicity and toxic to reproduction is International Agency for Research on Cancer (IARC) Monograph Series of publications on the evaluation of carcinogenic risk of chemicals to human beings. |

Dermatitis

- Some chemical substances adversely affect the skin and may produce a contact dermatitis (entrant eczema).
- Dermatitis is inflammation of the skin.
- Two types of contact dermatitis :
 - a) Irritant (more common),
 - b) Allergic.
- IRRITANT CONTACT DERMATITIS is caused by substances which affect the skin due to their inherent physical or chemical properties (e.g. alkalinity, acidity, abrasiveness, solvent effect, etc.). Contact with the skin causes direct damage which results in inflammation. The extent of damage produced is related to the properties of the substances and degree of exposure.
- Irritant contact dermatitis can be further divided into two groups.
 - 1) Acute irritant dermatitis which is caused by exposure to a substance likely to have an immediate effect on the skin. The degree of damage ranges from 'necrosis' (chemical burn) produced by potent acids and alkalis to 'chapping' from excessive hand washing (irritant action). Once the offending agent is removed, there is usually complete recovery.
 - 2) Chronic irritant dermatitis is caused by repeated exposure to one or more agents over a period of time (A single encounter is unnoticed but repeated exposure eventually produces sufficient damage to the skin to cause inflammation. Examples: solvents, detergents, etc). Action to be taken is to take measures to minimize exposure.

ALLERGIC CONTACT DERMATITIS

- Some of the *natural protective systems of the individual respond excessively to particular substances and inducing sensitization.*
- Sensitization is a process in which immunological reactivity is directed either against the whole molecule or against reactive group within the molecule provoking inflammation. *Sensitization is permanent and irreversible.*
- Susceptibility cannot be predicted but will be influenced by sensitizing capacity of the chemical and degree of exposure. *Once a person is sensitized, inflammation of skin may result from exposure to very small quantity of the chemical.*
- Action to be taken is to change the occupation of the individual has become sensitized to a chemical is obtained by patch testing under standard conditions prescribed by International Contact Dermatitis Research Group (ICDRG)

RESPIRATORY SENSITIZERS

- Substances which can induce a state of *specific air way hyper responsiveness* viz. immunological, irritant or other mechanisms.
- Once air ways become hyper responsive, further exposure to the substance even in very small quantities may cause *respiratory symptoms from a running nose to asthma.*
- Not all workers become hyper-responsive and it is *impossible to identify in advance those who are likely to be.*
- Respiratory sensitizers are assigned the risk phrase RYZ (may cause sensitization by inhalation) and are usually given a MEL (Maximum Exposure Limit).

CAS Numbers & EINECS

- Purpose is to precisely identify the chemical substance.
- CAS is the number assigned by the *Chemical Abstract Registry Service.*
- EINECS is the number assigned to a substance in the *European Inventory of Existing Commercial Chemical Substances.*

GHS Signal Word:

There are only two signal words in GHS: "**Danger**" or "**Warning**". They are used to emphasize chemical hazards and indicate the relative level of severity of the hazard. "Danger" indicates more severe hazards. Signal word is one integral part of a GHS label.

GHS Pictograms:

There are 9 GHS pictograms conveying the following types of chemical hazards:

| Physical Hazard (17 classes) | Health Hazard (10 classes) | Environmental Hazard (2 classes) |
|---|--|--|
| Explosives | Acute Toxicity (Oral/Dermal/Inhalation) | Hazardous to Aquatic Environment (Acute/Chronic) |
| Flammable gases | Skin Corrosion/Irritation | Hazardous to the Ozone Layer |
| Aerosols | Serious Eye Damage/ Eye Irritation | |
| Oxidizing Gases | Respiratory or Skin Sensitization | |
| Gases under pressure | Germ Cell Mutagenicity | |
| Flammable liquids | Carcinogenicity | |
| Flammable solids | Reproductive Toxicology | |
| Self-Reactive Substances and Mixtures | Target Organ Systemic Toxicity - Single Exposure | |
| Pyrophoric Liquids | Target Organ Systemic Toxicity - Repeated Exposure | |
| Pyrophoric Solids | Aspiration Toxicity | |
| Self- Heating Substances and Mixtures | | |
| Substances and Mixtures which, in contact with water emit flammable gases | | |
| Oxidizing liquids | | |
| Oxidizing Solids | | |
| Oxidizing peroxides | | |
| Corrosive to metals | | |
| Desensitized explosives | | |



GHS 01: Exploding Bomb
(Physical hazard)



GHS 02 : Flame
(Physical hazard)



GHS 03 : Flame over circle
(Physical hazard)



GHS 04 : Gas cylinder
(Physical hazard)



GHS 05 : Corrosion
(Physical & Health hazard)



GHS 06 : Skull and crossbones
(Health hazard)



GHS 07 : Exclamation mark
(Health hazard)



GHS 08 : Health hazard



GHS 09 : Environment
(Environmental hazard)

Hazard Statement:

Hazard statements means a statement assigned to a hazard class and category that describes the nature Of the hazards of hazardous product, including where appropriate, the degree of hazard.

Codification of Hazard statements:

- “2”: Physical hazards
- “3”: Health hazards
- “4”: Environmental hazards

List of GHS Hazard Statements and H Codes:

H200: Unstable explosive

H201: Explosive; mass explosion hazard

H202: Explosive; severe projection hazard

H203: Explosive; fire, blast or projection hazard

H204: Fire or projection hazard

H205: May mass explode in fire

H206: Fire, blast or projection hazard; increased risk of explosion if desensitizing agent is reduced

H207: Fire or projection hazard; increased risk of explosion if desensitizing agent is reduced

H208: Fire hazard; increased risk of explosion if desensitizing agent is reduced

H220: Extremely flammable gas

H221: Flammable gas

H222: Extremely flammable aerosol

H223: Flammable aerosol

H224: Extremely flammable liquid and vapour

H225: Highly flammable liquid and vapour

H226: Flammable liquid and vapour

H227: Combustible liquid

H228: Flammable solid

H229: Pressurized container: may burst if heated

H230: May react explosively even in the absence of air

H231: May react explosively even in the absence of air at elevated pressure and/or temperature

H232: May ignite spontaneously if exposed to air

H240: Heating may cause an explosion

H241: Heating may cause a fire or explosion

H242: Heating may cause a fire

H250: Catches fire spontaneously if exposed to air

H251: Self-heating; may catch fire

H252: Self-heating in large quantities; may catch fire

H260: In contact with water releases flammable gases which may ignite spontaneously

H261: In contact with water releases flammable gas

H270: May cause or intensify fire; oxidizer

H271: May cause fire or explosion; strong oxidizer

H272: May intensify fire; oxidizer

H280: Contains gas under pressure; may explode if heated

H281: Contains refrigerated gas; may cause cryogenic burns or injury

H290: May be corrosive to metals

H300: Fatal if swallowed

H301: Toxic if swallowed

H302: Harmful if swallowed

H303: May be harmful if swallowed

H304: May be fatal if swallowed and enters airways

H305: May be harmful if swallowed and enters airways

H310: Fatal in contact with skin

H311: Toxic in contact with skin

H312: Harmful in contact with skin

H313: May be harmful in contact with skin

H314: Causes severe skin burns and eye damage

H315: Causes skin irritation

H316: Causes mild skin irritation

H317: May cause an allergic skin reaction

H318: Causes serious eye damage

H319: Causes serious eye irritation

H320: Causes eye irritation

H330: Fatal if inhaled

H331: Toxic if inhaled

H332: Harmful if inhaled

H333: May be harmful if inhaled

H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled

H335: May cause respiratory irritation

H336: May cause drowsiness or dizziness

H340: May cause genetic defects

H341: Suspected of causing genetic defects

H350: May cause cancer

H351: Suspected of causing cancer

H360: May damage fertility or the unborn child

H361: Suspected of damaging fertility or the unborn child

H362: May cause harm to breast-fed children

H370: Causes damage to organs

H371: May cause damage to organs



H372: Causes damage to organs through prolonged or repeated exposure

H373: May cause damage to organs through prolonged or repeated exposure

H400: Very toxic to aquatic life

H401: Toxic to aquatic life

H402: Harmful to aquatic life

H410: Very toxic to aquatic life with long-lasting effects

H411: Toxic to aquatic life with long-lasting effects

H412: Harmful to aquatic life with long-lasting effects

H413: May cause long-lasting harmful effects to aquatic life

H420: Harms public health and the environment by destroying ozone in the upper atmosphere

Precautionary statement:

A precautionary statement is phrase (and/or pictogram) which describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous products, or improper storage or handling of a hazardous product.

- **P1xx:** general precautionary statement;
- **P2xx:** prevention precautionary statement;
- **P3xx:** response precautionary statement;
- **P4xx:** storage precautionary statement;
- **P5xx:** disposal precautionary statement;

List of GHS Precautionary Statements and P Codes

General Precautionary Statements

| | |
|------|---|
| P101 | If medical advice is needed, have product container or label at hand. |
| P102 | Keep out of reach of children. |
| P103 | Read label before use |

Prevention Precautionary Statements

| | |
|------|---|
| P201 | Obtain special instructions before use. |
| P202 | Do not handle until all safety precautions have been read and understood. |
| P210 | Keep away from heat, hot surface, sparks, open flames and other ignition sources. - No smoking. |
| P211 | Do not spray on an open flame or other ignition source. |
| P212 | Avoid heating under confinement or reduction of the desensitized agent. |
| P220 | Keep away from clothing and other combustible materials. |
| P221 | Take any precaution to avoid mixing with combustibles/... |
| P222 | Do not allow contact with air. |
| P223 | Do not allow contact with water. |
| P230 | Keep wetted with ... |
| P231 | Handle under inert gas. |
| P232 | Protect from moisture. |
| P233 | Keep container tightly closed. |
| P234 | Keep only in original container. |
| P235 | Keep cool. |
| P240 | Ground/bond container and receiving equipment. |
| P241 | Use explosion-proof [electrical/ventilating/lighting/...] equipment. |
| P242 | Use only non-sparking tools. |
| P243 | Take precautionary measures against static discharge. |
| P244 | Keep valves and fittings free from oil and grease. |
| P250 | Do not subject to grinding/shock/friction/... |
| P251 | Do not pierce or burn, even after use. |



| | |
|-----------|--|
| P260 | Do not breathe dust/fume/gas/mist/vapors/spray. |
| P261 | Avoid breathing dust/fume/gas/mist/vapors/spray. |
| P262 | Do not get in eyes, on skin, or on clothing. |
| P263 | Avoid contact during pregnancy/while nursing. |
| P264 | Wash ... thoroughly after handling. |
| P270 | Do not eat, drink or smoke when using this product. |
| P271 | Use only outdoors or in a well-ventilated area. |
| P272 | Contaminated work clothing should not be allowed out of the workplace. |
| P273 | Avoid release to the environment. |
| P280 | Wear protective gloves/protective clothing/eye protection/face protection. |
| P281 | Use personal protective equipment as required. |
| P282 | Wear cold insulating gloves/face shield/eye protection. |
| P283 | Wear fire resistant or flame retardant clothing. |
| P284 | [In case of inadequate ventilation] Wear respiratory protection. |
| P285 | In case of inadequate ventilation wear respiratory protection. |
| P231+P232 | Handle under inert gas/... Protect from moisture. |
| P235+P410 | Keep cool. Protect from sunlight. |

Response Precautionary Statements

| | |
|------|--|
| P301 | IF SWALLOWED: |
| P302 | IF ON SKIN: |
| P303 | IF ON SKIN (or hair): |
| P304 | IF INHALED: |
| P305 | IF IN EYES: |
| P306 | IF ON CLOTHING: |
| P307 | IF exposed: |
| P308 | IF exposed or concerned: |
| P309 | IF exposed or if you feel unwell |
| P310 | Immediately call a POISON CENTER or doctor/physician. |
| P311 | Call a POISON CENTER or doctor/... |
| P312 | Call a POISON CENTER or doctor/... if you feel unwell. |
| P313 | Get medical advice/attention. |
| P314 | Get medical advice/attention if you feel unwell. |
| P315 | Get immediate medical advice/attention. |
| P320 | Specific treatment is urgent (see ... on this label). |
| P321 | Specific treatment (see ... on this label). |
| P322 | Specific measures (see ...on this label). |
| P330 | Rinse mouth. |
| P331 | Do NOT induce vomiting. |
| P332 | IF SKIN irritation occurs: |
| P333 | If skin irritation or rash occurs: |
| P334 | Immerse in cool water [or wrap in wet bandages]. |
| P335 | Brush off loose particles from skin. |



- P336 Thaw frosted parts with lukewarm water. Do not rub affected area.
- P337 If eye irritation persists:
- P338 Remove contact lenses, if present and easy to do. Continue rinsing.
- P340 Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P341 If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P342 If experiencing respiratory symptoms:
- P350 Gently wash with plenty of soap and water.
- P351 Rinse cautiously with water for several minutes.
- P352 Wash with plenty of water/...
- P353 Rinse skin with water [or shower].
- P360 Rinse immediately contaminated clothing and skin with plenty of water before removing clothes.
- P361 Take off immediately all contaminated clothing.
- P362 Take off contaminated clothing.
- P363 Wash contaminated clothing before reuse.
- P364 And wash it before reuse.[Added in 2015 version]
- P370 In case of fire:
- P371 In case of major fire and large quantities:
- P372 Explosion risk.
- P373 DO NOT fight fire when fire reaches explosives.
- P374 Fight fire with normal precautions from a reasonable distance.
- P376 Stop leak if safe to do so.
- P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
- P378 Use ... to extinguish.
- P380 Evacuate area.
- P381 In case of leakage, eliminate all ignition sources.
- P390 Absorb spillage to prevent material damage.
- P391 Collect spillage.
- P301+P310 IF SWALLOWED: Immediately call a POISON CENTER/doctor/...
- P301+P312 IF SWALLOWED: call a POISON CENTER/doctor/... IF you feel unwell.
- P301+P330+P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
- P302+P334 IF ON SKIN: Immerse in cool water [or wrap in wet bandages].
- P302+P335+P334 Brush off loose particles from skin. Immerse in cool water [or wrap in wet bandages].
- P302+P350 IF ON SKIN: Gently wash with plenty of soap and water.
- P302+P352 IF ON SKIN: wash with plenty of water.
- P304+P312 IF INHALED: Call a POISON CENTER/doctor/... if you feel unwell.
- P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
- P304+P341 IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do - continue rinsing.
- P306+P360 IF ON CLOTHING: Rinse Immediately contaminated CLOTHING and SKIN with plenty of water before removing clothes.
- P307+P311 IF exposed: call a POISON CENTER or doctor/physician.



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| P308+P311 | IF exposed or concerned: Call a POISON CENTER/doctor/... |
| P308+P313 | IF exposed or concerned: Get medical advice/attention. |
| P309+P311 | IF exposed or if you feel unwell: call a POISON CENTER or doctor/physician. |
| P332+P313 | IF SKIN irritation occurs: Get medical advice/attention. |
| P333+P313 | IF SKIN irritation or rash occurs: Get medical advice/attention. |
| P335+P334 | Brush off loose particles from skin. Immerse in cool water/wrap in wet bandages. |
| P337+P313 | IF eye irritation persists: Get medical advice/attention. |
| P342+P311 | IF experiencing respiratory symptoms: Call a POISON CENTER/doctor/... |
| P361+P364 | Take off immediately all contaminated clothing and wash it before reuse. |
| P362+P364 | Take off contaminated clothing and wash it before reuse. |
| P370+P376 | in case of fire: Stop leak if safe to do so. |
| P370+P378 | In case of fire: Use ... to extinguish. |
| P370+P380 | In case of fire: Evacuate area. |
| P370+P380+P375 | In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion. |
| P371+P380+P375 | In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion. |

Storage Precautionary Statements

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| P401 | Store in accordance with ... |
| P402 | Store in a dry place. |
| P403 | Store in a well-ventilated place. |
| P404 | Store in a closed container. |
| P405 | Store locked up. |
| P407 | Maintain air gap between stacks or pallets. |
| P410 | Protect from sunlight. |
| P411 | Store at temperatures not exceeding ... °C/...°F. |
| P412 | Do not expose to temperatures exceeding 50 °C/ 122 °F. |
| P413 | Store bulk masses greater than ... kg/...lbs at temperatures not exceeding ... °C/...°F. |
| P420 | Store separately. |
| P422 | Store contents under ... |
| P402+P404 | Store in a dry place. Store in a closed container. |
| P403+P233 | Store in a well-ventilated place. Keep container tightly closed. |
| P403+P235 | Store in a well-ventilated place. Keep cool. |
| P410+P403 | Protect from sunlight. Store in a well-ventilated place. |
| P410+P412 | Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122°F. |
| P411+P235 | Store at temperatures not exceeding ... °C/...°F. Keep cool. |

Disposal Precautionary Statements

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| P501 | Dispose of contents/container to ... |
| P502 | Refer to manufacturer or supplier for information on recovery or recycling |