1 Identification of substance:
   Product details:
   Product name: 2-Butanone
   Stock number: 31069
   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#)
   2-Butanone (CAS# 78-93-3): 100%
   Identification number(s):
   EINECS Number: 201-159-0
   Index number: 606-002-00-3

3 Hazards identification
   Hazard description:
   Xi Irritant
   F Highly flammable
   Information pertaining to particular dangers for man and environment
   R 11 Highly flammable.
   R 36 Irritating to eyes.
   R 66 Repeated exposure may cause skin dryness or cracking
   R 67 Vapours may cause drowsiness and dizziness
   Classification system
   HMIS ratings (scale 0-4)
   (Hazardous Materials Identification System)
   HEALTH 1
   Health (acute effects) = 1
   Flammability = 3
   Reactivity = 1
   FIRE 3
   REACTIVITY 1

GHS label elements
   Danger
   2.6/2 - Highly flammable liquid and vapour.
   Warning
   3.3/2A - Causes serious eye irritation.
   3.8/3 - May cause drowsiness or dizziness.
   Prevention:
   Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
   Keep container tightly closed.
   Ground/Bond container and receiving equipment.
   Use explosion-proof electrical/ventilating/lighting/equipment.
   Use only non-sparking tools.
   Take precautionary measures against static discharge.
   Avoid breathing dust/fume/gas/mist/vapours/spray.
   Wash thoroughly after handling.
   Use only outdoors or in a well-ventilated area.
   Wear protective gloves/protective clothing/eye protection/face protection.
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.

Information for doctor
The following symptoms may occur:
Dizziness
Nausea
Gastric or intestinal disorders.
Headache
Danger If swallowed or in case of vomiting, danger of entering the lungs.

5 Fire fighting measures

Suitable extinguishing agents CO2, sand, extinguishing powder. Do not use water.

For safety reasons unsuitable extinguishing agents Water

Special hazards caused by the material, its products of combustion or resulting gases:
In case of fire, the following can be released:
Carbon monoxide and carbon dioxide

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
Keep away from ignition sources

Measures for environmental protection:
Do not allow material to be released to the environment without proper governmental permits.

Measures for cleaning/collecting:
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Ensure adequate ventilation.
Keep away from ignition sources.

Additional information:
See Section 7 for information on safe handling
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

Handling
Information for safe handling:
Keep container tightly sealed.
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:

<table>
<thead>
<tr>
<th>Compound</th>
<th>Limit Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Butanone (methyl ethyl ketone)</td>
<td>ppm</td>
</tr>
<tr>
<td>ACGIH TLV</td>
<td>200; 300-Ceiling</td>
</tr>
<tr>
<td>Austria TWA</td>
<td>200</td>
</tr>
<tr>
<td>Belgium TWA</td>
<td>200; 300-STEEL</td>
</tr>
<tr>
<td>Denmark TWA</td>
<td>100 (skin)</td>
</tr>
<tr>
<td>Finland TWA</td>
<td>150; 190-STEEL (skin)</td>
</tr>
<tr>
<td>France TWA</td>
<td>200 (skin)</td>
</tr>
<tr>
<td>Germany TWA</td>
<td>200</td>
</tr>
<tr>
<td>Hungary TWA</td>
<td>200; 600-STEEL</td>
</tr>
<tr>
<td>Ireland TWA</td>
<td>200; 300-STEEL (skin)</td>
</tr>
<tr>
<td>Netherlands TWA</td>
<td>200 (skin)</td>
</tr>
<tr>
<td>Poland TWA</td>
<td>200</td>
</tr>
<tr>
<td>Russia TWA</td>
<td>200; 200-STEEL</td>
</tr>
<tr>
<td>Sweden TWA</td>
<td>50; 100-STEEL</td>
</tr>
<tr>
<td>Switzerland TWA</td>
<td>200; 400-STEEL</td>
</tr>
<tr>
<td>United Kingdom TWA</td>
<td>200; 300-STEEL</td>
</tr>
<tr>
<td>USA PEL</td>
<td>200</td>
</tr>
</tbody>
</table>

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. Avoid contact with the eyes and skin.

Breathing equipment: Use suitable respirator when high concentrations are present.

Protection of hands: Impervious gloves

Eye protection: Safety glasses

Body protection: Protective work clothing.

9 Physical and chemical properties:

General Information

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form:</td>
<td>Liquid</td>
</tr>
<tr>
<td>Color:</td>
<td>Colorless</td>
</tr>
<tr>
<td>Odor:</td>
<td>Acetone-like</td>
</tr>
</tbody>
</table>

Change in condition

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melting point/Melting range:</td>
<td>-87°C (-125°F)</td>
</tr>
<tr>
<td>Boiling point/Boiling range:</td>
<td>80°C (176°F)</td>
</tr>
<tr>
<td>Sublimation temperature / start:</td>
<td>Not determined</td>
</tr>
</tbody>
</table>

Flash point: -3°C (27°F)

Ignition temperature: 514°C (957°F)
Decomposition temperature: Not determined

Explosion limits:
  Lower: 1.8 Vol %
  Upper: 11.5 Vol %

Vapor pressure at 20°C (68°F): 105 hPa (79 mm Hg)

Density at 20°C (68°F): 0.805 g/cm³

Solubility in / Miscibility with Water at 20°C (68°F): 292 g/l

Viscosity:
  dynamic at 20°C (68°F): 0.4 mPas

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: Carbon monoxide and carbon dioxide

11 Toxicological information

Acute toxicity:

LD/LC50 values that are relevant for classification:

<table>
<thead>
<tr>
<th>Oral</th>
<th>LD50</th>
<th>3000 mg/kg (mouse)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LDL0</td>
<td>2737 mg/kg (rat)</td>
</tr>
<tr>
<td>Dermal</td>
<td>LD50</td>
<td>714.3 mg/kg (human)</td>
</tr>
<tr>
<td>Inhalative</td>
<td>LC50</td>
<td>6480 mg/kg (rabbit)</td>
</tr>
<tr>
<td></td>
<td>LC50/4H</td>
<td>32000 mg/m3/4H (mouse)</td>
</tr>
<tr>
<td></td>
<td>LC50/8H</td>
<td>23500 mg/m3/8H (rat)</td>
</tr>
<tr>
<td></td>
<td>LCL0/30M</td>
<td>97300 mg/m3 (guinea pig)</td>
</tr>
<tr>
<td>Irritation of skin</td>
<td>mild</td>
<td>402 mg/24H (rabbit)</td>
</tr>
<tr>
<td>Irritation of eyes</td>
<td>severe</td>
<td>unknown mg (rabbit)</td>
</tr>
</tbody>
</table>

Primary irritant effect:
on the skin: Causes mild irritant effect.
on the eye: Irritating effect.

Sensitization: No sensitizing effects known.

Other information (about experimental toxicology):
Reproductive effects have been observed on tests with laboratory animals.

Subacute to chronic toxicity:
2-Butanone is irritating to the eyes, nose and throat. High concentrations may cause numbness of the extremities, dizziness, and drowsiness. It is an experimental teratogen.

Subacute to chronic toxicity:
The Registry of Toxic Effects of Chemical Substances (RTECS) reports the following effects in laboratory animals:
Behavioral - general anesthetic.
Behavioral - ataxia.
Biochemical - Metabolism (Intermediary) - lipids including transport.
Biochemical - Enzyme inhibition, induction, or change in blood or tissue levels - transaminases.
Cardiac - pulse rate.
Gastrointestinal - changes in structure or function of salivary glands.
Immunological Including Allergic - other immediate (humoral): urticaria, allergic rhinitis, serum sickness.
Kidney, Ureter, Bladder - other changes.
Kidney, Ureter, Bladder - urine volume increased.
Liver - other changes.
Liver - changes in liver weight.
Liver - liver function tests impaired.
Lungs, Thorax, or Respiration - other changes.
Lungs, Thorax, or Respiration - respiratory depression.
Lung, Thorax, or Respiration - cough.
Lungs, Thorax, or Respiration - emphysema.
Peripheral Nerve and Sensation - recording from peripheral motor nerve.
Peripheral Nerve and Sensation - sensory change involving peripheral nerve.
Related to Chronic Data - death.
Reproductive - Specific Developmental Abnormalities - craniofacial (including nose and tongue).
Reproductive - Specific Developmental Abnormalities - urogenital system.
Reproductive - Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus).
Reproductive - Specific Developmental Abnormalities - homeostasis.
Reproductive - Specific Developmental Abnormalities - musculoskeletal system.
Reproductive - Specific Developmental Abnormalities - gastrointestinal system.
Sense Organs and Special Senses (Olfaction) - effect, not otherwise specified.
Sense Organs and Special Senses (Eye) - conjunctive irritation.

Additional toxicological information:
To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.
EPA-D: Not classifiable as to human carcinogenicity; inadequate human and animal evidence of carcinogenicity or no data are available.

12 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.
Uncleaned packagings:
Recommendation: Disposal must be made according to official regulations.

14 Transport information

DOT regulations:

| Hazard class | 3 |
| Identification number | UN1193 |
| Packing group | II |
| Hazardous substance | 5000 lbs, 2270 kg |
| Proper shipping name (technical name) | ETHYL METHYL KETONE (METHYL ETHYL KETONE) |
| Label | 3 |

Land transport ADR/RID (cross-border)

| ADR/RID class | 3 (F1) Flammable liquids |
| Danger code (Kemler) | 33 |
| UN-Number | 1193 |
| Packaging group | II |
| Description of goods | 1193 ETHYL METHYL KETONE (METHYL ETHYL KETONE) |

Maritime transport IMDG:

| IMDG Class | 3 |
| UN Number | 1193 |
| Label | 3 |
| Packaging group | II |
Product name: 2-Butanone

Marine pollutant: No
Proper shipping name: ETHYL METHYL KETONE (METHYL ETHYL KETONE)

Air transport ICAO-TI and IATA-DGR:

- ICAO/IATA Class: 3
- UN/ID Number: 1193
- Label: 3
- Packaging group: II
- Proper shipping name: ETHYL METHYL KETONE (METHYL ETHYL KETONE)
- UN "Model Regulation": UN1193, ETHYL METHYL KETONE (METHYL ETHYL KETONE), 3, II

15 Regulations

Product related hazard informations:

- Hazard symbols:
  - Xi Irritant
  - F Highly flammable

- Risk phrases:
  - 11 Highly flammable.
  - 36 Irritating to eyes.
  - 66 Repeated exposure may cause skin dryness or cracking
  - 67 Vapours may cause drowsiness and dizziness

- Safety phrases:
  - 9 Keep container in a well-ventilated place.
  - 16 Keep away from sources of ignition - No smoking.

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 Organization
- ICAO-TI: Technical Instructions by the "International Civil Aviation Organization" (ICAO)
- 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