MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name: Anhydrous Ammonia, Liquified
Revision date: 09-27-2011
Version #: 01
CAS #: 7664-41-7
MSDS Number: 600
Product use: This product is intended for use as a refinery feedstock, fuel or for use in engineered processes. Use in other applications may result in higher exposures and require additional controls, such as local exhaust ventilation and personal protective equipment.

Synonym(s): Anhydrous Ammonia, Liquid Ammonia, Nitromite, Nitro-Sil, Ammonia (liquefied)
See section 16 for complete information.

Manufacturer/Supplier: Valero Marketing & Supply Company and Affiliates
P.O. Box 696000
San Antonio, TX 78269-6000
General Assistance: 210-345-4593

Emergency: 24 Hour Emergency: 866-565-5220
1-800-424-9300 (CHEMTREC USA)

2. Hazards Identification

Physical state: Gas.
Appearance: Colorless gas or cold, mobile liquid.
Emergency overview: DANGER

High pressure gas. Gas reduces oxygen available for breathing. Causes skin, eye and digestive tract burns. Harmful if inhaled or swallowed. Causes severe respiratory tract irritation. May cause allergic skin reaction. Contact with liquefied gas might cause frostbites, in some cases with tissue damage.

OSHA regulatory status: This product is hazardous according to OSHA 29 CFR 1910.1200.

Potential health effects:

Routes of exposure:
- Inhalation: Causes eye burns. Exposure to rapidly expanding gas or vaporizing liquid may cause frostbite ("cold burn").
- Eyes: Causes eye burns. Exposure to rapidly expanding gas or vaporizing liquid may cause frostbite ("cold burn").
- Skin: Causes skin burns. May cause allergic skin reaction. Exposure to rapidly expanding gas or vaporizing liquid may cause frostbite ("cold burn").
- Inhalation: Harmful if inhaled. Causes severe respiratory tract irritation. Suffocation (asphyxiant) hazard - if allowed to accumulate to concentrations that reduce oxygen below safe breathing levels.
- Ingestion: Harmful if swallowed. Causes digestive tract burns.

Target organs: Respiratory tract. Eyes. Central nervous system.

Chronic effects: May cause allergic skin reaction.

Potential environmental effects: Very toxic to aquatic organisms.

3. Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS #</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia, anhydrous</td>
<td>7664-41-7</td>
<td>&gt;99.5</td>
</tr>
</tbody>
</table>

4. First Aid Measures

First aid procedures:

Eye contact: Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention immediately.

Skin contact: Wash frost-bitten areas with plenty of water. Do not remove clothing. Get medical attention immediately.
Inhalation
Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Call a physician or poison control center immediately.

Ingestion
Call a physician or poison control center immediately. DO NOT induce vomiting. If victim is fully conscious, give a cupful of water. Never give anything by mouth to an unconscious person. If vomiting occurs, keep head lower than the hips to help prevent aspiration.

Notes to physician
Treat symptomatically.

5. Fire Fighting Measures
Flammable properties
Heat may cause the containers to explode.

Extinguishing media
Suitable extinguishing media
Dry chemical, CO2, water spray, fog, or foam.

Fire fighting equipment/instructions
Self-contained breathing apparatus, operated in positive pressure mode and full protective clothing must be worn in case of fire.

Hazardous combustion products
Nitrogen oxides.

6. Accidental Release Measures
Personal precautions
Evacuate the area promptly. No action shall be taken involving any personal risk or without suitable training. Keep unnecessary personnel away.

Ensure adequate ventilation. In case of inadequate ventilation, use respiratory protection. Wear appropriate personal protective equipment (See Section 8).

Environmental precautions
Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent from entering into soil, ditches, sanitary sewers, waterways and/or groundwater.

Methods for cleaning up
Ventilate well, stop flow of gas or liquid if possible. Immediately contact emergency personnel.

7. Handling and Storage
Handling
Wear appropriate personal protective equipment (See Section 8). Eating, drinking, and smoking should be prohibited in areas where this material is handled, stored, and processed. Do not breathe gas. Do not get in eyes, on skin, on clothing. Use only with adequate ventilation.

Storage
Store in accordance with local, regional, national, and international regulations. Secure cylinders in an upright position at all times, close all valves when not in use. Store in a cool, dry, well-ventilated place. Keep container tightly closed and sealed until ready for use. Protect cylinders from damage.

8. Exposure Controls / Personal Protection
Occupational exposure limits

<table>
<thead>
<tr>
<th>US. ACGIH Threshold Limit Values</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Components</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia, anhydrous (7664-41-7)</td>
<td>STEL</td>
<td>35 ppm</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>25 ppm</td>
</tr>
</tbody>
</table>

| US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) | Type       | Value    |
|------------------------------------------------------------------|------------|
| Components                                                      |            |
| Ammonia, anhydrous (7664-41-7)                                   | PEL        | 35 mg/m3 |
|                                                                  |            | 50 ppm   |

| Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) | Type       | Value    |
|---------------------------------------------------------------------------|------------|
| Components                                                                |            |
| Ammonia, anhydrous (7664-41-7)                                            | STEL       | 24 mg/m3 |
|                                                                              |            | 35 ppm   |
| TWA                                                                        |            | 17 mg/m3 |
|                                                                              |            | 25 ppm   |
### Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia, anhydrous (7664-41-7)</td>
<td>STEL</td>
<td>35 ppm</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>25 ppm</td>
</tr>
</tbody>
</table>

### Canada. Ontario OELs. (Ministry of Labor - Control of Exposure to Biological or Chemical Agents)

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia, anhydrous (7664-41-7)</td>
<td>STEL</td>
<td>24 mg/m3</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>17 mg/m3</td>
</tr>
</tbody>
</table>

### Canada. Quebec OELS. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia, anhydrous (7664-41-7)</td>
<td>STEL</td>
<td>24 mg/m3</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>17 mg/m3</td>
</tr>
</tbody>
</table>

### Mexico. Occupational Exposure Limit Values

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia, anhydrous (7664-41-7)</td>
<td>STEL</td>
<td>27 mg/m3</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>18 mg/m3</td>
</tr>
</tbody>
</table>

### Engineering controls

Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. The engineering controls also need to keep gas, vapor, or dust concentrations below any lower explosive limits.

### Personal protective equipment

- **Eye / face protection**: Wear approved safety glasses or goggles.
- **Skin protection**: Wear protective clothing appropriate for the risk of exposure.
- **Respiratory protection**: If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.
- **General hygiene considerations**: Do not eat, drink or smoke when using the product. Wash thoroughly after handling. Provide eyewash station and safety shower. Handle in accordance with good industrial hygiene and safety practices.

### 9. Physical & Chemical Properties

- **Appearance**: Colorless gas or cold, mobile liquid.
- **Color**: Colorless
- **Odor**: Penetrating odor.
- **Odor threshold**: Not available.
- **Physical state**: Gas.
- **Form**: Gas or liquid.
- **pH**: Not available.
- **Melting point**: Not available.
- **Freezing point**: -108 °F (-77.77 °C)
- **Boiling point**: -44 - 11.1 °F (-42.2 - -11.6 °C)
- **Flash point**: Not available.
- **Evaporation rate**: Not available.
- **Flammability limits in air, upper, % by volume**: 28 %
- **Flammability limits in air, lower, % by volume**: 15 %
Vapor pressure: Not available.
Vapor density: 0.6
Specific gravity: 0.682
Solubility (water): Partially soluble.
Partition coefficient (n-octanol/water): Not available.
Auto-ignition temperature: 1204 °F (651.11 °C)
Decomposition temperature: Not available.
Molecular weight: 17.04 g/mol
Molecular formula: NH3

10. Chemical Stability & Reactivity Information

Chemical stability: Stable under normal temperature conditions and recommended use.
Conditions to avoid: In a fire or if heated, a pressure increase will occur and the container may burst or explode.
Hazardous decomposition products: None known.
Possibility of hazardous reactions: Polymerization will not occur.

11. Toxicological Information

Toxicological information: Inhalation exposure produces upper airway, eyes, nose, and throat irritation at concentrations around 25 ppm. Inhalation of concentrations of greater than 500 ppm can result in pulmonary edema, acute congestion, bronchitis, and pneumonia; depending on the concentration and the individual. Exposure to high gas concentrations may cause temporary blindness and severe eye damage.

Acute effects: Causes severe skin, eye and digestive tract burns. Harmful if inhaled or swallowed. Causes severe respiratory tract irritation. Suffocation (asphyxiant) hazard - if allowed to accumulate to concentrations that reduce oxygen below safe breathing levels. Exposure to rapidly expanding gas or vaporizing liquid may cause frostbite ("cold burn").

Sensitization: May cause an allergic skin reaction.

12. Ecological Information

Ecotoxicological data

<table>
<thead>
<tr>
<th>Components</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia, anhydrous (7664-41-7)</td>
<td>LC50 Carp (Hypophthalmichthys nobilis): 0.3 mg/l 96 hours</td>
</tr>
</tbody>
</table>

Ecotoxicity
Persistence and degradability
Bioaccumulation / Accumulation
Partition coefficient (n-octanol/water)
Mobility in environmental media

13. Disposal Considerations

Disposal instructions: Dispose in accordance with all applicable regulations. Empty containers may contain product residues. Do not puncture or incinerate even when empty. This material and/or its container must be disposed of as hazardous waste. Return the empty cylinder to the supplier.

14. Transport Information

DOT

Basic shipping requirements:
UN number: UN1005
Proper shipping name: Ammonia, anhydrous
### Hazard class
2.2

### Labels required
2.2

### Additional information:

<table>
<thead>
<tr>
<th>Special provisions</th>
<th>13, T50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging exceptions</td>
<td>None</td>
</tr>
<tr>
<td>Packaging non bulk</td>
<td>304</td>
</tr>
<tr>
<td>Packaging bulk</td>
<td>314, 315</td>
</tr>
<tr>
<td>ERG number</td>
<td>125</td>
</tr>
</tbody>
</table>

### DOT BULK

**Basic shipping requirements:**

<table>
<thead>
<tr>
<th>UN number</th>
<th>UN1005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper shipping name</td>
<td>Ammonia, anhydrous</td>
</tr>
</tbody>
</table>

### IATA

**Basic shipping requirements:**

<table>
<thead>
<tr>
<th>UN number</th>
<th>1005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper shipping name</td>
<td>Ammonia, anhydrous</td>
</tr>
</tbody>
</table>

### IMDG

**Basic shipping requirements:**

<table>
<thead>
<tr>
<th>UN number</th>
<th>1005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper shipping name</td>
<td>AMMONIA, ANHYDROUS</td>
</tr>
</tbody>
</table>

### TDG

**Basic shipping requirements:**

| Proper shipping name | AMMONIA, ANHYDROUS |

### 15. Regulatory Information

**US federal regulations**

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

All components are on the U.S. EPA TSCA Inventory List.

**TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)**

Not regulated.

**US EPCRA (SARA Title III) Section 302 - Extremely Hazardous Spill: Reportable quantity**

- Ammonia, anhydrous (CAS 7664-41-7) 100 LBS

**US EPCRA (SARA Title III) Section 302 - Extremely Hazardous Substance: Threshold Planning Quantity**

- Ammonia, anhydrous (CAS 7664-41-7) 500 LBS
US EPCRA (SARA Title III) Section 313 - Toxic Chemical: De minimis concentration
Ammonia, anhydrous (CAS 7664-41-7) 1.0 %

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance
Ammonia, anhydrous (CAS 7664-41-7) Listed.

CERCLA (Superfund) reportable quantity (lbs) (40 CFR 302.4)
Ammonia, anhydrous: 100

Superfund Amendments and Reauthorization Act of 1986 (SARA)
Hazard categories
Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - Yes
Reactivity Hazard - No

Section 302 extremely hazardous substance (40 CFR 355, Appendix A)
Yes

Section 311/312 (40 CFR 370)
Yes

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130)
Hazardous substance

Drug Enforcement Administration (DEA) (21 CFR 1308.11-15)
Not controlled

Canadian regulations
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.

WHMIS status
Controlled

WHMIS classification
A - Compressed Gas
D2B - Other Toxic Effects-TOXIC
E - Corrosive

WHMIS labeling

Inventory status

<table>
<thead>
<tr>
<th>Country(s) or region</th>
<th>Inventory name</th>
<th>On inventory (yes/no)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Australian Inventory of Chemical Substances (AICS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
<td>Domestic Substances List (DSL)</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
<td>Non-Domestic Substances List (NDSL)</td>
<td>No</td>
</tr>
<tr>
<td>China</td>
<td>Inventory of Existing Chemical Substances in China (IECSC)</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe</td>
<td>European Inventory of Existing Commercial Chemical Substances (EINECS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe</td>
<td>European List of Notified Chemical Substances (ELINCS)</td>
<td>No</td>
</tr>
<tr>
<td>Japan</td>
<td>Inventory of Existing and New Chemical Substances (ENCS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Korea</td>
<td>Existing Chemicals List (ECL)</td>
<td>Yes</td>
</tr>
<tr>
<td>New Zealand</td>
<td>New Zealand Inventory</td>
<td>Yes</td>
</tr>
<tr>
<td>Philippines</td>
<td>Philippine Inventory of Chemicals and Chemical Substances (PICCS)</td>
<td>Yes</td>
</tr>
<tr>
<td>United States &amp; Puerto Rico</td>
<td>Toxic Substances Control Act (TSCA) Inventory</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations

US - California Hazardous Substances (Director's): Listed substance
Ammonia, anhydrous (CAS 7664-41-7) Listed.

US - Massachusetts RTK - Substance: Listed substance
Ammonia, anhydrous (CAS 7664-41-7) Listed.

US - New Jersey Community RTK (EHS Survey): Reportable threshold
Ammonia, anhydrous (CAS 7664-41-7) 500 LBS
16. Other Information

Further information

HMIS® is a registered trade and service mark of the NPCA.

Other information

Note: This Material Safety Data Sheet applies to the listed products and synonym descriptions for Hazard Communication purposes only. Technical Specifications vary greatly depending on the products and are not reflected in this document. Consult specification sheets for technical information.

HMIS® ratings

Health: 3
Flammability: 1
Physical hazard: 0

NFPA ratings

Health: 3
Flammability: 1
Instability: 0

Disclaimer

This Material Safety Data Sheet (MSDS) was prepared in accordance with 29 CFR 1910.1200 by Valero Marketing & Supply Co., ("VALERO"). VALERO does not assume any liability arising out of product use by others. The information, recommendations, and suggestions presented in this MSDS are based upon test results and data believed to be reliable. The end user of the product has the responsibility for evaluating the adequacy of the data under the conditions of use, determining the safety, toxicity and suitability of the product under these conditions, and obtaining additional or clarifying information where uncertainty exists. No guarantee expressed or implied is made as to the effects of such use, the results to be obtained, or the safety and toxicity of the product in any specific application. Furthermore, the information herein is not represented as absolutely complete, since it is not practicable to provide all the scientific and study information in the format of this document, plus additional information may be necessary under exceptional conditions of use, or because of applicable laws or government regulations.

Issue date

09-27-2011