1 Identification of substance:
   Product details:
   Product name: Ammonium sulfate
   Stock number: A11682, L13170
   Manufacturer/Supplier:
   Alfa Aesar, A Johnson Matthey Company
   Johnson Matthey Catalog Company, Inc.
   30 Bond Street
   Ward Hill, MA 01835-8099
   Emergency Phone: (978) 521-6300
   CHEMTREC: (800) 424-9300
   Web Site: www.alfa.com
   Information Department: Health, Safety and Environmental Department
   Emergency information:
   During normal hours the Health, Safety and Environmental Department. After normal hours call CHEMTREC at (800) 424-9300.

2 Composition/Data on components:
   Chemical characterization:
   Description: (CAS#)
   Ammonium sulfate (CAS# 7783-20-2)
   Identification number(s):
   EINECS Number: 231-984-1

3 Hazards identification
   Hazard description: Not applicable
   Information pertaining to particular dangers for man and environment Not applicable
   Classification system
   HMIS ratings (scale 0-4)
   (Hazardous Materials Identification System)
   HEALTH 1
   Fire 0
   Reactivity 1
   Health (acute effects) = 1
   Flammability = 0
   Reactivity = 1
   GHS label elements Void

4 First aid measures
   After inhalation
   Supply fresh air. If required, provide artificial respiration. Keep patient warm.
   Seek immediate medical advice.
   After skin contact
   Immediately wash with water and soap and rinse thoroughly.
   Seek immediate medical advice.
   After eye contact
   Rinse opened eye for several minutes under running water. Then consult a doctor.
   After swallowing Seek immediate medical advice.

5 Fire fighting measures
   Suitable extinguishing agents
   Product is not flammable. Use fire fighting measures that suit the surrounding fire.
   Special hazards caused by the material, its products of combustion or resulting gases:
   In case of fire, the following can be released:
   Nitrogen oxides (NOx)
   Sulfur oxides (SOx)
   Protective equipment:
   Wear self-contained respirator.
   Wear fully protective impervious suit.

6 Accidental release measures
   Person-related safety precautions:
   Wear protective equipment. Keep unprotected persons away.
   Ensure adequate ventilation
   Measures for environmental protection:
   Do not allow material to be released to the environment without proper governmental permits.
7 Handling and storage

Handling
Information for safe handling:
Keep container tightly sealed.
Store in cool, dry place in tightly closed containers.
Ensure good ventilation at the workplace.
Information about protection against explosions and fires: The product is not flammable

Storage
Requirements to be met by storerooms and receptacles: No special requirements.
Information about storage in one common storage facility:
Store away from strong bases.
Store away from oxidizing agents.
Further information about storage conditions:
Keep container tightly sealed.
Store in cool, dry conditions in well sealed containers.

8 Exposure controls and personal protection

Additional information about design of technical systems:
Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.

Components with limit values that require monitoring at the workplace: Not required.

Additional information: No data

Personal protective equipment
General protective and hygienic measures
The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Remove all soiled and contaminated clothing immediately.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
Breathing equipment: Use suitable respirator when high concentrations are present.
Protection of hands:
Impervious gloves
Check protective gloves prior to each use for their proper condition.
Material of gloves
The selection of suitable gloves not only depends on the material, but also on quality.
Quality will vary from manufacturer to manufacturer.
Eye protection: Safety glasses
Body protection: Protective work clothing.

9 Physical and chemical properties:

<table>
<thead>
<tr>
<th>General Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Form:</strong></td>
</tr>
<tr>
<td><strong>Color:</strong></td>
</tr>
<tr>
<td><strong>Odor:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Change in condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Melting point/Melting range:</strong> ca 280°C (ca 536°F) (dec)</td>
</tr>
<tr>
<td><strong>Boiling point/Boiling range:</strong> Not determined</td>
</tr>
<tr>
<td><strong>Sublimation temperature / start:</strong> Not determined</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Health and safety hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flash point:</strong>  Not applicable</td>
</tr>
<tr>
<td><strong>Ignition temperature:</strong> Not determined</td>
</tr>
<tr>
<td><strong>Decomposition temperature:</strong> Not determined</td>
</tr>
<tr>
<td><strong>Danger of explosion:</strong> Product does not present an explosion hazard.</td>
</tr>
<tr>
<td><strong>Explosion limits:</strong></td>
</tr>
<tr>
<td><strong>Lower:</strong>  Not determined</td>
</tr>
</tbody>
</table>
Material Safety Data Sheet
acc. to OSHA and ANSI

Printing date 04/08/2010
Reviewed on 04/07/2010

Product name: Ammonium sulfate

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper</td>
<td>Not determined</td>
</tr>
<tr>
<td>Vapor pressure</td>
<td>Not determined</td>
</tr>
<tr>
<td>Density at 20°C (68°F)</td>
<td>1.769 g/cm³</td>
</tr>
<tr>
<td>Solubility in / Miscibility with</td>
<td></td>
</tr>
<tr>
<td>Water at 20°C (68°F)</td>
<td>760 g/l</td>
</tr>
<tr>
<td>pH-value (100 g/l) at 20°C (68°F)</td>
<td>5-5.5</td>
</tr>
</tbody>
</table>

10 Stability and reactivity

Thermal decomposition / conditions to be avoided:
Decomposition will not occur if used and stored according to specifications.

Materials to be avoided:
Oxidizing agents
Bases

Dangerous reactions: No dangerous reactions known

Dangerous products of decomposition:
Nitrogen oxides
Sulfur oxides (SOx)

11 Toxicological information

Acute toxicity:

LD/LC50 values that are relevant for classification:

<table>
<thead>
<tr>
<th>Route</th>
<th>LD50/LC50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>640 mg/kg (mouse)</td>
</tr>
<tr>
<td></td>
<td>2840 mg/kg (rat)</td>
</tr>
<tr>
<td></td>
<td>1500 mg/kg (human)</td>
</tr>
</tbody>
</table>

Primary irritant effect:
on the skin: No irritant effect.
on the eye: May cause irritation

Sensitization: No sensitizing effects known.

Subacute to chronic toxicity:

The Registry of Toxic Effects of Chemical Substances (RTECS) reports the following effects in laboratory animals:

Gastrointestinal - hypermotility, diarrhea.
Gastrointestinal - nausea or vomiting.
Gastrointestinal - other changes.
Behavioral - somnolence (general depressed activity).
Behavioral - muscle contraction or spasticity.
Behavioral - tremor.
Behavioral - convulsions or effect on seizure threshold.

Lungs, Thorax, or Respiration - other changes.
Lungs, Thorax, or Respiration - dyspnea.
Lungs, Thorax, or Respiration - respiratory stimulation.
Sense Organs and Special Senses (Eye) - mydriasis (pupillary dilation).

Additional toxicological information:

To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.

No classification data on carcinogenic properties of this material is available from the EPA, IARC, NTP, OSHA or ACGIH.

12 Ecological information:

Additional ecological information:

General notes:
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
Do not allow material to be released to the environment without proper governmental permits.

13 Disposal considerations

Product:
Recommendation: Consult state, local or national regulations to ensure proper disposal.

(Contd. on page 4)
Material Safety Data Sheet
acc. to OSHA and ANSI

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Reviewed on 04/07/2010

Product name: Ammonium sulfate

(Contd. of page 3)

14 Transport information
Not a hazardous material for transportation.

<table>
<thead>
<tr>
<th>DOT regulations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard class:</td>
</tr>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Land transport ADR/RID (cross-border)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADR/RID class:</td>
</tr>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maritime transport IMDG:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMDG Class:</td>
</tr>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marine pollutant:</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air transport ICAO-TI and IATA-DGR:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICAO/IATA Class:</td>
</tr>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

Transport/Additional information: Not dangerous according to the above specifications.

15 Regulations

Product related hazard informations:
Observe the general safety regulations when handling chemicals

National regulations
All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory.
All components of this product are listed on the Canadian Domestic Substances List (DSL).

Information about limitation of use: For use only by technically qualified individuals.

16 Other information:
Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

Department issuing MSDS: Health, Safety and Environmental Department.
Contact: Zachariah Holt

Abbreviations and acronyms:
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
IATA-DGR: Dangerous Goods Regulations by the "International Air Transport Association" (IATA)
ICAO: International Civil Aviation Organisation
ICAO-TI: Technical Instructions by the "International Civil Aviation Organization" (ICAO)
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
HMIS: Hazardous Materials Identification System (USA)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent

USA