SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name: 1-Methyl-2-pyrrolidinone

Product Number: 328634
Brand: Sigma-Aldrich
Index-No.: 606-021-00-7
CAS-No.: 872-50-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone: +1 314 771-5765
Fax: +1 800 325-5052

1.4 Emergency telephone

Emergency Phone #: 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 4), H227
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Reproductive toxicity (Category 1B), H360
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements
The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada

Pictogram

Signal Word Danger

Hazard statement(s)
H227 Combustible liquid.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H360 May damage fertility or the unborn child.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.
P261 Avoid breathing mist or vapors.
P264 Wash skin thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P337 + P313 If eye irritation persists: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms:
N-Methyl-2-pyrrolidone
1-Methyl-2-pyrrolidone
NMP
M-PYROL™

Formula: C₅H₉NO
Molecular weight: 99.13 g/mol
CAS-No.: 872-50-4
EC-No.: 212-828-1
Index-No.: 606-021-00-7

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-methyl-2-pyrrolidone</td>
<td>Flam. Liq. 4; Skin Irrit. 2; Eye Irrit. 2A; Repr. 1B; STOT SE 3; H227, H315, H319, H360, H335</td>
<td>&lt;= 100 %</td>
</tr>
<tr>
<td></td>
<td>Concentration limits: &gt;= 10 %: STOT SE 3, H335;</td>
<td></td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder
Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Nitrogen oxides (NOx)
Combustible.
Vapors are heavier than air and may spread along floors.
Forms explosive mixtures with air on intense heating.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Remove container from danger zone and cool with water. Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Keep away from heat and sources of ignition. Evacuate the danger area, observe emergency procedures, consult an expert. For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully with liquid-absorbent material (e.g. Chemizorb®). Dispose of properly. Clean up affected area.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Advice on safe handling
Work under hood. Do not inhale substance/mixture. Avoid generation of vapours/aerosols.

Advice on protection against fire and explosion
Keep away from open flames, hot surfaces and sources of ignition. Take precautionary measures against static discharge.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance. For precautions see section 2.2.
7.2 Conditions for safe storage, including any incompatibilities

**Storage conditions**
Tightly closed. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Store under inert gas. Moisture sensitive.

**Storage class**
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-methyl-2-pyrrolidone</td>
<td>872-50-4</td>
<td>TWA</td>
<td>15 ppm 60 mg/m3</td>
<td>USA. Workplace Environmental Exposure Levels (WEEL)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remarks</td>
<td>Skin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>STEL 30 ppm 120 mg/m3</td>
<td>USA. Workplace Environmental Exposure Levels (WEEL)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Skin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PEL 1 ppm 4 mg/m3</td>
<td>California permissible exposure limits for chemical contaminants (Title 8, Article 107)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Skin</td>
<td></td>
</tr>
</tbody>
</table>

**Biological occupational exposure limits**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Parameters</th>
<th>Value</th>
<th>Biological specimen</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-methyl-2-pyrrolidone</td>
<td>872-50-4</td>
<td>5-Hydroxy-N-methyl-2-pyrrolidone</td>
<td>100 mg/l</td>
<td>Urine</td>
<td>ACGIH - Biological Exposure Indices (BEI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remarks</td>
<td>End of shift (As soon as possible after exposure ceases)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Derived No Effect Level (DNEL)**

<table>
<thead>
<tr>
<th>Application Area</th>
<th>Routes of exposure</th>
<th>Health effect</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers</td>
<td>Skin contact</td>
<td>Long-term systemic effects</td>
<td>4.8mg/kg BW/d</td>
</tr>
<tr>
<td>Workers</td>
<td>Inhalation</td>
<td>Long-term systemic effects</td>
<td>14.4 mg/m3</td>
</tr>
</tbody>
</table>

**Predicted No Effect Concentration (PNEC)**

<table>
<thead>
<tr>
<th>Compartment</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>5 mg/l</td>
</tr>
<tr>
<td>Environment</td>
<td>Concentration</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Sea water</td>
<td>0.025 mg/kg</td>
</tr>
<tr>
<td>Fresh water</td>
<td>0.25 mg/l</td>
</tr>
<tr>
<td>Onsite sewage treatment plant</td>
<td>10 mg/l</td>
</tr>
<tr>
<td>Soil</td>
<td>0.0701 mg/kg</td>
</tr>
<tr>
<td>Sea sediment</td>
<td>0.109 mg/kg</td>
</tr>
<tr>
<td>Fresh water sediment</td>
<td>1.09 mg/kg</td>
</tr>
</tbody>
</table>

8.2 Exposure controls

**appropriate engineering controls**
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

**Personal protective equipment**

**Eye/face protection**
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

**Skin protection**
This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: butyl-rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Butoject® (KCL 898)

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Splash contact
Material: Latex gloves
Minimum layer thickness: 0.6 mm
Break through time: 60 min
Material tested:Lapren® (KCL 706 / Aldrich Z677558, Size M)

**Body Protection**
protective clothing

**Respiratory protection**
required when vapours are generated. Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

**Control of environmental exposure**
Do not let product enter drains.
SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance
   Form: clear, liquid
   Color: colorless

b) Odor
   amine-like

c) Odor Threshold
   No data available

d) pH
   8.5 - 10.0 at 100 g/l at 20 °C (68 °F)

e) Melting point/freezing point
   Melting point/range: -24 °C (-11 °F)

f) Initial boiling point and boiling range
   202 °C 396 °F
   81 - 82 °C (178 - 180 °F) at 13 hPa

g) Flash point
   91 °C (196 °F) - Pensky-Martens closed cup - ISO 2719

h) Flammability (solid, gas)
   No data available

i) Upper/lower flammability or explosive limits
   Upper explosion limit: 9.5 %(V)
   Lower explosion limit: 1.3 %(V)

k) Vapor pressure
   0.32 hPa at 20 °C (68 °F) - OECD Test Guideline 104

l) Vapor density
   3.42 - (Air = 1.0)

m) Density
   1.028 g/mL at 25 °C (77 °F)
   Relative density
   No data available

n) Water solubility
   1,000 g/l at 20 °C (68 °F) - soluble

o) Partition coefficient:
   n-octanol/water
   log Pow: -0.46 at 25 °C (77 °F) - OECD Test Guideline 107 - Bioaccumulation is not expected.

p) Autoignition temperature
   245 °C (473 °F) at 1,013 hPa - DIN 51794

q) Decomposition temperature
   No data available

r) Viscosity
   No data available

s) Explosive properties
   No data available

t) Oxidizing properties
   none

9.2 Other safety information

Conductivity
   0.2 - 0.4 µS/cm

Surface tension
   40.4 mN/m

Relative vapor density
   3.42 - (Air = 1.0)
SECTION 10: Stability and reactivity

10.1 Reactivity
Forms explosive mixtures with air on intense heating.
A range from approx. 15 Kelvin below the flash point is to be rated as critical.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature).

10.3 Possibility of hazardous reactions
Risk of ignition or formation of inflammable gases or vapours with:
- Oxidizing agents
- Violent reactions possible with:
  - Strong acids
  - Strong bases
  - various plastics

10.4 Conditions to avoid
Strong heating.

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

**Acute toxicity**
LD50 Oral - Rat - male and female - 4,150 mg/kg
(OECD Test Guideline 401)
LC50 Inhalation - Rat - male and female - 4 h - > 5.1 mg/l - aerosol
(OECD Test Guideline 403)
LD50 Dermal - Rat - male and female - > 5,000 mg/kg
(OECD Test Guideline 402)

**Skin corrosion/irritation**
Skin - Rabbit
Result: Irritating to skin. - 24 h
(OECD Test Guideline 404)
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

**Serious eye damage/eye irritation**
Eyes - Rabbit
Result: Eye irritation
(OECD Test Guideline 405)
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

**Respiratory or skin sensitization**
Local lymph node assay (LLNA) - Mouse
Result: negative
(OECD Test Guideline 429)

**Germ cell mutagenicity**
Test Type: Ames test
Test system: *Salmonella typhimurium*
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative
Test Type: In vitro mammalian cell gene mutation test
Test system: Chinese hamster ovary cells
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 476
Result: negative
Test Type: unscheduled DNA synthesis assay
Test system: rat hepatocytes
Method: OECD Test Guideline 482
Result: negative

Test Type: In vivo micronucleus test
Species: Mouse
Cell type: Bone marrow
Application Route: Oral
Method: OECD Test Guideline 474
Result: negative

Test Type: Chromosome aberration test
Species: Chinese hamster
Cell type: Bone marrow
Application Route: Oral
Method: OECD Test Guideline 475
Result: negative

**Carcinogenicity**
IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA’s list of regulated carcinogens.

**Reproductive toxicity**
May damage the unborn child.

**Specific target organ toxicity - single exposure**
Inhalation - May cause respiratory irritation. - Respiratory system

**Specific target organ toxicity - repeated exposure**
No data available

**Aspiration hazard**
No data available
11.2 Additional Information

Repeated dose toxicity - Rabbit - male - Dermal - 20 d - NOAEL (No observed adverse effect level) - 826 mg/kg - LOAEL (Lowest observed adverse effect level) - 1,653 mg/kg
Remarks: Subacute toxicity

RTECS: UY5790000
Prolonged or repeated exposure may cause: Vomiting, Diarrhea, Abdominal pain, Rats exposed to 1-methyl-2-pyrrolidinone at a concentration of 1 mg/L as an aerosol for 10 days showed depletion of hematopoietic cells in the bone marrow and atrophy of the lymphoid tissues of the thymus, spleen, and lymph nodes.
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Bone marrow - Irregularities - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish static test LC50 - Oncorhynchus mykiss (rainbow trout) - > 500 mg/l - 96 h
Remarks: (ECHA)

Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia magna (Water flea) - ca. 4,897 mg/l - 48 h
Remarks: (IUCLID)

Toxicity to algae static test EC50 - Desmodesmus subspicatus (green algae) - 672.8 mg/l - 72 h
(DIN 38412)

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) semi-static test NOEC - Daphnia magna (Water flea) - 12.5 mg/l - 21 d
(OECD Test Guideline 211)

12.2 Persistence and degradability

Biodegradability aerobic - Exposure time 28 d
Result: 73 % - Readily biodegradable.
(OECD Test Guideline 301C)

Biochemical Oxygen Demand (BOD) 1.100 mg/g
Remarks: (Lit.)

Chemical Oxygen Demand (COD) 1.600 mg/g
Remarks: (Lit.)

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available
12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
NA-Number: 1993    Class: NONE    Packing group: III
Proper shipping name: Combustible liquid, n.o.s.
Reportable Quantity (RQ):
   Poison Inhalation Hazard: No

IMDG
Not dangerous goods

IATA
Not dangerous goods

SECTION 15: Regulatory information

SARA 302 Components
This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-methyl-2-pyrrolidone</td>
<td>872-50-4</td>
<td>2007-03-01</td>
</tr>
</tbody>
</table>

Massachusetts Right To Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-methyl-2-pyrrolidone</td>
<td>872-50-4</td>
<td>2007-03-01</td>
</tr>
</tbody>
</table>
Pennsylvania Right To Know Components
N-methyl-2-pyrrolidone

California Prop. 65 Components
, which is/are known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

SECTION 16: Other information

Further information
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 Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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