

**Technical Note:**

**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 Insolubles % & 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 fire fighting 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 fire fighting 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.

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## **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.
- LD<sub>50</sub> 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).



- LD<sub>50</sub> 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).
- LD<sub>50</sub> of blends = LD<sub>50</sub> of active substance x 100 B % of active substance by weight.
- LC<sub>50</sub> 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 / m<sup>3</sup> of air ( ppm ) of vapors.
- The European Union (EU) has adopted following classification for assessing the toxicity of chemical substances.

Oral LD <sub>50</sub> ( Rat )	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).
- LCL<sub>0</sub> Lethal Concentration – Low is the lowest concentration of a substance in air, other than LC<sub>50</sub> , 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  $\text{mg} / \text{m}^3$  @ 25°C & 760 mm Hg pressure.

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

(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:

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

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

<b>Category</b>	<b>Classification</b>
<b>Category 1</b>	Substances known to be carcinogenic to humans. Sufficient evidence of human exposure and development of cancer.
<b>Category 2</b>	Substances which should be regarded as if they are carcinogenic to human based on appropriate long term animal studies and other relevant information.
<b>Category 3</b>	Substances which cause concern for human beings due to possible carcinogenic effects. Provisional classification or human inducing effect insufficient for Category 2 classification.
<b>Labeling Requirements</b>	
<b>Category 1 &amp; 2</b>	Symbol : Skull & Cross bones Risk Phrase : Toxic – May cause cancer (R45) or Toxic – May cause cancer by inhalation (R49)
<b>Category 3</b>	Symbol : Andrew's Cross. Risk Phrase : Possible risk of irreversible effects



### **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 :

<b>Category</b>	<b>Classification</b>
<b>Category 1</b>	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.
<b>Category 2</b>	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.
<b>Category 3</b>	Substances which cause concern for human beings owing to mutagenic effects. There is evidence from appropriate Mutagenecity studies but this is insufficient to place the substance in category 2.

### **Substances Toxic to Reproduction.**

- The EU criteria for classification are :

<b>Category</b>	<b>Classification</b>
<b>Category 1</b>	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.
<b>Category 2</b>	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"> <li>- 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.</li> <li>- Other relevant information.</li> </ul> 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"> <li>- 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.</li> <li>- Other relevant information.</li> </ul>



<b>Category 3</b>	<p>1) Substances which cause concern for human fertility on the basis of</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- Other relevant information.</li> </ul> <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"> <li>- 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.</li> <li>- Other relevant information.</li> </ul>
<ul style="list-style-type: none"> <li>• Carcinogenicity, Mutagenicity and Toxic to Reproduction properties of a substance are not directly related to and must be considered separately from toxicity.</li> <li>• 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.</li> </ul>	

### 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.*

**EU Classification of Health Effects.**

<b>Category</b>	<b>Property</b>	<b>Letter / Symbol</b>	
<b>Very Toxic</b>	Substances and Preparations which in Very Low quantities cause death or acute or chronic damage to health when inhaled, swallowed or absorbed via skin.	T+	
<b>Toxic</b>	Substances and Preparations which in Low quantities cause death or acute or chronic damage to health when inhaled, swallowed or absorbed via skin.	T	
<b>Harmful</b>	Substances and Preparations which may cause death or acute or chronic damage to health when inhaled swallowed or absorbed via skin.	Xn	
<b>Corrosive</b>	Substances and Preparations which may on contact with living tissues destroy them.	C	
<b>Irritant</b>	Non-Corrosive substances and preparations which through immediate, prolonged or repeated contact with skin or mucous membrane may cause inflammation.	Xi	
<b>Sensitizing</b>	Substances and preparations which, if they are inhaled or if they penetrate the skin, are capable of eliciting a reaction by hypersensitization such that on further exposure to the substance or preparation characteristic adverse effects are reduced. Sensitization by inhalation : Sensitization by skin contact :	Xn Xi	
<b>Carcinogenic</b>	Substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce heritable genetic defects or increase their incidence. Category 1 : Category 2 : Category 3 :	T T Xn	 
<b>Toxic to Reproduction</b>	Substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may produce or increase the incidence of non-heritable adverse effects in progeny and / or an impairment of male / female reproductive functions or capacity. Category 1 : Category 2 : Category 3 :	T T Xn	 
<b>Dangerous for environment</b>	Substances which if they enter into the environment would present or may present an immediate or delayed danger for one or more components of the environment.	N	
<b>Explosive</b>	Explosive substances or preparations.	E	
<b>Oxidizing</b>	Oxidizing substances or preparations.	O	
<b>Extremely Flammable</b>	Extremely Flammable substances or preparations.	F+	
<b>Highly Flammable</b>	Highly Flammable substances or preparations.	F	

**EU DEFINED RISK PHRASES**

<b>(R1)</b>	Explosive when dry.	<b>(R34)</b>	Causes burns.
<b>(R2)</b>	Risk of explosion by shock, friction, fire or other sources of ignition.	<b>(R35)</b>	Causes severe burns.
<b>(R3)</b>	Extreme risk of explosion by shock, friction, fire or other sources of ignition.	<b>(R36)</b>	Irritating to the eyes.
<b>(R4)</b>	Forms very sensitive explosive metallic compounds.	<b>(R37)</b>	Irritating to the respiratory system.
<b>(R5)</b>	Heating may cause explosion.	<b>(R38)</b>	Irritating to the skin.
<b>(R6)</b>	Explosives with or without contact with air.	<b>(R39)</b>	Danger of very serious irreversible effects.
<b>(R7)</b>	May cause fire.	<b>(R40)</b>	Possible risk of irreversible effects.
<b>(R8)</b>	Contact with combustible material may cause fire.	<b>(R41)</b>	Risk of serious damage to eyes.
<b>(R9)</b>	Explosive when mixed with combustible material.	<b>(R42)</b>	May cause sensitization by inhalation.
<b>(R10)</b>	Flammable.	<b>(R43)</b>	May cause sensitization by skin contact.
<b>(R11)</b>	Highly flammable.	<b>(R44)</b>	Risk of explosion if heated under confinement.
<b>(R12)</b>	Extremely flammable.	<b>(R45)</b>	May cause cancer.
<b>(R14)</b>	Reacts violently with water.	<b>(R46)</b>	May cause heritable genetic damage.
<b>(R15)</b>	Contact with water liberates extremely flammable gases.	<b>(R48)</b>	Danger of serious damage to health by prolonged exposure.
<b>(R16)</b>	Explosive when mixed with oxidizing substances.	<b>(R49)</b>	May cause cancer by inhalation.
<b>(R17)</b>	Spontaneously flammable in air.	<b>(R50)</b>	Very toxic to aquatic organisms.
<b>(R18)</b>	In use may form flammable / explosive vapor – mixture.	<b>(R51)</b>	Toxic to aquatic organisms.
<b>(R19)</b>	May form explosive peroxides.	<b>(R52)</b>	Harmful to aquatic organisms.
<b>(R20)</b>	Harmful by inhalation.	<b>(R53)</b>	May cause long term effects in the aquatic environment.
<b>(R21)</b>	Harmful in contact with skin.	<b>(R54)</b>	Toxic to flora.
<b>(R22)</b>	Harmful when swallowed.	<b>(R55)</b>	Toxic to fauna.
<b>(R23)</b>	Toxic by inhalation.	<b>(R56)</b>	Toxic to soil organisms.
<b>(R24)</b>	Toxic in contact with skin.	<b>(R57)</b>	Toxic to bees.
<b>(R25)</b>	Toxic when swallowed.	<b>(R58)</b>	May cause long term adverse effects in the environment.
<b>(R26)</b>	Very Toxic by inhalation.	<b>(R59)</b>	Dangerous for ozone layer.
<b>(R27)</b>	Very Toxic in contact with skin.	<b>(R60)</b>	May impair fertility.
<b>(R28)</b>	Very Toxic when swallowed.	<b>(R61)</b>	May cause harm to unborn child.
<b>(R29)</b>	Contact with water liberates toxic gas	<b>(R62)</b>	Possible risk of impaired fertility.
<b>(R30)</b>	Can become highly flammable in use.	<b>(R63)</b>	Possible risk of harm to unborn child.
<b>(R31)</b>	Contact with acids liberates toxic gas.	<b>(R64)</b>	May cause harm to breastfed babies.
<b>(R32)</b>	Contact with acids liberates very toxic gas.	<b>(R65)</b>	Harmful. May cause lung damage if swallowed.
<b>(R33)</b>	Danger of cumulative effects.		

**EU DEFINED RISK PHRASES: [Combination of Particular Risks]**

R 14/15	Reacts violently with water, liberating extremely flammable gases.
R 15/29	Contact with water liberates toxic, extremely flammable gas.
R 20/21	Harmful by inhalation and in contact with skin.
R 20/21/22	Harmful by inhalation, in contact with skin and if swallowed.
R 20/22	Harmful by inhalation and if swallowed.
R 21/22	Harmful in contact with skin and if swallowed.
R 23/24	Toxic by inhalation and in contact with skin.
R 23/24/25	Toxic by inhalation, in contact with skin, and if swallowed.
R 23/25	Toxic by inhalation and if swallowed.
R 24/25	Toxic in contact with skin and if swallowed.
R 26/27	Very toxic by inhalation and in contact with skin.
R 26/27/28	Very toxic by inhalation, in contact with skin and if swallowed.
R 26/28	Very toxic by inhalation and if swallowed.
R 27/28	Very toxic in contact with skin and if swallowed.
R 36/37	Irritating to eyes and respiratory system.
R 36/37/38	Irritating to eyes, respiratory system and skin.
R 36/38	Irritating to eyes and skin.
R 37/38	Irritating to respiratory system and skin.
R 39/23	Toxic: danger of very serious irreversible effects through inhalation.
R 39/23/24	Toxic: danger of very serious irreversible effects through inhalation and in contact with skin.
R 39/23/24/25	Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
R 39/23/25	Toxic: danger of serious irreversible effects through inhalation and if swallowed.
R 39/24	Toxic: danger of very serious irreversible effects in contact with skin.
R 39/24/25	Toxic: danger of very serious irreversible effects in contact with skin and if swallowed.
R 39/25	Toxic: danger of very serious irreversible effects if swallowed.
R 39/26	Very toxic: danger of very serious irreversible effects through inhalation.
R 39/26/27	Very toxic: danger of very serious irreversible effects through inhalation and in contact with skin.
R 39/26/27/28	Very toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
R 39/26/28	Very toxic: danger of very serious irreversible effects through inhalation and if swallowed.
R 39/27	Very toxic: danger of very serious irreversible effects in contact with skin.
R 39/27/28	Very toxic: danger of very serious irreversible effects in contact with skin and if swallowed.
R 39/28	Very toxic: danger of very serious irreversible effects if swallowed.
R 40/20	Harmful: possible risk of irreversible effects through inhalation.
R 40/20/21	Harmful: possible risk of irreversible effects through inhalation and in contact with skin.
R 40/20/21/22	Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed.
R 40/20/22	Harmful: possible risk of irreversible effects through inhalation and if swallowed.
R 40/21	Harmful: possible risk of irreversible effects in contact with skin.

**EU DEFINED RISK & SAFETY PHRASES: [Combination of Particular Risks]...Cont.**

R 40/21/22	Harmful: possible risk of irreversible effects in contact with skin and if swallowed.
R 40/22	Harmful: possible risk of irreversible effects if swallowed.
R 42/43	May cause sensitization by inhalation and skin contact.
R 48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R 48/20/21	Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R 48/20/21/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R 48/20/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R 48/21	Harmful: danger of serious damage to health by prolonged exposure in contact with skin.
R 48/21/22	Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R 40/22	Harmful: possible risk of irreversible effects if swallowed.
R 42/43	May cause sensitization by inhalation and skin contact.
R 48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R 48/20/21	Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R 48/20/21/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R 48/20/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R 48/21	Harmful: danger of serious damage to health by prolonged exposure in contact with skin.
R 48/21/22	Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R 48/22	Harmful: danger of serious damage to health by prolonged exposure if swallowed.
R 48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R 48/23/24	Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R 48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R 48/23/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R 48/24	Toxic: danger of serious damage to health by prolonged exposure in contact with skin.
R 48/24/25	Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R 48/25	Toxic: danger of serious damage to health by prolonged exposure if swallowed.
R 50/53	Very toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment.
R 51/53	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R 52/53	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R 313	Deflating of the skin. (Proposal by Sweden)
R 320	May be harmful by inhalation. (Proposal by Sweden)

**EU DEFINED SAFETY PHRASES**

<b>S 1</b>	Keep locked up.
<b>S 2</b>	Keep out of reach of children.
<b>S 3</b>	Keep in a cool place.
<b>S 4</b>	Keep away from living quarters.
<b>S 5</b>	Keep contents under ..... (Appropriate liquid to be specified by the manufacturer).
<b>S 6</b>	Keep under (inert gas to be specified by the manufacturer).
<b>S 7</b>	Keep container tightly closed.
<b>S 8</b>	Keep container dry.
<b>S 9</b>	Keep container in a well ventilated place.
<b>S 12</b>	Do not keep the container sealed.
<b>S 13</b>	Keep away from food, drink and animal feeding stuffs.
<b>S 14</b>	Keep away from.... (Incompatible materials to be indicated by the manufacturer).
<b>S 15</b>	Keep away from heat.
<b>S 16</b>	Keep away from sources of ignition – No smoking.
<b>S 17</b>	Keep away from combustible material.
<b>S 18</b>	Handle and open container with care.
<b>S 20</b>	When using do not eat or drink.
<b>S 21</b>	When using do not smoke.
<b>S 22</b>	Do not breathe dust.
<b>S 23</b>	Do not breathe gas /fumes / vapor /spray (appropriate wording to be specified by the manufacturer).
<b>S 24</b>	Avoid contact with the skin.
<b>S 25</b>	Avoid contact with the eyes.
<b>S 26</b>	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
<b>S 27</b>	Take off immediately all contaminated clothing..
<b>S 28</b>	After contact with skin, wash immediately with plenty of .... (To be specified by the manufacturer).
<b>S 29</b>	Do not empty into drains.
<b>S 30</b>	Never add water to this product.
<b>S 33</b>	Take precautionary measures against static discharges.
<b>S 35</b>	This material and its container must be disposed of in a safe way.
<b>S 36</b>	Wear suitable protective clothing.
<b>S 37</b>	Wear suitable gloves.
<b>S 38</b>	In case of insufficient ventilation, wear suitable respiratory equipment.
<b>S 39</b>	Wear eye / face protection.
<b>S 40</b>	To clean the floor and all objects contaminated by this material use. (To be specified by the manufacturer).
<b>S 41</b>	In case of fire and / or explosion do not breathe fumes..
<b>S 42</b>	During fumigation / spraying wear suitable respiratory equipment (appropriate wording to be specified).
<b>S 43</b>	In case of fire, use... (Indicate in the space the precise type of firefighting equipment. If water increases the risk add – Never use water).



**EU DEFINED SAFETY PHRASES.....Cont.**

<b>S 45</b>	In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).
<b>S 46</b>	If swallowed seek medical advice immediately and show this container or label.
<b>S 47</b>	Keep at temperature not exceeding ....°C (to be specified by the manufacturer).
<b>S 48</b>	Keep wetted with .... (Appropriate material to be specified by the manufacturer).
<b>S 49</b>	Keep only in the original container.
<b>S 50</b>	Do not mix with .... (To be specified by the manufacturer).
<b>S 51</b>	Use only in well ventilated areas.
<b>S 52</b>	Not recommended for interior use on large surface areas.
<b>S 53</b>	Avoid exposure – obtain special instruction before use.
<b>S 56</b>	Dispose of this material and its container to hazardous or special waste collection point.
<b>S 57</b>	Use appropriate containment to avoid environmental contamination.
<b>S 59</b>	Refer to manufacturer / supplier for information on recovery / recycling.
<b>S 60</b>	This material and / or its container must be disposed of as hazardous waste.
<b>S 61</b>	Avoid release to the environment. Refer to special instructions / Safety data sheet.
<b>S 62</b>	If swallowed, do not induce vomiting seek medical advice immediately and show this container or label.

**Combinations of Safety Measures**

<b>S 1/2</b>	Keep locked up and out of the reach of children.
<b>S 3/7</b>	Keep container tightly closed in a cool place.
<b>S 3/9/14</b>	Keep in a cool well ventilated place away from ... (incompatible materials to be indicated by manufacturer).
<b>S 3/9/14/49</b>	Keep only in the original container in a cool well ventilated place away from ... (Incompatible materials to be indicated by the manufacturer).
<b>S 3/9/49</b>	Keep only in the original container in a cool well ventilated place.
<b>S 3/14</b>	Keep in a cool place away from ....(incompatible materials to be indicated by the manufacturer).
<b>S 7/8</b>	Keep container tightly closed and dry.
<b>S 7/9</b>	Keep container tightly closed and in a well ventilated place.
<b>S 20/21</b>	When using; Do not eat, drink or smoke.
<b>S 24 /25</b>	Avoid contact with skin and eyes.
<b>S 29/56</b>	Do not empty into drains, dispose of this material and its container to hazardous or special waste collection point.
<b>S 36/37</b>	Wear suitable protective clothing and gloves.
<b>S 36/37/39</b>	Wear suitable protective clothing, gloves and eye/face protection.
<b>S 36/39</b>	Wear suitable protective clothing and eye/face protection.
<b>S 47/49</b>	Keep only in the original container at temperature not exceeding .... °C (to be specified by manufacturer).

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