Section 1 - Product and Company Information

Product Name                 TETRAETHYLTHIURAM DISULFIDE CRYSTALLINE
Product Number               T1132
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>DISULFIRAM TETRAETHYLTHIURAM DISULFIDE</td>
<td>97-77-8</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Formula</th>
<th>Synonyms</th>
</tr>
</thead>
<tbody>
<tr>
<td>C10H20N2S4</td>
<td>Abstensil * Abstinil * Abstinyl * Alcophobin * Antabus * Antabuse * Antaenyl * Antaethyl * Antalcol * Antetan * Antetil * Anti-ethyl * Antietil * Antikol * Antivitium * Aversan * Averzan * Bis((diethylamino)thioxomethyl)disulphide * Bis(diethylthiocarbamoyl) disulfide * Bis(N,N-diethylthiocarbamoyl) disulfide * Bis(diethylthiocarbamoyl)disulphide * Bis(N,N-diethylthiocarbamoyl)disulphide * Contralin * Cronetal * Dicupral * Disulfiram (ACGIH) * Disulfuram * Disulphuram * 1,1'-Dithiobis(N,N-diethylthioformamide) * Dupon 4472 * Dupont fungicide 4472 * Ekagom TEDS * ENT 27,340 * Ephorran * Espenal * Esperal * Etabus * Ethyldithiourame * Ethyldithiourame * Ethyl thiuram * Ethyl thiurad * Ethyl tuads * Ethyl TUEX * Exhoran * Formamide, 1,1'-dithiobis(N,N-diethylthio- * HOCA * Krotenal * NCI-C02959 * Nochin * Noxal * NSC 190940 * Refusal * Ro-Sulfiram * Stopetyl * Tenurid * Tenutex * TETD * Tetidis * Tetradin * Tetradine * Tetraethylthioperoxydicarboxonic diamide * Tetraethylthiram disulphide * Tetraethylthiram disulfide * Tetraethylthiram disulphide * N,N,N',N'-Tetraethylthiuram disulphide * Tetraethylthiram disulfide * Tetraethylthiram disulfide, tetraethyl- * Thiuram E * Thiuram disulfide, tetraethyl- * Thiuranide * USAF B-33</td>
</tr>
</tbody>
</table>

RTECS Number: J01225000

Section 3 - Hazards Identification
EMERGENCY OVERVIEW
Dangerous for the environment. Toxic (USA) Harmful (EU).
Harmful if swallowed. May cause sensitization by skin contact.
Harmful: danger of serious damage to health by prolonged exposure
if swallowed. Very toxic to aquatic organisms, may cause long-term
adverse effects in the aquatic environment.
Target organ(s): Nerves.

HMIS RATING
HEALTH: 3*
FLAMMABILITY: 0
REACTIVITY: 0

NFPA RATING
HEALTH: 3
FLAMMABILITY: 0
REACTIVITY: 0

*additional chronic hazards present.

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.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If breathing becomes difficult,
call a physician.

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

FLASH POINT
N/A

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Water spray. Carbon dioxide, dry chemical powder, or
appropriate foam.

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.
Section 6 - Accidental Release Measures

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear respirator, chemical safety goggles, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Avoid breathing dust. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Mechanical exhaust required.

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 dust mask type N95 (US) or type P1 (EN 143) respirator.
Other: Wear appropriate government approved respirator, chemical-resistant gloves, safety goggles, other protective clothing.

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

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>ACGIH</td>
<td>TWA</td>
<td>2 MG/M3</td>
</tr>
<tr>
<td>New Zealand</td>
<td>OEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks:</td>
<td>check ACGIH TLV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>NIOSH</td>
<td>TWA</td>
<td>2 MG/M3</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>Molecular Weight</td>
<td>296.54 AMU</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>BP/BP Range</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>MP/MP Range</td>
<td>69 °C</td>
<td></td>
</tr>
<tr>
<td>Freezing Point</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Vapor Density</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Saturated Vapor Conc.</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
Bulk Density N/A
Odor Threshold N/A
Volatile% N/A
VOC Content N/A
Water Content N/A
Solvent Content N/A
Evaporation Rate N/A
Viscosity N/A
Surface Tension N/A
Partition Coefficient N/A
Decomposition Temp. N/A
Flash Point N/A
Explosion Limits N/A
Flammability N/A
Autoignition Temp N/A
Refractive Index N/A
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: Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide, Nitrogen oxides, Sulfur oxides.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: May cause skin irritation.
Skin Absorption: May be harmful if absorbed through the skin.
Eye Contact: May cause eye irritation.
Inhalation: May be harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.
Ingestion: Harmful if swallowed.

SENSITIZATION
Sensitization: Sensitizer.
Skin: May cause allergic skin reaction.

TARGET ORGAN(S) OR SYSTEM(S)
Nerves.

SIGNS AND SYMPTOMS OF EXPOSURE
A serious toxic interaction has been observed in rats fed tetraethylthiuram (antabuse, ro-sulfiram) and then exposed to vapors of 1,2-dibromoethane. Ingestion of ethyl alcohol may result in: nausea, vomiting, pallor, hypotension, dizziness, headache, dyspnea, convulsions, cardiac arrhythmias, unconsciousness, and death. May cause acneform eruptions, allergic dermatitis, urticaria, lassitude, reduced sexual potency, a garlic-like or metallic taste. Peripheral neuritis, polyneuritis and optic neuritis as well as both cholestatic and
fulminant hepatitis have been reported. Sensitization to alcohol may last for as long as 6 to 14 days after last ingestion of tetraethylthiuram disulfide.

CONDITIONS AGGRAVATED BY EXPOSURE
May cause nervous system disturbances.

TOXICITY DATA

Oral
Woman
90 mg/kg
LDLO

Oral
Man
150 mg/kg
LDLO
Remarks: Liver: Hepatitis (hepatocellular necrosis), diffuse.

Oral
Human
160 mg/kg
LDLO

Oral
Rat
500 mg/kg
LD50

Intraperitoneal
Rat
248 MG/KG
LD50

Oral
Mouse
1980 mg/kg
LD50

Intraperitoneal
Mouse
75 MG/KG
LD50

Subcutaneous
Mouse
2600 MG/KG
LD50

Oral
Rabbit
1800 mg/kg
LD50

IRRITATION DATA

Eyes
Rabbit
100 mg
Remarks: Mild irritation effect

CHRONIC EXPOSURE - CARCINOGEN
Result: This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

Species: Mouse
Route of Application: Oral
Dose: 35 GM/KG
Exposure Time: 78W
Frequency: I
Result: Tumorigenic: Neoplastic by RTECS criteria. Liver: Tumors.

Species: Mouse
Route of Application: Subcutaneous
Dose: 1000 MG/KG

IARC CARCINOGEN LIST
Rating: Group 3

NTP CARCINOGEN LIST
Rating: No evidence.
Species: Mouse/rat
Route: Feed

ACGIH CARCINOGEN LIST
Rating: A4

CHRONIC EXPOSURE - TERATOGEN
Species: Rat
Dose: 400 MG/KG
Route of Application: Parenteral
Exposure Time: (4-11D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Species: Rat
Dose: 800 MG/KG
Route of Application: Parenteral
Exposure Time: (2D MALE/2D PRE)
Result: Effects on Embryo or Fetus: Fetal death. Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).
Species: Mouse  
Dose: 1278 MG/KG  
Route of Application: Subcutaneous  
Exposure Time: (6-14D PREG)  
Result: Specific Developmental Abnormalities: Craniofacial (including nose and tongue). Specific Developmental Abnormalities: Musculoskeletal system.

CHRONIC EXPOSURE - MUTAGEN

Species: Human  
Dose: 100 UMOL/L  
Cell Type: HeLa cell  
Mutation test: DNA inhibition

Species: Rat  
Route: Oral  
Dose: 12600 MG/KG  
Exposure Time: 6W  
Mutation test: Morphological transformation.

Species: Mouse  
Dose: 16 UG/L  
Cell Type: lymphocyte  
Mutation test: specific locus test

Species: Mouse  
Dose: 10 MG/L  
Cell Type: Embryo  
Mutation test: DNA inhibition

Species: Mouse  
Route: Oral  
Dose: 200 MG/KG  
Exposure test: Sister chromatid exchange

Species: Hamster  
Dose: 20 UG/L  
Cell Type: Embryo  
Mutation test: Morphological transformation.

Species: Hamster  
Dose: 5 UMOL/L  
Cell Type: ovary  
Mutation test: Sister chromatid exchange

Species: Chicken  
Dose: 120 NMOL/L  
Cell Type: Embryo  
Mutation test: DNA inhibition

Species: Chicken  
Dose: 120 NMOL/L  
Cell Type: Embryo  
Mutation test: Other mutation test systems

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD

Species: Rat  
Dose: 5 GM/KG  
Route of Application: Oral  
Exposure Time: (3-12D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Species: Rat
Dose: 310 MG/KG
Route of Application: Oral
Exposure Time: (31D MALE)
Result: Paternal Effects: Testes, epididymis, sperm duct.

Species: Mouse
Dose: 13200 MG/KG
Route of Application: Oral
Exposure Time: (15D PRE/1-18D PREG)
Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Species: Mouse
Dose: 39200 MG/KG
Route of Application: Oral
Exposure Time: (7-14D PREG)
Result: Effects on Newborn: Viability index (e.g., # alive at day 4 per # born alive).

Species: Mouse
Dose: 1278 MG/KG
Route of Application: Subcutaneous
Exposure Time: (6-14D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord). Effects on Fertility: Litter size (e.g.; # fetuses per litter; measured before birth).

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. Dissolve or mix the material with a combustible solvent and burn 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: None
Non-Hazardous for Transport: This substance is considered to be non-hazardous for transport.

IATA
Proper Shipping Name: Environmentally hazardous substance, solid, n.o.s
IATA UN Number: 3077
Hazard Class: 9
Packing Group: III
Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: Xn-N
Indication of Danger: Harmful. Dangerous for the environment.
R: 22-43-48/22-50/53
Risk Statements: Harmful if swallowed. May cause sensitization by skin contact. Also harmful: danger of serious damage to health by prolonged exposure if swallowed. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S: 24-37-60-61
Safety Statements: Avoid contact with skin. Wear suitable gloves. 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: Dangerous for the environment. Toxic (USA) Harmful (EU).
Risk Statements: Harmful if swallowed. May cause sensitization by skin contact. Harmful: danger of serious damage to health by prolonged exposure if swallowed. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety Statements: 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. 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 Statements: Target organ(s): Nerves.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: No
TSCA INVENTORY ITEM: Yes

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: Yes
NDSL: 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 2009 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.