Section 1 - PRODUCT AND COMPANY IDENTIFICATION

Material Name: DIBORANE 0.4-2.5%/ HYDROGEN (BALANCE) GAS MIXTURE

Product Use
Industrial and Specialty Gas Applications.

Restrictions on Use
None known.

Details of the supplier of the safety data sheet
MATHESON TRI-GAS, INC.
150 Allen Road, Suite 302
Basking Ridge, NJ 07920
General Information: 1-800-416-2505
Emergency #: 1-800-424-9300 (CHEMTREC)
Outside the US: 703-527-3887 (Call collect)

Section 2 - HAZARDS IDENTIFICATION

Classification in accordance with paragraph (d) of 29 CFR 1910.1200.
Flammable Gases - Category 1
Gases Under Pressure - Compressed gas
Acute Toxicity - Inhalation - Gas - Category 3
Skin Corrosion/Irritation - Category 2
Serious Eye Damage/Eye Irritation - Category 2A
Specific target organ toxicity - Single exposure - Category 1
Specific target organ toxicity - Repeated exposure - Category 1

GHS Label Elements
Symbol(s)

Signal Word
Danger

Hazard Statement(s)
Extremely flammable gas.
Contains gas under pressure; may explode if heated.
Toxic if inhaled.
Causes skin irritation.
Causes serious eye irritation.
Causes damage to respiratory system.
Causes damage to nervous system and respiratory system through prolonged or repeated exposure.

Precautionary Statement(s)
Prevention
Keep away from heat, sparks, open flame, and hot surfaces - No smoking.
Do not breathe gas.
Use only outdoors or in a well-ventilated area.
Material Name: DIBORANE 0.4-2.5%/ HYDROGEN (BALANCE) GAS MIXTURE

Wash thoroughly after handling.
Wear protective gloves and eye/face protection.
Do not eat, drink or smoke when using this product.

Response
Leaking gas fire.
Do not extinguish, unless leak can be stopped safely.
Eliminate all ignition sources if safe to do so.
IF exposed.
Call a POISON CENTER or doctor/physician.
IF INHALED.
Remove victim to fresh air and keep at rest in a position comfortable for breathing.
Call a POISON CENTER or doctor/physician.
Specific treatment may be needed, see first aid section of Safety Data Sheet.
IF ON SKIN: Wash with plenty of soap and water.
If skin irritation occurs: Get medical advice/attention.
Take off contaminated clothing and wash before reuse.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists: Get medical advice/attention.

Storage
Store in a well-ventilated place.
Protect from sunlight.
Keep container tightly closed.
Store locked up.

Disposal
Dispose in accordance with all applicable regulations.

Other Hazards
May cause asphyxia. Rapid release of compressed gas may cause frostbite.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>CAS</th>
<th>Component Name</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1333-74-0</td>
<td>Hydrogen</td>
<td>97.5-99.6</td>
</tr>
<tr>
<td>19287-45-7</td>
<td>Diborane</td>
<td>0.4-2.5</td>
</tr>
</tbody>
</table>

Section 4 - FIRST AID MEASURES

Inhalation
If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

Skin
If frostbite or freezing occur, immediately flush with plenty of lukewarm water (105-115°F; 41-46°C). DO NOT USE HOT WATER. If warm water is not available, gently wrap affected parts in blankets. Get immediate medical attention.

Eyes
Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Then get immediate medical attention.

Ingestion
If swallowed, get medical attention.
Safety Data Sheet

Material Name: DIBORANE 0.4-2.5%/ HYDROGEN (BALANCE) GAS MIXTURE  
SDS ID: 00244502

Most Important Symptoms/Effects
Acute
suffocation, frostbite, respiratory tract irritation, skin irritation, eye irritation, respiratory system damage

Delayed
nervous system damage, respiratory system damage

Note to Physicians
For inhalation, consider oxygen.

Section 5 - FIRE FIGHTING MEASURES

Extinguishing Media
Suitable Extinguishing Media
regular dry chemical, carbon dioxide, water spray, alcohol resistant foam, Let burn unless leak can be stopped immediately.

Unsuitable Extinguishing Media
Do not use water. Do not use halogenated extinguishing agents.

Special Hazards Arising from the Chemical
Severe fire hazard. Vapor/air mixtures are explosive. Containers may rupture or explode if exposed to heat. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

Hazardous Combustion Products
boric acid, oxides of boron

Fire Fighting Measures
Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. For smaller tanks or cylinders, extinguish and isolate from other flammables. Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Evacuate if fire gets out of control or containers are directly exposed to fire. Evacuation radius: 500 meters (1/3 mile). Consider downwind evacuation if material is leaking. Stop flow of gas.

Special Protective Equipment and Precautions for Firefighters
Wear full protective fire fighting gear including self contained breathing apparatus (SCBA) for protection against possible exposure.

Section 6 - ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures
Wear personal protective clothing and equipment, see Section 8.

Methods and Materials for Containment and Cleaning Up
Avoid heat, flames, sparks and other sources of ignition. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Stop leak if possible without personal risk. Eliminate all ignition sources if safe to do so. Reduce vapors with water spray. Keep unnecessary people away, isolate hazard area and deny entry. Ventilate closed spaces before entering. All equipment used when handling the product must be grounded.

Environmental Precautions
Avoid release to the environment.

Section 7 - HANDLING AND STORAGE

Precautions for Safe Handling
Safety Data Sheet

Material Name: DIBORANE 0.4-2.5%/ HYDROGEN (BALANCE) GAS MIXTURE

Keep away from heat, sparks, open flame, and hot surfaces - No smoking. Do not breathe gas. Use only outdoors or in a well-ventilated area. Wash hands thoroughly after handling. Wear protective gloves/eye protection/face protection. Do not eat, drink or smoke when using this product.

Conditions for Safe Storage, Including any Incompatibilities
Store in a well-ventilated place.
Protect from sunlight.
Keep container tightly closed.
Store locked up.

Incompatible Materials
bases, combustible materials, halocarbons, halogens, metal oxides, metal salts, metals, oxidizing materials

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Component Exposure Limits

<table>
<thead>
<tr>
<th>Component</th>
<th>Exposure Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>1333-74-0</td>
</tr>
<tr>
<td>ACGIH:</td>
<td>(See Appendix F: Minimal Oxygen Content, explosion hazard)</td>
</tr>
<tr>
<td>Diborane</td>
<td>19287-45-7</td>
</tr>
<tr>
<td>ACGIH:</td>
<td>0.1 ppm TWA</td>
</tr>
<tr>
<td>NIOSH:</td>
<td>0.1 ppm TWA ; 0.1 mg/m3 TWA</td>
</tr>
<tr>
<td></td>
<td>15 ppm IDLH</td>
</tr>
<tr>
<td>OSHA (US):</td>
<td>0.1 ppm TWA ; 0.1 mg/m3 TWA</td>
</tr>
<tr>
<td>Mexico:</td>
<td>0.1 ppm TWA VLE-PPT ; 0.1 mg/m3 TWA VLE-PPT</td>
</tr>
</tbody>
</table>

ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI)
There are no biological limit values for any of this product's components.

Engineering Controls
Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Individual Protection Measures, such as Personal Protective Equipment
Eye/face protection
Wear splash resistant safety goggles with a faceshield. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin Protection
For the gas: Wear appropriate chemical resistant clothing. For the liquid: Wear appropriate protective, cold insulating clothing.

Respiratory Protection
Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before use. For Unknown Concentrations or Immediately Dangerous to Life or Health -. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing
apparatus operated in pressure-demand or other positive-pressure mode. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

**Glove Recommendations**
For the gas: Wear appropriate chemical resistant gloves. For the liquid: Wear insulated gloves.

### Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>colorless gas</td>
</tr>
<tr>
<td>Odor</td>
<td>irritating odor, sweet odor</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>Not available</td>
</tr>
<tr>
<td>Melting Point</td>
<td>Not available</td>
</tr>
<tr>
<td>Boiling Point Range</td>
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<tr>
<td>Evaporation Rate</td>
<td>Not available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>Not available</td>
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<tr>
<td>Lower Explosive Limit</td>
<td>4 % (Hydrogen)</td>
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<tr>
<td>Upper Explosive Limit</td>
<td>75 % (Hydrogen)</td>
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<tr>
<td>Vapor Density (air=1)</td>
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<tr>
<td>Water Solubility</td>
<td>(Reacts)</td>
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<tr>
<td>Viscosity</td>
<td>Not available</td>
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<tr>
<td>Solubility (Other)</td>
<td>Not available</td>
</tr>
<tr>
<td>Physical Form</td>
<td>compressed gas</td>
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</table>

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>gas</td>
</tr>
<tr>
<td>Color</td>
<td>colorless</td>
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<tr>
<td>pH</td>
<td>Not available</td>
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<tr>
<td>Boiling Point</td>
<td>Not available</td>
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<tr>
<td>Freezing point</td>
<td>Not available</td>
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<tr>
<td>Flammability (solid, gas)</td>
<td>Not available</td>
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<tr>
<td>Flash Point</td>
<td>(Flammable gas)</td>
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<tr>
<td>Decomposition temperature</td>
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<td>Vapor Pressure</td>
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<td>Specific Gravity (water=1)</td>
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<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>Not available</td>
</tr>
<tr>
<td>Kinematic viscosity</td>
<td>Not available</td>
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<tr>
<td>Density</td>
<td>Not available</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>Not available</td>
</tr>
</tbody>
</table>

### Section 10 - STABILITY AND REACTIVITY

**Chemical Stability**
May decompose explosively when heated above 40 C. May ignite on contact with water or moist air.

**Possibility of Hazardous Reactions**
Will not polymerize.

**Conditions to Avoid**
Avoid heat, flames, sparks and other sources of ignition. Minimize contact with material. Containers may rupture or explode if exposed to heat. Avoid contact with water or moisture.

**Incompatible Materials**
bases, combustible materials, halocarbons, halogens, metal oxides, metal salts, metals, oxidizing materials

**Hazardous decomposition products**
boric acid, oxides of boron

**Water or Moisture**
Section 11 - TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure

Inhalation
nausea, vomiting, difficulty breathing, irregular heartbeat, headache, drowsiness, fatigue, dizziness, Disorientation, mood swings, tingling sensation, loss of coordination, convulsions, Unconsciousness, coma, irritation (possibly severe), cough, chills, fever, chest pain, blurred vision, lung congestion, kidney damage, liver damage, death

Skin Contact
frostbite, irritation (possibly severe)

Eye Contact
frostbite, irritation (possibly severe), eye damage, blindness

Ingestion
ingestion of harmful amounts is unlikely

Acute and Chronic Toxicity

Component Analysis - LD50/LC50
The components of this material have been reviewed in various sources and the following selected endpoints are published:

**Hydrogen (1333-74-0)**
Inhalation LC50 Rat >15000 ppm 1 h

**Diborane (19287-45-7)**
Inhalation LC50 Rat 40 ppm 4 h

Product Toxicity Data

Acute Toxicity Estimate
No data available.

Immediate Effects
suffocation, frostbite, respiratory tract irritation, skin irritation, eye irritation, respiratory system damage

Delayed Effects
nervous system damage, respiratory system damage

Irritation/Corrosivity Data
respiratory tract irritation, skin irritation, eye irritation

Respiratory Sensitization
No data available.

Dermal Sensitization
No data available.

Component Carcinogenicity
None of this product's components are listed by ACGIH, IARC, NTP, DFG or OSHA.

Germ Cell Mutagenicity
No data available for the mixture.

Tumorigenic Data
No data available.

Reproductive Toxicity
No data available for the mixture.

Specific Target Organ Toxicity - Single Exposure
Respiratory system

Specific Target Organ Toxicity - Repeated Exposure
nervous system, Respiratory system

Aspiration hazard
Not applicable.
Safety Data Sheet

Material Name: DIBORANE 0.4-2.5%/ HYDROGEN (BALANCE) GAS MIXTURE

Medical Conditions Aggravated by Exposure
skin disorders, respiratory disorders, eye disorders

Section 12 - ECOLOGICAL INFORMATION

Component Analysis - Aquatic Toxicity
No LOLI ecotoxicity data are available for this product’s components.

Persistence and Degradability
The components will volatilize and degrade into other organic compounds.

Bioaccumulative Potential
The components do not present a bioaccumulation hazard.

Mobility
This product does not present a mobility in the soil hazard.

Other Toxicity
May cause adverse environmental effects if used improperly or released into the environment.

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Methods
Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262.
Hazardous Waste Number(s): D001, D003.

Component Waste Numbers
The U.S. EPA has not published waste numbers for this product’s components.

Section 14 - TRANSPORT INFORMATION

US DOT Information:
Shipping Name: COMPRESSED GAS, TOXIC, FLAMMABLE, N.O.S. , (Contains: Hydrogen, Diborane)
Hazard Class: 2.3
UN/NA #: UN1953
Required Label(s): 2.3 2.1

IMDG Information:
Shipping Name: COMPRESSED GAS, TOXIC, FLAMMABLE, N.O.S. , (Contains: Hydrogen, Diborane)
Hazard Class: 2.3
UN#: UN1953
Required Label(s): 2.3 2.1

International Bulk Chemical Code
This material does not contain any chemicals required by the IBC Code to be identified as dangerous chemicals in bulk.

Section 15 - REGULATORY INFORMATION

U.S. Federal Regulations
This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), and/or require an OSHA process safety plan.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>UN Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diborane</td>
<td>19287-45-7</td>
</tr>
<tr>
<td>SARA 302:</td>
<td>100 lb TPQ</td>
</tr>
<tr>
<td>OSHA (safety):</td>
<td>100 lb TQ</td>
</tr>
</tbody>
</table>
Safety Data Sheet

Material Name: DIBORANE 0.4-2.5%/ HYDROGEN (BALANCE) GAS MIXTURE  
SDS ID: 00244502

SARA 304: 100 lb EPCRA RQ

SARA Section 313/312 (40 CFR 370 Subparts B and C) reporting categories
Flammable; Gas Under Pressure; Acute toxicity; Skin Corrosion/Irritation; Serious Eye Damage/Eye Irritation;
Specific Target Organ Toxicity

U.S. State Regulations
The following components appear on one or more of the following state hazardous substances lists:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS</th>
<th>CA</th>
<th>MA</th>
<th>MN</th>
<th>NJ</th>
<th>PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>1333-74-0</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Diborane</td>
<td>19287-45-7</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Not listed under California Proposition 65

Canada Regulations
Canadian WHMIS Ingredient Disclosure List (IDL)
Components of this material have been checked against the Canadian WHMIS Ingredients Disclosure List. The List
is composed of chemicals which must be identified on MSDSs if they are included in products which meet WHMIS
criteria specified in the Controlled Products Regulations and are present above the threshold limits listed on the IDL.

Component Analysis - Inventory
Hydrogen (1333-74-0)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>DSL</td>
<td>EIN</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Diborane (19287-45-7)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>DSL</td>
<td>EIN</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Section 16 - OTHER INFORMATION

NFPA Ratings
Health: 4 Fire: 4 Reactivity: 3
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe
Safety Data Sheet

Material Name: DIBORANE 0.4-2.5%/ HYDROGEN (BALANCE) GAS MIXTURE

Summary of Changes
Updated: 05/01/2015

Key / Legend
ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CA/MA/MN/NJ/PA - California/Massachusetts/Minnesota/New Jersey/Pennsylvania*; CAS - Chemical Abstracts Service; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CFR - Code of Federal Regulations (US); CLP - Classification, Labelling, and Packaging; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSD - Dangerous Substance Directive; DSL - Domestic Substances List; EC – European Commission; EEC - European Economic Community; EIN - European Inventory of (Existing Commercial Chemical Substances); EINECS - European Inventory of Existing Commercial Chemical Substances; ENCS - Japan Existing and New Chemical Substance Inventory; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; F - Background (for Venezuela Biological Exposure Indices); IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL - Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime Dangerous Goods; ISHL - Japan Industrial Safety and Health Law; IUCLID - International Uniform Chemical Information Database; JP - Japan; Kow - Octanol/water partition coefficient; KR KECI Annex 1 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); KR KECI Annex 2 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL) ; KR - Korea; LD50/LC50 - Lethal Dose/ Lethal Concentration; LEI - Lower Explosive Limit; LLV - Level Limit Value; LOLI - List Of Lists™ - ChemADVISOR’s Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL - Maximum Exposure Limits; MX - Mexico; Ne- Non-specific; NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; Nq - Non-quantitative; NSL – Non-Domestic Substance List (Canada); NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PEL - Permissible Exposure Limit; PH - Philippines; RCRA - Resource Conservation and Recovery Act; REACH-Registration, Evaluation, Authorisation, and restriction of Chemicals; RID - European Rail Transport; SARA - Superfund Amendments and Reauthorization Act; Sc - Semi-quantitative; STEL - Short-term Exposure Limit; TCCA – Korea Toxic Chemicals Control Act; TDG - Transportation of Dangerous Goods; TLV - Threshold Limit Value; TSCA - Toxic Substances Control Act; TW – Taiwan; TWA - Time Weighted Average; UEL - Upper Explosive Limit; UN/NA - United Nations/North American; US - United States; VLE - Exposure Limit Value (Mexico); VN (Draft) - Vietnam (Draft); WHMIS - Workplace Hazardous Materials Information System (Canada).

Other Information

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