Section 1 - Product and Company Information

Product Name                  HYDRAZINE HYDRATE
Product Number               H0883
Brand                        SIGMA
Company                      Sigma-Aldrich Canada, Ltd
Address                      2149 Winston Park Drive
                              Oakville ON L6H 6J8 CA
Technical Phone:             9058299500
Fax:                         9058299292
Emergency Phone:             800-424-9300

Section 2 - Composition/Information on Ingredient

<table>
<thead>
<tr>
<th>Substance Name</th>
<th>CAS #</th>
<th>SARA 313</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYDRAZINE MONOHYDRATE, APPROX 64%</td>
<td>7803-57-8</td>
<td>Yes</td>
</tr>
<tr>
<td>HYDRAZINE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HAZARDOUS COMPONENTS:</td>
<td>CAS #</td>
<td>Percent</td>
</tr>
<tr>
<td>HYDRAZINE ANHYDROUS</td>
<td>None</td>
<td>&gt;= 64</td>
</tr>
</tbody>
</table>

Formula                               H4N2.H2O
Synonyms                              Hydrazine hydrate * Hydrazine hydroxide *
                                      Hydrazinium hydroxide * Idrazina idrata (Italian)
RTECS Number:                         MV8050000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW
Toxic.
May cause cancer. Toxic by inhalation, in contact with skin and if swallowed. Causes burns. May cause sensitization by skin contact.
Readily absorbed through skin. Target organ(s): Blood. Liver.
Combustible.

HMIS RATING
HEALTH: 3*
FLAMMABILITY: 2
REACTIVITY: 1

NFPA RATING
HEALTH: 3
FLAMMABILITY: 2
REACTIVITY: 1

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is
conscious. Call a physician. Do not induce vomiting.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

DERMAL EXPOSURE
In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

CONDITIONS OF FLAMMABILITY
Warning: hydrazine vapor in air is flammable at 4.7 to 100% hydrazine by volume - handle under nitrogen! Some metals and alloys including monel, bronze, brass, cadmium, gold, molybdenum, and stainless steel with more than 0.5% molybdenum or rust cause decomposition of hydrazine.

FLASH POINT
165 °F   74 °C   Method: closed cup

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Emits toxic fumes under fire conditions. Combustible liquid.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area. Shut off all sources of ignition.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Cover with dry lime or soda ash, pick up, keep in a closed container, and hold for waste disposal. Ventilate area and wash spill site after material pickup is complete.
Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe vapor. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed. Keep away from heat and open flame. Store in a cool dry place.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Safety shower and eye bath. Use only in a chemical fume hood.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Hand: Compatible chemical-resistant gloves. Eye: Chemical safety goggles. Other: Faceshield (8-inch minimum).

GENERAL HYGIENE MEASURES
Wash contaminated clothing before reuse. Discard contaminated shoes. Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS
<table>
<thead>
<tr>
<th>Country</th>
<th>Source</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>NIOSH</td>
<td>Ceiling</td>
<td>co0.03 PPM/120M</td>
</tr>
</tbody>
</table>

Section 9 - Physical/Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
<th>At Temperature or Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Physical State: Clear liquid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Color: Colorless</td>
<td></td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>50.06 AMU</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>BP/BP Range</td>
<td>120.1 °C</td>
<td>760 mmHg</td>
</tr>
<tr>
<td>MP/MP Range</td>
<td>- 51.7 °C</td>
<td></td>
</tr>
<tr>
<td>Freezing Point</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>5 mmHg</td>
<td>25 °C</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>&gt; 1 g/l</td>
<td></td>
</tr>
<tr>
<td>Saturated Vapor Conc.</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>SG/Density</td>
<td>1.032 g/cm3</td>
<td></td>
</tr>
<tr>
<td>Bulk Density</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Volatile%</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>VOC Content</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Water Content</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Solvent Content</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Viscosity</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Surface Tension</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Partition Coefficient</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Decomposition Temp.</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
Flash Point: 165 °F 74 °C  
Method: closed cup

Explosion Limits: N/A
Flammability: N/A
Autoignition Temp: N/A
Refractive Index: 1.428
Optical Rotation: N/A
Miscellaneous Data: N/A
Solubility: N/A

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Oxidizing agents, Oxygen, Copper, Zinc, Organic materials.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Nitrogen oxides.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: Causes burns.
Skin Absorption: Readily absorbed through skin. Toxic if absorbed through skin.
Eye Contact: Causes burns.
Inhalation: Toxic if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.
Ingestion: Toxic if swallowed.

SENSITIZATION
Skin: May cause allergic skin reaction.

TARGET ORGAN(S) OR SYSTEM(S)

SIGNS AND SYMPTOMS OF EXPOSURE

TOXICITY DATA
Oral
Rat
129 mg/kg
LD50
Oral
Mouse
83 mg/kg
LD50

Intraperitoneal
Mouse
156 MG/KG
LD50

Oral
Rabbit
55 mg/kg
LD50

Oral
Guinea pig
40 mg/kg
LD50

CHRONIC EXPOSURE - CARCINOGEN
Result: This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Species: Mouse
Route of Application: Skin
Dose: 80 GM/KG
Exposure Time: 43W
Frequency: I
Result: Tumorigenic: Carcinogenic by RTECS criteria. Lungs, Thorax, or Respiration: Tumors.

IARC CARCINOGEN LIST
Rating: Group 2B Group 2B

ACGIH CARCINOGEN LIST
Rating: A3

IRIS/EPA CARCINOGEN LIST
Rating: Group B2

CHRONIC EXPOSURE - MUTAGEN
Result: Laboratory experiments have shown mutagenic effects.

Species: Rat
Route: Inhalation
Dose: 850 UG/M3/5H/16W-I
Mutation test: Cytogenetic analysis

Species: Mouse
Dose: 10 UMOL/L
Cell Type: liver
Mutation test: DNA repair

Species: Mouse
Route: Intraperitoneal  
Dose: 1560 UMOL/KG  
Mutation test: DNA damage

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD
Result: Overexposure may cause reproductive disorder(s) based on tests with laboratory animals.

Species: Rat  
Dose: 3240 UG/KG  
Route of Application: Oral  
Exposure Time: (24W PRE)  
Result: Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea). Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Species: Rat  
Dose: 130 UG/M3/5H  
Route of Application: Inhalation  
Exposure Time: (16W PRE)  
Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea).

Species: Rat  
Dose: 10 UG/M3/5H  
Route of Application: Inhalation  
Exposure Time: (8W MALE)  
Result: Paternal Effects: Spermatogenesis (including genetic material, sperm morphology, motility, and count).

Species: Hamster  
Dose: 150 MG/KG  
Route of Application: Intramuscular  
Exposure Time: (12D PREG)  
Result: Effects on Newborn: Biochemical and metabolic.

Section 12 - Ecological Information
No data available.

Section 13 - Disposal Considerations
APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. This combustible material may be burned in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information
DOT  
Proper Shipping Name: Hydrazine hydrate [or] Hydrazine aqueous solutions, [with not less than 37 percent but not more than 64 percent hydrazine, by mass]  
UN#: 2030  
Class: 8  
Packing Group: Packing Group II
Hazard Label: Corrosive
Hazard Label: Toxic substances.
PIH: Not PIH

IATA
Proper Shipping Name: Hydrazine, aqueous solution
IATA UN Number: 2030
Hazard Class: 8
Packing Group: II
Not Allowed - Aircraft: Cargo aircraft only. Not permitted on passenger aircraft.

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: T-N
Indication of Danger: Toxic. Dangerous for the environment.
R: 45-10-23/24/25-34-43-50/53
Risk Statements: May cause cancer. Flammable. Also toxic by inhalation, in contact with skin and if swallowed. Causes burns. May cause sensitization by skin contact. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S: 53-45-60-61
Safety Statements: Restricted to professional users. Attention - Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). This material and its container must be disposed of as hazardous waste. Avoid release to the environment. Refer to special instructions/safety data sheets.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Toxic.
Risk Statements: May cause cancer. Toxic by inhalation, in contact with skin and if swallowed. Causes burns. May cause sensitization by skin contact.
Safety Statements: Avoid exposure - obtain special instructions before use. Do not breathe vapor. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing, gloves, and eye/face protection. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
NOTES: This product is or contains a component that is subject to SARA313 reporting requirements.

UNITED STATES - STATE REGULATORY INFORMATION
CALIFORNIA PROP - 65
California Prop - 65: This product is or contains chemical(s) known to the state of California to cause cancer.

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: No
Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2008 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.