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*WCO Programme Global Shield (PGS) – E-book No.05*

[Training Material for Departmental Use]

**E-BOOK**

On

**Material Safety  
Data Sheets**

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**Note:**

1. In this E-book, attempts have been made to make the officers aware about *Material Safety Data Sheets and their utility at the time of handling, examination and storage of various chemicals*. This will also help in proper classification of chemicals under Customs Tariff.
2. Though all efforts have been made to make this document error free, it is possible that some errors might have crept into the document. If you notice any errors, the same may be brought to the notice of the NACEN, RTI, Kanpur on the Email address: [rtinacenkanpur@yahoo.co.in](mailto:rtinacenkanpur@yahoo.co.in). This may not be a perfect E-book. If you have any suggestion to improve this book, you are requested to forward the same to us.
3. This e-book is one of the several e-books dealing with different aspects of WCO Programme Global Shield (PGS). The Programme Global Shield (PGS) is a long term law enforcement initiative of WCO alongwith its partner organizations, namely, United Nations Office on Drug and Crime (UNODC), International Police Organization (INTERPOL) and member countries. This Programme is aimed at combating the illicit diversion and trafficking of high risk precursor chemicals, which are commonly used by criminal elements/terrorist organizations to make Improvised Explosive Devices (IEDs).
4. It is acknowledged here that in preparing this e-book, the WCO training material as well as material from other sources including that available freely on internet have been used. Wherever possible, the source of material has been indicated in this e-book. It might be possible that for some material, we may not have specifically mentioned such source. This e-book is meant for education and training of Customs officers in India and is for non-commercial use. While it is not our intention to infringe any copyrights, if anybody has any issue with regard to any of the material used in this e-book, the same may kindly be brought to our notice on the email addresses mentioned above.
5. This e-book has been prepared by **Shri. K. V. S. Singh, Additional Director General, Directorate of Revenue Intelligence, Kolkata**. He along with Shri C. P. Goyal, Additional Director General, NACEN, RTI, Kanpur attended Train-the-Trainer Course conducted by WCO at Dushanbe, Tajikistan from 13.04.2015 to 24.04.2015 and are expert faculties in India for imparting training on the various aspects of Programme Global Shield.
6. If you feel that this e-book has really helped you in improving your knowledge or understanding of the subject matter, we request you to take few minutes out of your precious time and provide us your valuable feedback. Your feedback is important and will help us in improving our e-books.

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## INDEX

<b>Abbreviations .....</b>	<b>1</b>
1. Introduction .....	2
2. What are Material Safety Data Sheets (MSDSs) and who prepares them? .....	3
3. Legal requirements on the Form and Content of MSDSs.....	4
4. MSDSs of Acetone and their interpretation.....	5
5. MSDS requirement under Indian Laws: .....	10
6. Format of MSDS under Schedule 9 of the MSIHC Rules, 1989 .....	11
<b>Glossary of the Term used in Safety Data Sheet .....</b>	<b>14</b>
7. Important Websites .....	18
8. Reference Materials.....	18

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## **Abbreviations**

ACGIH:	Conference of Governmental Industrial Hygienists
CAS:	Chemical Abstract Service
CAS#:	Chemical Abstract Service Number
CI#:	Colour Index Number
GHS:	Globally Harmonized System of Classification and Labelling of Chemicals (also known as Purple Book)
MSDS:	Material Safety Data Sheet
OSHA:	Occupational Safety and Health Administration (USA)
PGS:	Programme Global Shield
RTECS:	Registry of Toxic Effects of Chemical Substances
REACH:	Registration, Evaluation, Authorization and Restriction of Chemicals (EU)
SDS:	Safety Data Sheet
TLV:	Threshold Limit Value
TSCA:	Toxic Substance Control Act
WHMIS:	Workplace Hazardous Materials Information System (Canada)

## 1. Introduction

- 1.1 Customs officers often have to deal with chemicals while inspecting/examining import/export consignments of chemicals or taking samples for testing etc. They are also required to handle chemicals while stock taking in manufacturing premises or godowns. Sometimes the officers also have to supervise transport and storage of chemicals, especially those seized by the officers. They need to be extremely careful while dealing with chemicals. Slight mistake in dealing with or handling chemicals may pose risk to their life as well as life of others. In this regard, it is important for Customs officers to know about Material Safety Data Sheets (MSDSs) accompanying these chemicals. The information contained in MSDSs is vital for the safety of individuals as well as the environment. Such knowledge will not only enable them to do their job efficiently, but will ensure their own safety.
- 1.2 The use of chemicals to enhance and improve life is a widespread practice worldwide. While on one side, there are benefits of using these chemicals, on the other side, there is also potential for adverse effects to people or the environment. **To ensure enhanced protection of human health and the environment, there is need that all stake holders such as workers, consumer, transport workers, emergency responders, public in general are effectively communicated the various hazards associated with the Chemical.**
- 1.3 The various hazards associated with chemicals may be broadly put into three categories-
- (i) **Physical hazards** such as explosive, inflammable solid/liquid/gas, self-reactivity; oxidizing liquid/solid; pyrophoric liquids/solids etc.
  - (ii) **Health Hazards** such as acute toxicity-oral or dermal; skin corrosion/irritation; serious eye damage/eye irritation; respiratory/skin sensitization; specific target organ toxicity; germ cell mutagenicity; carcinogenicity, reproductive toxicity, aspiration hazard, poisonous, infectious, radioactive etc.
  - (iii) **Environmental Hazards** such as very toxic/toxic/harmful to aquatic life; adverse impact on ozone layer etc.

- 1.4 Communication of various hazards to various stake holders dealing with these chemicals at place of manufacture, workplace, storage, transportation, port/airports, warehouses etc. is an important part of strategy to protect people and environment. Requirement of labeling and safety Data Sheets (SDS) forms important elements of effective Chemical Hazard Communication System.
- 1.5 While basic details of Safety Data Sheets have been explained in this e-book, the details about classification of hazards, requirement for labeling of chemicals or requirement for safe transportation of hazardous chemicals are available in **e-book on Globally Harmonized System of classification and Labeling of Chemicals (GHS)**.

## *2. What are Material Safety Data Sheets (MSDSs) and who prepares them?*

- 2.1 Material Safety Data Sheets (MSDSs) are documents prepared by the manufactures/ suppliers of the chemicals and contain information on physical and chemical properties of the material, potential hazards of the material and how to work safely with these materials. They also contain information on usages, storage, handling and emergency procedures related to the hazards of the materials. In fact, they provide a single reference for all information about hazardous substances.
- 2.2 MSDSs provide information on chemicals, chemical compounds and chemical mixtures and are primarily intended for use by the personnel working with hazardous chemical substances.
- 2.3 MSDSs need to be updated every three years, but if any significant new information becomes available about the material, then it should be incorporated into MSDS even before lapse of three years.
- 2.4 The revised (Material) Safety Data Sheets (SDS) contains **Sixteen (16) Sections**, however, different countries provide for 9 to 16 sections and their format varies from country to country. As per purple book on GHS, the information in the SDS should normally be presented using the following 16 headings in the order given below:
  - (1) Identification
  - (2) Hazard (s) identification

- (3) Composition/ information on ingredients
- (4) First-aid measures
- (5) Fire-fighting measures
- (6) Accidental release measures
- (7) Handling and Storage
- (8) Exposure controls/personal protection
- (9) Physical and Chemical Properties
- (10) Stability and reactivity
- (11) Toxicological information
- (12) Ecological information
- (13) Disposal Considerations
- (14) Transport information
- (15) Regulatory information
- (16) Other information

### ***3. Legal requirements on the Form and Content of MSDSs.***

- 3.1** Annexure 4 of the revised Purple Book of United Nation's Globally Harmonized System of Classification and Labelling of Chemicals (UN GHS) provides for the content and format of Safety Data Sheets. Since it is not a binding regulation of the UN, countries are required to promulgate their own regulations.
- 3.2 United States of America:** In the US, MSDSs are mandated by the Occupational Safety and Health Administration (OSHA) through Hazard Communication Regulation. MSDSs are reviewed by US Chemical Safety and Hazard Investigation Board.
- 3.3 Canada:** In Canada, the requirement of MSDS is mandated by Hazardous Product Act, Part II and the Controlled Products Regulations under program known as Workplace Hazardous Materials Information System (WHMIS).
- 3.4 Europe:** In Europe, MSDS are mandated by EU legislation introduced by Regulation (EC) No 1272/2008 (CLP) via an updated Annexure II of REACH.
- 3.5 India:** In India, MSDS contain 9 Sections listed under Schedule 9 of "The Manufacture, Storage and Import of Hazardous Chemicals Rule, 1989".

#### 4. *MSDSs of Acetone and their interpretation*

In order to understand the format and content of MSDS let us examine and interpret the Material Safety Data Sheets of Acetone as discussed below:

**4.1 Section 1:** This section contains product identification, name and address of the supplier of MSDS and emergency telephone numbers.

<b>Section 1: Chemical Product and Company Identification</b>
<b>Product Name:</b> Acetone
<b>Catalogue Codes:</b> SLA3502, SLA1645, SLA3151, SLA3808
<b>CAS#:</b> 67-64-1
<b>RTECS:</b> AL3150000
<b>TSCA:</b> TSCA 8(b) inventory: Acetone
<b>CI#:</b> Not applicable.
<b>Synonym:</b> 2-propanone; Dimethyl Ketone; Dimethylformaldehyde; Pyroacetic Acid
<b>Chemical Name:</b> Acetone
<b>Chemical Formula:</b> C <sub>3</sub> H <sub>6</sub> O
<b>Contact Information:</b> Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396
<b>US Sales:</b> 1-800-901-7247
<b>International Sales:</b> 1-281-441-4400
<b>Order Online:</b> ScienceLab.com
<b>CHEMTREC (24HR Emergency Telephone), call:</b> 1-800-424-9300
<b>International CHEMTREC, call:</b> 1-703-527-3887
<b>For non-emergency assistance, call:</b> 1-281-441-4400

**Note:** CHEMTREC: Established in 1971 as a public service of American Chemistry Council (ACC) to provide round-the-clock information for emergency incidents involving chemicals, hazardous materials and dangerous goods.

**4.2 Section 2:** This section contains percentage composition by weight of the ingredients and toxicological data on the ingredients of the given chemical.

### Section 2: Composition and Information on Ingredients

#### Composition:

Name CAS # % by Weight.

Acetone 67-64-1 100.

#### Toxicological Data on Ingredients:

##### Acetone:

ORAL (LD50): Acute: 5800 mg/kg [Rat]. 3000 mg/kg [Mouse]. 5340 mg/kg [Rabbit]. VAPOR (LC50): Acute: 50100 mg/m<sup>3</sup> 8 hours [Rat]. 44000 mg/m<sup>3</sup> 4 hours [Mouse].

**Note:** 1. LD50 means lethal dose in mg/kg of the body weight of the test animal at which 50% percent of the test animals die.

2. LC50 means lethal concentration in mg/ cubic m concentration for a particular exposure time at which 50% of test animals die.

**4.3 Section3:** This section contains the information on toxicology of the chemical, its and acute (short term) and chronic (long term) health effects.

### Section 3: Hazards Identification

#### Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

#### Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED].

The substance is toxic to central nervous system (CNS).

The substance may be toxic to kidneys, the reproductive system, liver, skin. Repeated or prolonged exposure to the substance can produce target organs damage.

- 4.4 **Section 4:** This section provides for exposure routes, signs and symptoms of exposure, and emergency and first aid procedure.

Section 4: First Aid Measures
<p><b>Eye Contact:</b> Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.</p>
<p><b>Skin Contact:</b> In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.</p>
<p><b>Serious Skin Contact:</b> Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.</p>
<p><b>Inhalation:</b> If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.</p>
<p><b>Serious Inhalation:</b> Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.</p>
<p><b>Ingestion:</b> Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.</p>
<p><b>Serious Ingestion:</b> Not available.</p>

- 4.5 **Section 5:** This section contains information about flammability, stability and reactivity of the substance.

Section 5: Fire and Explosion Data
<p><b>Flammability of the Product:</b> Flammable.</p>
<p><b>Auto-Ignition Temperature:</b> 465°C (869°F)</p>
<p><b>Flash Points:</b> CLOSED CUP: -20°C (-4°F). OPEN CUP: -9°C (15.8°F) (Cleveland).</p>
<p><b>Flammable Limits:</b> LOWER: 2.6% UPPER: 12.8%</p>
<p><b>Products of Combustion:</b> These products are carbon oxides (CO, CO<sub>2</sub>).</p>

**Fire Hazards in Presence of Various Substances:** Highly flammable in presence of open flames and sparks, of heat.

**Explosion Hazards in Presence of Various Substances:** Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of oxidizing materials, of acids.

**Fire Fighting Media and Instructions:** Flammable liquid, soluble or dispersed in water.

**SMALL FIRE:** Use DRY chemical powder.

**LARGE FIRE:** Use alcohol foam, water spray or fog.

**Special Remarks on Fire Hazards:** Vapour may travel considerable distance to source of ignition and flash back.

**Special Remarks on Explosion Hazards:** Forms explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulphuric acid, chromic anhydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nitryl perchlorate, permonosulfuric acid, thiodiglycol + hydrogen peroxide, potassium ter-butoxide, sulphur dichloride, 1-methyl-1,3-butadiene, bromoform, carbon, air, chloroform, thitriazylperchlorate.

**Note:** The chemical is flammable only within the lower and upper limit range of the limits given above. If the concentration is below the lower limit the chemical concentration is so lean that it will not catch fire. Similarly if the concentration is higher than the upper limit, it will cut off the oxygen supply and will not burn.

- 4.6 **Section 6:** This section provides for measures to be adopted during accidental release of the chemical due to spill or leak etc.

### Section 6: Accidental Release Measures

**Small Spill:** Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

**Large Spill:** Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

- 4.7 **Section 7:** This section contains precautions for safe handling, storage conditions and reactivity with other materials.

### Section 7: Handling and Storage

**Precautions:** Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis.

**Storage:** Store in a segregated and approved area (flammables area). Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

- 4.8 **Section 8:** This section provides details about the types of Personal Protective Equipment (PPE) required by the person working with these chemicals, hygiene practices and ventilation requirements to reduce potential for exposure.

### Section 8: Exposure Controls/Personal Protection

**Engineering Controls:** Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

**Personal Protection:** Splash goggles. Lab coat. Vapour respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

**Personal Protection in Case of a Large Spill:** Splash goggles. Full suit. Vapour respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:** TWA: 500 STEL: 750 (ppm) from ACGIH (TLV) [United States] TWA: 750 STEL: 1000 (ppm) from OSHA (PEL) [United States] TWA: 500 STEL: 1000 [Australia] TWA: 1185 STEL: 2375 (mg/m<sup>3</sup>) [Australia] TWA: 750 STEL: 1500 (ppm) [United Kingdom (UK)] TWA: 1810 STEL: 3620 (mg/m<sup>3</sup>) [United Kingdom (UK)] TWA: 1800 STEL: 2400 from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

- 4.9 **Section 9:** This section contains the physical and chemical properties of the chemical.

Section 9: Physical and Chemical Properties
<b>Physical state and appearance:</b> Liquid.
<b>Odour:</b> Fruity. Mint-like. Fragrant. Ethereal
<b>Taste:</b> Pungent, Sweetish
<b>Molecular Weight:</b> 58.08 g/mole
<b>Colour:</b> Colourless, Clear
<b>pH (1% soln/water):</b> Not available.
<b>Boiling Point:</b> 56.2°C (133.2°F)
<b>Melting Point:</b> -95.35 (-139.6°F)
<b>Critical Temperature:</b> 235°C (455°F)
<b>Specific Gravity:</b> 0.79 (Water = 1)
<b>Vapour Pressure:</b> 24 kPa (@ 20°C)
<b>Vapour Density:</b> 2 (Air = 1)
<b>Volatility:</b> Not available.
<b>Odour Threshold:</b> 62 ppm
<b>Water/Oil Dist. Coeff.:</b> The product is more soluble in water; $\log(\text{oil/water}) = -0.2$
<b>Ionicity (in Water):</b> Not available.
<b>Dispersion Properties:</b> See solubility in water.
<b>Solubility:</b> Easily soluble in cold water, hot water.

- 4.10 Section 10 to 16 may contain some additional data on ecological information, disposal consideration, transport information, other regulatory information etc.

## 5. *MSDS requirement under Indian Laws:*

- 5.1 In India, Schedule 9 of “*The Manufacture, Storage and Import of Hazardous Chemicals Rule, 1989*” provides for the form and content of Material Safety Data Sheets which have Nine Sections.

5.2 The contents of various sections as per the Manufacture, Storage and Import of Hazardous Chemicals Rule, 1989 are as follows:

Section 1: Chemical Identity

Section 2: Physical and Chemical Data

Section 3: Fire and Explosion Hazard Data

Section 4: Reactivity Data

Section 5: Health Hazard Data

Section 6: Preventive Measures

Section 7: Emergency and First Aid Measure

Section 8: Additional Information/ References

Section 9: Manufacturer/ Supplier Data

## 6. *Format of MSDS under Schedule 9 of the MSIHC Rules, 1989*

### SCHEDULE -9

(See Rule 17)

### SAFETY DATA SHEET

#### 1. CHEMICAL IDENTITY

Chemical Name		Chemical Classification	
Synonyms		Trade Name	
Formula	C.A.S. No	U.N. No.:	
Regulated Identification	Shipping Name Codes/Label	Hazchem No.:	
		Hazardous Waste I.D. No.:	
Hazardous Ingredients	C.A.S. No.	Hazardous Ingredients	C.A.S No.:
1.		3.	
2.		4.	

## 2. PHYSICAL AND CHEMICAL DATA

Boiling Range/Point C	Physical State	Appearance
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Melting/Freezing Point oC	Vapour Pressure @ 35 oC mm/Hg	Odour
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Vapour Density (Air=1)	Solubility in Water at 30oC Others
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Specific Gravity Water =1	pH
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## 3. FIRE AND EXPLOSION HAZARD DATA

Flammability	Yes/No	LEL	%	Flash Point oC	Auto ignition Temperature oC
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TDG Flammability	UEL	%	Flash Point oC
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Explosion Sensitivity to Impact	Explosion Sensitivity to Static Electricity	Hazardous Combustion Products
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Hazardous Polymerisation Combustible Liquid	Explosive Material	Corrosive Material
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Flammable Material	Oxidiser	Others
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Pyrophoric Material	Organic Peroxide
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## 4. REACTIVITY DATA

Chemical Stability

Incompatibility with other Material

Reactivity

Hazardous Reaction Products

## 5. HEALTH HAZARD DATA

Routes of Entry

Effects of Exposure/Symptoms

Emergency Treatment

TLV(ACGIH) mg/m <sup>3</sup>	ppm	mg/m <sup>3</sup>	STEL	ppm
Permissible Exposure Limits LD50	ppm	mg/m <sup>3</sup>	Odour threshold LD50	ppm mg/m <sup>3</sup>
NPA Hazard Signals	Health	Flammability	Stability	Special

## 6. PREVENTIVE MEASURES

Personnel  
Protective  
Equipment

Handling and  
Storage  
Precautions

## 7. EMERGENCY AND FIRST AID MEASURE

Fire Extinguishing  
Media  
FIRE

Special Procedures

Unusual Hazards  
EXPOSURE

First Aid Measures

Antidotes/Dosages  
SPILLS

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Steps to be taken

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Waste Disposal Method

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## 8. ADDITIONAL INFORMATION / REFERENCES

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## 9. MANUFACTURER / SUPPLIER DATA

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Name of Firm	Contact Person in Emergency
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Mailing Address	Local Bodies Involved
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Telephone/Telex Nos.	Standard Packing
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Telegraphic Address	Tremcard Details/Ref Other.
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## 10. DISCLAIMER

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Information contained in this material data sheet is believed to be reliable but no representation; guarantee or warranties of any kind are made as to its accuracy, suitability for a particular application or results to be obtained from them. It is upto the manufacturer/seller to ensure that the information contained in the material safety datasheet is relevant to the product manufactured/handled or sold by him as the case may be.

The Government makes no warranties expressed or implied in respect of the adequacy of this document for any particular purpose.

## **Glossary of the Term used in Safety Data Sheet**

1. **Chemical Name:** Approved chemical name, or common name.
2. **Synonyms:** The other name by which the chemical is known.

3. **CAS No.:** The unique identification number assigned each compound registered with the Chemical Abstracts Service (CAS). The number allows one to uniquely identify a chemical regardless of the naming system.
4. **U.N. No.:** United Nations (UN) Numbers are four-digit numbers used world-wide in international commerce and transportation to identify hazardous chemicals or classes of hazardous materials. These numbers generally range between 0000 and 3500 and are ideally preceded by the letters "UN" (for example, "UN1008") to avoid confusion with other number codes.
5. **Shipping Name:** Name indicted against the specific U.N. No.
6. **Codes/Label/Class:** The classification of goods by the type of goods involved. The hazards transport of goods is sub-divided to show the primary hazard of the substance, which determines the Class into which the substance is assigned, and, where appropriate, the subsidiary risks. The classifications identified are those adopted by the United Nations Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonised System of Classification and Labeling of Chemicals, and are as follows:

**Class 1: Explosives:** Substances which may explode under the effect of flame heat, heat or photochemical conditions, or which are more sensitive to shocks or friction than dinitrobenzene. A substance which is not itself an explosive but which can form an explosive atmosphere of gas, vapour or dust is not generally included in Class 1.

**Class 2: Gases** – compressed, liquefied, dissolved under pressure or deeply refrigerated. Some gases are flammable; others non-flammable.

**Class 3: Inflammable (flammable) liquids:** These are liquids or mixture of liquids, or liquids containing solids in solution or suspension having flash point of not more than 60.5 degree C (closed-cup), or not more than 65.6 degree C (open-cup).

**Class 4:**

- (i). Inflammable solids
- (ii). Substances liable to spontaneous combustion
- (iii). Substances which, in contact with water, emit flammable gases.

**Class 5:**

- (i). Oxidising substances
- (ii). Organic peroxides

**Class 6:**

- (i). Poisonous (toxic) substances
- (ii). Infectious substances

**Class 7:** Radioactive substances

**Class 8:** Corrosive substances

**Class 9:** Miscellaneous dangerous substances not covered by other classes.

7. **Hazchem Code :** **Emergency Action codes (EACs)**, also known as Hazchem, are for the use of the emergency services in conjunction with Emergency Action Code Cards. EACs indicate to the emergency services actions that may be necessary, during the first few minutes of an incident involving dangerous goods, should the officer in charge of the incident deem it necessary to take immediate actions. The code uses one of the numerals 1, 2, 3 or 4 followed by one or two letters.

8. **Hazardous Waste I.D. No. :** Hazardous Waste Identification number as indicated under categories of Wastes in the Schedule of the Hazardous Wastes (Management and Handling) Rules 1989.

9. **TDG Flammability :** Transport of Dangerous Goods Flammability. This term is used in Canada and is based on Classifications of Dangerous Goods by the U.N. Committee of experts on Transport of Dangerous Goods. The Classes indicated are 2 (flammable), 3, 4 and 5.

10. **LD50 (Oral) :Lethal Dose Fifty (Oral)** – a calculated orally ingested dose of a material which is expected to cause the death of 50% of an entire defined experimental animal population. Generally animals are rat, mouse or rabbit.

11. **LC50 : Lethal Concentration Fifty** – a calculated concentration of a material in air, exposure to which for a specified length of time, hours (H), month (M), or week (W), is expected to cause the death of 50% of entire defined experimental animal population.

12. **Permissible Exposure Limit :** Permissible Levels of certain Chemical Substances in Work Environment as laid down in the Second Schedule of the Factories Act.

13. **Threshold Limit Value - Short-Term Exposure Limits:** The parts of vapor (gas per million parts of contaminated air by volume at 25o C (77o F) and one atmosphere pressure is given. The limits are given in milligrams per cubic meter maximum permissible average exposures for the time periods specified.

14. **ppm :** Parts per million parts of air.

15. **mg/m3 :** Milligram per cubic metre.

16. **NFPA Hazard Signals** : National Fire Protection Associations USA Hazard Signal – A simple, readily recognizable and easily understood markings (alerting signals) which give at a glance a general idea of the inherent hazards of the material and the order of severity of these hazards as they relate to fire prevention, exposure and control. The system identifies the hazards of a material in terms of three categories – Health, Flammability and Reactivity, and indicates the order of severity in each of these categories. Another category (special) is reserved for additional information when such may be of value to the fire fighter.

17. **Chemical Classification (Hazardous)**: The chemicals hazard classification as per the Corrosive Reactive Explosive Flammable Toxic (CREFT) Classification.

18. **ACGIH** : The American Conference of Governmental Industrial Hygienists, Inc., ACGIH, is an organization open to all practitioners in industrial hygiene, occupational health, environmental health, or safety. Their web site is <http://www.acgih.org/>.

19. **Asphyxiant**: An asphyxiant is a substance that can cause unconsciousness or death by suffocation (asphyxiation). Asphyxiants which have no other health effects and are sometimes referred to as simple asphyxiants. Asphyxiants work by displacing so much oxygen from the ambient atmosphere that the hemoglobin in the blood can not pick up enough oxygen from the lungs to fully oxygenate the tissues. As a result, the victim slowly suffocates.

20. **Flammable limits** : Flammable limits apply generally to vapours and are defined as the concentration range in which a flammable substance can produce a fire or explosion when an ignition source (such as a spark or open flame) is present. The concentration is generally expressed as percent fuel by volume.

a. Above the upper flammable limit (UFL) the mixture of substance and air is too rich in fuel (deficient in oxygen) to burn. This is sometimes called the upper explosive limit (UEL).

b. Below the lower flammable limit (LFL) the mixture of substance and air lacks sufficient fuel (substance) to burn. This is sometimes called the lower explosive limit (LEL). Any concentration between these limits can ignite or explode -- use extreme caution! Being above the upper limit is not particularly safe, either. If a confined space is above the upper flammable limit and is then ventilated or opened to an air source, the vapor will be diluted and the concentration can drop into the flammable limit range.

21. **Flash Point** : This is defined as the lowest temperature at which vapors above a volatile combustible substance will ignite in air when exposed to a flame. Depending on the test method used, the values given are either Tag closed cup (C.C.) (ASTM D56) or

Cleveland open cup (O.C.) (ASTM D93). The values, along with those in 6.2 and 6.7 below, give an indication of the relative flammability of the chemical. In general, the open cup value is about 10o to 15o F higher than the closed cup value.

## 7. *Important Websites*

- (i) Website of United Nations Economic Commission for Europe i.e. [www.unece.org](http://www.unece.org) to know more about Globally Harmonized System of Classification and Labeling of Chemicals (GHS)
- (ii) Website of WCO i.e. [www.wcoomd.org](http://www.wcoomd.org) to know more about World Customs Organization, its activities and about Programme Global Shield.
- (iii) Website of Ministry of Environment, Forest and Climate Change, Government of India i.e. [www.envfor.nic.in](http://www.envfor.nic.in) to know more out of the Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 as amended.
- (iv) Website of Central Pollution Control Board, India i.e. [www.cpcb.nic.in](http://www.cpcb.nic.in) to know more about Material Safety Data Sheets.
- (v) Website of Central Board of Excise & Customs, Department of Revenue, Ministry of Finance, India i.e. [www.cbec.gov.in](http://www.cbec.gov.in) to know more about Indian Customs, legal text of indirect tax statutes, rule, notification etc.
- (vi) Website of National Academy of Customs, Excise and Narcotics, Regional Training Institute, Kanpur, India i.e. [www.nacenkanpur.gov.in](http://www.nacenkanpur.gov.in) for free learning resources on Customs, Central Excise and Service Tax.

## 8. *Reference Materials*

- 8.1 Relevant Rules of Manufacture, storage and Import of Hazardous Chemical Rules, 1989

### 8.1.1: Definition of the term “Hazardous Chemical” under MSIHC Rules, 1989.

**Rule 2(e) of the MSIHC Rules, 1989** contains definition of the term “Hazardous Chemical”. As per the definition, the term "*hazardous chemical*" means-

- (i) *any chemical which satisfies any of the criteria laid down in Part I of Schedule I and is listed in Column 2 of Part II of this Schedule;*
- (ii) *any chemical listed in Column 2 of Schedule 2;*

- (iii) any chemical listed in Column 2 of Schedule 3;

### 8.1.2: Rule 17 of MSIHC Rules, 1989 Providing for MSDS

**Rule 17 of MSIHC Rules, 1989** provides as under:-

*17. Collection, Development and Dissemination of Information.*

(1) *This rule shall apply to an industrial activity in which a hazardous chemical which satisfies any of the criteria laid down in part I of Schedule I and is listed in Column 2 of Part II of this Schedule is or may be involved.*

(2) *An occupier, who has control of an industrial activity in term of sub-rule 1 of this rule, shall arrange to obtain or develop information in the form of safety data sheet as specified in Schedule 9. The information shall be accessible upon request for reference.*

(3) *The occupier while obtaining or developing a safety data sheet as specified in Schedule 9 in respect of a hazardous chemical handled by him shall ensure that the information is recorded accurately and reflects the scientific evidence used in making the hazard determination. In case, any significant information regarding hazard of a chemical is available, it shall be added to the material safety data sheet as specified in Schedule 9 as soon as practicable.*

(4) *Every container of a hazardous chemical shall be clearly labeled or marked to identify,-*  
(a) *the contents of the container,*  
(b) *the name and address of manufacturer or importer of the hazardous chemical;*  
(c) *the physical, chemical and toxicological data as per the criteria given at Part I of Schedule 1.*

(5) *In terms of sub-rule 4 of this rule where it is impracticable to label a chemical in view of the size of the container or the nature of the package, provision should be made for other effective means like tagging or accompanying documents.*

### 8.1.3: Rule 18 of MSIHC Rules, 1989

**Rule 18 of Import of hazardous chemicals** provides as under:-

(1) *This rule shall apply to a chemical which satisfies any of the criteria laid down in Part I of Schedule I and is listed in Column 2 of Part II of this Schedule.*

(2) *Any person responsible for importing hazardous chemicals in India shall provide at the time of import or within thirty days from the date of import to the concerned authorities as identified in Column 2 of Schedule 5 the information pertaining to-*

- (i) *the name and address of the person receiving the consignment in India;*

- (ii) the port of entry in India;
- (iii) mode of transport from the exporting country to India
- (iv) the quantity of chemical(s) being imported; and
- (v) complete product safety information.

(3) If the concerned authority at the State is satisfied that the chemical being imported is likely to cause major accident, it may direct the importer to take such steps including stoppage of such imports as the concerned authority at the State may deem it appropriate.

(4) The concerned authority at the State shall simultaneously inform the concerned Port Authority to take appropriate steps regarding safe handling and storage of hazardous chemicals while off-loading the consignment with the port premises.

(5) Any person importing hazardous chemicals shall maintain the records of the hazardous chemicals imported as specified in Schedule 10 and the records so maintained shall be open for inspection by the concerned authority at the State or the Ministry of Environment and Forests or any officer appointed by them in this behalf.

(6) The importer of the hazardous chemical of a person working on his behalf shall ensure that transport of hazardous chemicals from port of entry to the ultimate destination is in accordance with the Central Motor Vehicles Rules, 1989 framed under the provisions of the Motor Vehicles Act, 1988.

#### 8.1.4: List of Hazardous Chemicals under MSIHC Rules, 1989

List of Hazardous Chemicals					
ID No.	Chemical Name	ID No.	Chemical Name	ID No.	Chemical Name
1	Acetaldehyde	301	Hexachlorodibenzo-p-dioxin	601	tert-Butylperoxyiso-butyrate (conc>=80%)
2	Acetic acid	302	Hexachloronaphthalene	602	Tetra hydrofuran
3	Acetic anhydride	303	Hexafluoropropanoneses quihydrate	603	Tetramethyl lead
4	Acetone	304	Hexamethylphosphoramide	604	Tetranitromethane
5	Acetone cynohydrin	305	Hexamethylenediamine N N dibutyl	605	2,3,7,8 - Tetrachlorodibenzo-p-dioxin
6	Acetone thiosemicarbazide	306	Hexane	606	Tetraethyl lead
7	Acetonitrile	307	Hexanitrostilbene 2,2,4,4,6,6	607	Tetrafluoroethylene
8	Acetylene	308	Hexene	608	Tetramethylenedisulfotetra mine
9	Acetylene tetrachloride	309	Hydrogen selenide	609	Thallic oxide

Material Safety Data Sheets and their relevance to Customs work

10	Acrolein	310	Hydrogen sulphide	610	Thallium carbonate
11	Acrylamide	311	Hydrazine	611	Thallium sulphate
12	Acrylonitrile	312	Hydrazine nitrate (55% solution)	612	Thallos chloride
13	Adiponitrile	313	Hydrochloric acid (gas)	613	Thallosmalonate
14	Aldicarb	314	Hydrogen	614	Thallosulphate
15	Aldrin	315	Hydrogen bromide	615	Thiocarbazide
16	Allyl alcohol	316	Hydrogen cyanide	616	Thiocynamic acid, 2-(benzothioazolyethio) methyl
17	Allylamine	317	Hydrogen fluoride	617	Thiofomox
18	Allyl chloride	318	Hydrogen peroxide	618	Thiometon
19	Aluminium (powder)	319	Hydroquinone	619	Thionazin
20	Aluminiumazide	320	Indene	620	Thionyl chloride
21	Aluminiumborohydride	321	Indium powder	621	Thiophenol
22	Aluminium chloride	322	Indomethacin	622	Thiosemicarbazide
23	Aluminium fluoride	323	Iodine	623	Thiourea (2-chloro-phenyl)
24	Aluminium phosphide	324	Iridium tetrachloride	624	Thiourea (2-methyl phenyl)
25	4-Aminodiphenyl	325	Iron pentacarbonyl	625	Tirpate
26	Amino pyridine	326	Isobenzan	626	Titanium powder
27	2-Aminophenol	327	Isoamyl alcohol	627	Titanium tetra-chloride
28	Aminopterin	328	Isobutyl alcohol	628	Toluene
29	Amiton	329	Isobutyronitrile	629	Toluene 2,4-diisocyanate
30	Amiton oxalate	330	Isocyanic acid 3 4-dichlorophenyl ester	630	Tolylene 2,6-diisocyanate
31	Ammonia	331	Isodrin	631	Trans 1,4-di chloro-butane
32	Ammonium chloroplatinate	332	Isofluorphate	632	Tri nitro anisole
33	Ammonium nitrate	333	Isophoronedisocyanate	633	Tri (cyclohexyl) methylstannyl 1,2,4 triazole)
34	Ammonium nitrite	334	Isopropyl alcohol	634	Tri(cyclohexyl) stannyl-1h-1,2,3- triazole
35	Ammonium picrate	335	Isopropyl chlorocarbonate	635	Triaminotrinitrobenzene
36	Anabasine	336	Isopropyl formate	636	Triamiphos
37	Aniline	337	Isopropyl methyl pyrazolyl dimethyl carbamate	637	Triazophos
38	Aniline 2,4,6-trimethyl	338	Juglone	638	638 2,4,6-Tribromophenol
39	Anthraquinone	339	Ketene	639	Trichloronaphthalene
40	Antimony pentafluoride	340	Lactonitrile	640	Trichloro (chloromethyl) silane
41	Antimycin A	341	Lead arsenite	641	Trichloroacetyl chloride
42	ANTU (alpha-Naphthylthiourea)	342	Lead at high temp (molten)	642	Trichloro(dichlorophenyl)silane
43	Arsenic pentoxide	343	Lead azide	643	Trichloroethylsilane
44	Arsenic trioxide	344	Lead styphnate	644	Trichloroethylene
45	Arsenoustrichloride	345	Leptophos	645	Trichloromethanesulphenyl chloride

## Material Safety Data Sheets and their relevance to Customs work

46	Arsine	346	Lewisite	646	Trichloronate
47	Asphalt	347	Liquefied petroleum gas	647	Trichorophenol 2,3,6
48	Azinphos-ethyl	348	Lithium hydride	648	Trichlorophenol 2,4,5
49	Azinphos methyl	349	m-Dinitrobenzene	649	Trichlorophenylsilane
50	Bacitracin	350	Magnesium powder or ribbon	650	Trichlorophon
51	Barium azide	351	Malathion	651	Triethoxysilane
52	Barium nitrate	352	Maleic anhydride	652	Triethylamine
53	Barium nitride	353	Malononitrile	653	Triethylenemelamine
54	Benzal chloride	354	Managanesetricarbonylcy clopentadiene	654	Trimethylchlorosilane
55	Benzenamine, 3-trifluoromethyl	355	Mechlorethamine	655	Trimethyl propane phosphite
56	Benzene	356	Mephospholan	656	Trimethyl tin chloride
57	Benzene sulfonyl chloride	357	Mercuric chloride	657	Trinitroaniline
58	Benzene, 1-(chloromethyl)-4 nitro	358	Mercuric oxide	658	Trinitrobenzene
59	Benzene arsenic acid	359	Mercury acetate	659	Trintrobenzoic acid
60	Benzidine	360	Mercury fulminate	660	2,4,6-Trinitrophenetole
61	Benzidine salts	361	Mercury methyl chloride	661	Trinitro-m-cresol
62	Benzimidazole, 4,5-dichloro-2 (trifluoromethyl)	362	Mesitylene	662	2,4,6-Trinitrotoluene
63	Benzoquinone-P	363	Methacroleindiacetate	663	Triorthocresyl phosphate
64	Benzotrichloride	364	Methacrylic anhydride	664	Triphenyltin chloride
65	Benzoyl chloride	365	Methacrylonitrile	665	Tris (2-chloroethyl) amine
66	Benzoyl peroxide	366	Methacryloyloxyethylisoc yanate	666	666 Turpentine oil
67	Benzyl chloride	367	Methamidophos	667	Uranium and compounds
68	Beryllium (powder, compound)	368	Methane	668	Valinomycin
69	Bicyclo(2,2,1) heptane-2-carbonitrile	369	Methanesulphonyl fluoride	669	Vanadium pentoxide
70	Biphenyl	370	Methidathion	670	Vinyl acetate monomer
71	Bis (2-chloroethyl) sulphide	371	Methiocarb	671	Vinyl bromide
72	Bis (chloromethyl) ketone	372	Menthonyl	672	Vinyl chloride
73	1,1-di-(tert-Butylperoxy)cyclohexane	373	Methoxy ethanol	673	Vinyl cyclohexane dioxide
74	2,2-Bis (tert-butylperoxy) butane	374	Methoxyethyl mercuric acetate	674	Vinyl fluoride
75	bis(2,4,6-Trinitrophenyl) amine	375	Methacryloyl chloride	675	Vinyl norbornene
76	Bis(chloromethyl) ether	376	Methyl 2-chloroacrylate	676	Vinyl toluene
77	Bismuth and	377	Methyl alcohol	677	Vinyledene chloride

Material Safety Data Sheets and their relevance to Customs work

	compounds				
78	Bisphenol-A	378	Methyl amine	678	Warfarin
79	Bitoscanate	379	Methyl bromide	679	Warfarin sodium
80	Boron powder	380	Methyl chloride	680	Xylene dichloride
81	Boron trichloride	381	Methyl chloroform	681	Xylidine
82	Boron trifluoride	382	Methyl chloroformate	682	Zinc dichloropentanitrile
83	Boron trifluoride compound with methyl ether 1:1	383	4-Methyl-1-cyclohexene	683	Zinc phosphate
84	Bromine	384	Methyl disulphide	684	Zirconium and compounds
85	Bromine pentafluoride	385	Methyl ethyl ketone peroxide (conc. 60 %)	685	Ammonium nitrates in fertilizers
86	Bromochloro methane	386	Methyl formate	686	Chlorotrinitrobenzene
87	Bromadiolone	387	Methyl hydrazine	687	Fluoro 2-hydroxy butyric acid
88	Butadiene	388	Methyl isobutyl ketone	688	Fluoro 2-hydroxy butyric acid, amides
89	Butane	389	Methyl isocyanate	689	Fluoro 2-hydroxy butyric acid, esters
90	Butanone-2	390	Methyl isothiocyanate	690	Fluoroacetic acid
91	Butyl amine tert	391	Methyl mercuric dicyanamide	691	Fluoroacetic acid, esters
92	Butyl glycidyl ether	392	Methyl mercaptan	692	Fluoroacetic acid, salts
93	Butyl isovalerate	393	Methyl methacrylate	693	Methyl isobutyl ketone peroxide
94	Butyl peroxy maleate, tertiary	394	Methyl phencapton	694	O,O-Diethyl-S-isopropylthio methyl phosphorodithioate
95	Butyl vinyl ether	395	Methyl phosphonic dichloride	695	O,O-Diethyl-S-propylthio methyl phosphorodithioate
96	Butyl-n-mercaptan	396	Methyl thiocyanate	696	Peracetic acid
97	C.I. Basic Green	397	Methyl trichlorosilane	697	tert-Butylperoxy isopropyl carbonate (concentration >=80%)
98	Cadmium oxide	398	Methyl vinyl ketone	698	Tert-butyl peroxy maleate (conc >= 80 %)
99	Cadmium stearate	399	Methylene bis (2-chloroaniline)	699	2,4,6-Trinitroanilole
100	Calcium arsenate	400	Methylene chloride	700	2,4-Dinitrophenol sodium salt hydrate
101	Calcium carbide	401	Methylenebis-4,4 (2-chloroaniline)	701	4 - fluorocrotonic acid, amides
102	Calcium cyanide	402	Metolcarb	702	4-Fluorobutyric acid
103	Camphechlor (toxaphene)	403	Mevinphos	703	4-Fluorobutyric acid, amides
104	Cantharidin	404	Mezcarb	704	4-fluorobutyric acid, salts
105	Captan	405	Mitomycin C	705	4-Fluorocrotonic acid
106	Carbachol chloride	406	Molybdenum powder	706	4-Fluorocrotonic acid, salts
107	Carbaryl	407	Monocrotophos	707	Benzidinedihydrochloride
108	Carbofuran	408	Morpholine	708	Beryllium acetylacetonate
109	Carbon tetrachloride	409	Muscimol	709	Beryllium nitrate
110	Carbon disulphide	410	Mustard gas	710	Beryllium silicate

## Material Safety Data Sheets and their relevance to Customs work

111	Carbon monoxide	411	n-Butyl acetate	711	Beryllium sulfate
112	Carbophenothion	412	n-Butyl alcohol	712	Bismuth basic carbonate
113	Carvone	413	n-Hexane	713	Bismuth nitrate
114	Cellulose nitrate	414	N-Methyl-N,2,4,6-tetranitroaniline	714	Bismuth subsalicylate
115	Chloroacetic acid	415	Naphtha	715	Bismuth sulfide
116	Chlordane	416	Naphtha solvent	716	Carbonylhydrotris(triphenyl phosphine)rhodium
117	Chlorfenvinphos	417	Naphthalene	717	Chloro(1,5-cyclooctadiene)rhodium(I) dimer
118	Chlorinated benzenes	418	2-Naphthylamine	718	Copper(I) bromide
119	Chlorine	419	Nickel tetracarbonyl	719	Copper(I) iodide
120	Chlorine dioxide	420	2-Nickel (metal, oxides, carbonates, sulphides as powder)	720	Copper(II) fluoride
121	Chlorine trifluoride	421	Nicotine	721	Dibenzyl
122	Chlormephos	422	Nicotine sulphate	722	Dichlorobenzene
123	Chlormequat chloride	423	Nitric acid	723	Ethylenebis(indenyl)zirconium dichloride
124	Chloroacetyl chloride	424	Nitric oxide	724	N,N,N',N'-Tetramethylbenzidine
125	Chloroacetaldehyde	425	Nitrobenzene	725	Rhodium, carbonylchlorobis(triphenyl phosphine)
126	Chloroaniline-2	426	Nitrocellulose (dry)	726	Trichlorobenzene
127	4-Chloroaniline	427	Nitrochlorobenzene	727	Tris(triphenylphosphine)rhodium(I) chloride
128	Chlorobenzene	428	Nitrocyclohexane	728	Uranium hexafluoride
129	Chloroethylchloroformate	429	Nitrogen	729	Uranium(IV) bromide
130	Chloroform	430	Nitrogen dioxide	730	Uranium(IV) chloride
131	Chloroformylmorpholine	431	Nitrogen oxide	731	Zinc phosphide
132	Chloromethane	432	Nitrogen trifluoride	732	Zirconium tert-butoxide
133	Chloromethyl methyl ether	433	Nitroglycerine	733	Zirconium(IV) bromide
134	Chloronitrobenzene	434	1-Nitropropane	734	3,3'-Dihydroxybenzidine
135	Chlorophacinone	435	2-Nitropropane	735	Powdered metals and mixtures (Metal powder, flammable)
136	Chlorosulphonic acid	436	Nitroso dimethyl amine		
137	Chlorothiophos	437	Nonane		
138	Chloroxuron	438	Norbormide		
139	Chromic acid	439	o-Cresol		
140	Chromic chloride	440	o-Nitrotoluene		
141	Chromium powder	441	o-Toluidine		
142	Cobalt carbonyl	442	o-Xylene		
143	Cobalt nitrilmethylidyne compound	443	p-Nitroaniline		

144	Cobalt (powder)	444	Oleum		
145	Colchicine	445	OO diethyl s ethyl suph methyl phos		
146	Copper and compounds	446	O,O-Diethyl-S-isopropylthio methyl phosphorodithioate		
147	Copper oxychloride	447	O,O-Diethyl-S-ethylsulphinylmethylphosphorothioate		
148	Coumafuryl	448	O,O-Diethyl-S-ethylsulphonyl methyl phosphorothioate		
149	Coumaphos	449	O,O-Diethyl S-ethylthiomethylphosphorothioate		
150	Coumatetralyl	450	Organo rhodium complex		
151	Crimidine	451	Orotic acid		
152	Crotenaldehyde	452	Osmium tetroxide		
153	Crotonaldehyde	453	Ouabain		
154	Cumene	454	Oxamyl		
155	Cyanogen bromide	455	Oxetane 3,3-bis(chloromethyl)		
156	Cyanogen iodide	456	Oxidiphenoxarsine		
157	Cyanophos	457	Oxydisulfoton		
158	Cyanothoate	458	Oxygen (liquid)		
159	Cyanuric fluoride	459	Oxygen difluoride		
160	Cyclohexylamine	460	Ozone		
161	Cyclohexane	461	p-Nitrophenol		
162	Cyclohexanone	462	Paraffin		
163	Cycloheximide	463	Paraoxon		
164	Cyclopentadiene	464	Paraquat		
165	Cyclopentane	465	Paraquatmethosulfate		
166	Cyclotetramethylenetranitramine	466	Parathion		
167	Cyclotrimethylenetranitramine	467	Parathion methyl		
168	Cypermethrin	468	Paris green		
169	DDT	469	Pentaborane		
170	Decaborane (1:4)	470	Pentachloroethane		
171	Demeton	471	Pentachlorophenol		
172	Demeton-S-methyl	472	Pentabromophenol		
173	Di-n-propyl peroxydicarbonate (Conc. 80%)	473	Pentachloro naphthalene		
174	Dialifos	474	Pentadecylamine		
175	Diazodinitrophenol	475	Pentaerythritoltetranitrate		
176	Dibenzylperoxydicarbonate	476	Pentane		
177	Diborane	477	Pentanone		
178	Dichloroacetylene	478	Perchloric acid		

179	Dichlorobenzalkonium chloride	479	Perchloroethylene		
180	Dichloroethyl ether	480	Peroxyacetic acid		
181	Dichloromethylphenylsilane	481	Phenol		
182	2,6-Dichlorophenol	482	Phenol 2,2-thiobis (4, 6 - dichloro )		
183	2,4-Dichlorophenol	483	Phenol 2,2-thiobis (4-chloro 6-methyl phenol)		
184	Dichlorophenoxy acetic acid	484	Phenol, 3-(1-methylethyl)-, methylcarbamate		
185	Dichloropropane-2,2	485	Phenyl hydrazine hydrochloride		
186	Dichlorosalicylic acid-3,5	486	Phenyl mercury acetate		
187	Dichlorvos	487	Phenyl silatrane		
188	Dicrotophos	488	Phenyl thiourea		
189	Dieldrin	489	Phenylene-p-diamine		
190	Diepoxybutane	490	Phorate		
191	Diethyl carbamazine citrate	491	Phosacetim		
192	Diethyl chlorophosphate	492	Phosfolan		
193	Diethyl ethanolamine	493	Phosgene		
194	Diethyl peroxydicarbonate	494	Phosmet		
195	Diethyl phenylenediamine	495	Phosphamidon		
196	Diethylamine	496	Phosphine		
197	Diethylene glycol	497	Phosphoric acid		
198	Diethylene glycol dinitrate	498	Phosphoric acid dimethyl (4-methyl thio) phenyl		
199	Diethylenetriamine	499	Phosphonothioic acid, dimethyl-, s-(2-bis ) ester		
200	Diethyleneglycol butyl ether	500	Phosphorothioic acid , methyl ester		
201	Diglycidyl ether	501	Phosphorothioic acid, O,O-dimethyl S-(2methyl)		
202	Digitoxin	502	Phosphorothioic, methyl-ethyl ester		
203	2,2-Dihydroperoxypropane	503	Phosphorous		
204	Diisobutryl peroxide	504	Phosphorous oxychloride		
205	Dimefox	505	Phosphorous pentoxide		
206	Dimethoate	506	Phosphorous trichloride		
207	Dimethyl dichlorosilane	507	Phosphorous penta chloride		

208	Dimethyl hydrazine	508	Phthalic anhydride		
209	Dimethylnitrosamine	509	Phylloquinone		
210	Dimethyl p phenylenediamine	510	Physostigmine		
211	Dimethyl phosphor amidocyanidic acid	511	Physostigmine salicylate (1:1)		
212	Dimethyl phosphorochloridothioate	512	Picric acid		
213	Dimethyl sulfolane	513	Picrotoxin		
214	Dimethyl sulphide	514	Piperidine		
215	Dimethylamine	515	Piprotal		
216	Dimethylaniline	516	Pirinifos-ethyl		
217	Dimethylcarbamoyl chloride	517	Platinous chloride		
218	Dimetilan	518	Platinum tetrachloride		
219	Dinitro-o-cresol	519	Potassium arsenite		
220	Dinitrophenol	520	Potassium chlorate		
221	Dinitrotoluene	521	Potassium cyanide		
222	Dinoseb	522	Potassium hydroxide		
223	Dinoterb	523	Potassium nitride		
224	Dioxane	524	Potassium nitrite		
225	Dioxathion	525	Potassium peroxide		
226	Dioxine N	526	Potassium silver cyanide		
227	Diphacinone	527	Powdered metals and mixtures (Self-heating metal powders)		
228	Diphosphoramidooctamethyl	528	Promecarb		
229	Diphenyl methane diisocyanate (MDI)	529	Promurit		
230	Dipropylene glycol butyl ether	530	Propanesultone		
231	Dipropylene glycol methyl ether	531	Propargyl alcohol		
232	Di-(sec-butyl)peroxydicarbonate	532	Propargyl bromide		
233	Disulfoton	533	Propen-1,-2-chloro-1,3-diol diacetate		
234	Dithiazanine iodide	534	Propiolactone beta		
235	Dithiobiurate	535	Propionitrile		
236	Endosulfan	536	Propionitrile, 3-chloro		
237	Endothion	537	Propiophenone, 4-amino		
238	Endrin	538	Propyl chloroformate		
239	Epichlorohydrin	539	Propylene dichloride		

240	EPN	540	Propylene glycol allyl ether		
241	Ergocalciferol	541	Propylene imine		
242	Ergotamine tartrate	542	Propylene oxide		
243	Ethanesulfenyl chloride, 2 chloro	543	Prothoate		
244	Ethanol 1-2 dichloracetate	544	Pseudocumene		
245	Ethion	545	Pyrazoxon		
246	Ethoprophos	546	Pyrene		
247	Ethyl acetate	547	Pyridine		
248	Ethyl alcohol	548	Pyridine, 2-methyl-5-Vinyl		
249	Ethyl benzene	549	Pyridine, 4-nitro-1-oxide		
250	Ethyl bis amine	550	Pyridine 4-nitro-1-oxide		
251	Ethyl bromide	551	Pyriminil		
252	Ethyl carbamate	552	Quinalphos		
253	Ethyl ether	553	Quinone		
254	Ethyl hexanol-2	554	Rhodium trichloride		
255	Ethyl mercaptan	555	Salcomine		
256	Ethyl mercuric phosphate	556	Sarin		
257	Ethyl methacrylate	557	Selenious acid		
258	Ethyl nitrate	558	Selenium hexafluoride		
259	Ethyl thiocyanate	559	Selenium oxychloride		
260	Ethylamine	560	Semicarbazide hydrochloride		
261	Ethylene	561	Silane (4-aminio butyl) diethoxymethyl-		
262	Ethylene chlorohydrin	562	Sodium		
263	Ethylene dibromide	563	Sodium anthra-quinone-1-sulphonate		
264	Ethylene diamine	564	Sodium arsenate		
265	Ethylenediaminedihydrochloride	565	Sodium arsenite		
266	Ethylene flourohydrine	566	Sodium azide		
267	Ethylene glycol	567	Sodium cacodylate		
268	Ethylene glycol dinitrate	568	Sodium chlorate		
269	Ethylene oxide	569	Sodium cyanide		
270	Ethyleneimine (inhibited)	570	Sodium fluoroacetate		
271	Ethylene dichloride	571	Sodium hydroxide		
272	Fenamiphos	572	Sodium pentachlorophenate		
273	Femitrothion	573	Sodium picramate		
274	Fensulphothion	574	Sodium selenate		
275	Fluenetil	575	Sodium selenite		
276	Fluorine	576	Sodium sulphide		

277	Fluoro 2-hydroxy butyric acid, salts	577	Sodium tellorite		
278	Fluoroacetamide	578	Stannaneacetoxypentaphenyl		
279	Fluoroacetic acid amides	579	Stibine		
280	Fluoroacetyl chloride	580	Strychnine		
281	4-fluorobutyric acid, esters	581	Strychnine sulphate		
282	4-Fluorocrotonic acid, esters	582	Styphnic acid		
283	Fluorouracil	583	Styrene		
284	Fonofos	584	Sulfotep		
285	Formaldehyde	585	Sulphoxide, 3-chloropropyl octyl		
286	Formetanate hydrochloride	586	Sulphur dichloride		
287	Formic acid	587	Sulphur dioxide		
288	Formoparanate	588	Sulphurmonochloride		
289	Formothion	589	Sulphurtetrafluoride		
290	Fosthietan	590	Sulphur trioxide		
291	Fuberidazole	591	Sulphuric acid		
292	Furan	592	Tellurium		
293	Gallium trichloride	593	Tellurium hexafluoride		
294	Glyconitrile	594	TEPP		
295	Guanyl-4-nitrosaminogwynyl-1-tetrazene	595	Terbufos		
296	Heptachlor	596	tert-Butyl alcohol		
297	3,3,6,6,9,9-Hexamethyl-1,2,4,5-tetroxonane (conc. 75% or more)	597	Tert-butyl peroxy carbonate		
298	Hexachlorobenzene	598	tert-Butyl peroxyisopropyl carbonate		
299	Lindane	599	tert-Butylperoxyacetate (conc> = 70 %)		
300	Hexachlorocyclopentadiene	600	tert-Butylperoxypivalate (conc>= 77%)		

**Note:** Yellow background indicate that the chemical is a explosive precursor chemical and subjected to monitoring under Programme Global Shield.

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