Product Safety Assessment

**DOW™ Aminoethylpiperazine**


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**Names**
- CAS No. 140-31-8
- DOW™ aminoethylpiperazine
- GNS GS-AEP aliphatic amine
- AEP
- N-(2-Aminoethyl)piperazine
- 2-Piperazin-1-ylethylamin
- Piperazine, 1-(2-aminoethyl)-
- 1-Piperazinethanamine
- 2-Piperazin-1-ylethylamine

**Product Overview**
- **DOW™** aminoethylpiperazine is a cyclic member of the ethyleneamines family. At room temperature, it is a clear, colorless liquid with an ammonia-like odor and is typically 96.5–99.5% pure.¹ For further details, see Product Description.
- **DOW** aminoethylpiperazine is used as an asphalt additive, mineral processing aid, and petroleum production chemical. It is also used in corrosion inhibitors, epoxy curing agents, and as an intermediate in the production of certain polyurethane catalysts.¹ For further details, see Product Uses.
- **DOW** aminoethylpiperazine is manufactured and used in closed systems. However, workplace exposure is possible during maintenance, transfer, or sampling operations. Although **DOW** aminoethylpiperazine is not sold for direct consumer use, it can be a component of products used by the public.² For further details, see Exposure Potential.
- Aminoethylpiperazine liquid can cause severe burns to the eyes and skin or to the mouth and throat if swallowed. Exposure to liquid or vapor may result in an allergic skin or respiratory reaction. It can contain components that have caused birth defects and have been toxic to the fetus in animal testing.³ For further details, see Health Information.
- **DOW** aminoethylpiperazine is slightly toxic to aquatic organisms. Its bioconcentration potential is low, and it biodegrades relatively slowly in the environment. It would not be expected to persist in the environment and would be removed by normal wastewater-treatment processes. For further details, see Environmental Information.
- **DOW** aminoethylpiperazine is is stable under normal conditions of storage and use, but can react with a variety of chemicals. Organic-based absorbents should not be applied to spills. It can react with carbon dioxide in the air to form amine-carbamate salts, which can plug vent or relief lines.⁴ For further details, see Physical Hazard Information.

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Manufacture of Product\textsuperscript{5}

- **Capacity** – Global annual production of ethyleneamines was estimated at 468,100 metric tons (approximately 1 billion pounds) in 2012.\textsuperscript{6} Dow produces ethyleneamines in the following locations: Freeport, Texas, USA; Hahnville, Louisiana, USA (St. Charles Operations); and Terneuzen, The Netherlands.

- **Process** – DOW\textsuperscript{™} aminoethylpiperazine is produced by reacting ethylene dichloride with an excess of ammonia under high pressure and moderate temperature. The resultant solution is neutralized with caustic soda to form aminoethylpiperazine and other ethyleneamines, which are then separated and purified by distillation. Sodium chloride is formed as a by-product. The reaction sequence is shown below.

\[
\begin{align*}
\text{CH}_2\text{Cl} & \xrightarrow{[\text{NH}_3]} \text{NH}_2\text{HCl} + \text{CH}_2\text{Cl} \quad \text{NH}_2\text{HCl} + \text{Cl} \quad \text{NH}_2\text{HCl} + \text{NaOH} \\
\text{H}_2\text{C} & \text{H}_2\text{C} \quad \text{H}_2\text{C} \quad \\
\text{Cl} & \quad \text{NH}_2\text{HCl} \quad \text{NH}_2\text{HCl} + \text{NaCl + H}_2\text{O} \\
\text{CH}_2\text{Cl} & \quad \\
\text{Ethylene dichloride} & \quad \text{AEP}
\end{align*}
\]

Product Description\textsuperscript{3,5}

DOW\textsuperscript{™} aminoethylpiperazine (C\textsubscript{6}H\textsubscript{15}N\textsubscript{3}) is a cyclic member of the ethyleneamines family. At room temperature, it is a clear, colorless liquid with an ammonia-like odor. DOW aminoethylpiperazine is typically 96.5–99.5% pure with the common impurities listed below.

<table>
<thead>
<tr>
<th>Product Description</th>
<th>CAS No.</th>
<th>Impurity Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aminoethylethanolamine</td>
<td>111-41-1</td>
<td>1.5–4.5%</td>
</tr>
<tr>
<td>Diethylenetriamine</td>
<td>111-40-0</td>
<td>0.1–2.0%</td>
</tr>
<tr>
<td>Ethylenediamine</td>
<td>107-15-3</td>
<td>0.1–2.0%</td>
</tr>
<tr>
<td>Triethylenetetramine mixture</td>
<td>112-24-3</td>
<td>0.1–2.0%</td>
</tr>
</tbody>
</table>

Product Uses\textsuperscript{1,7,8}

DOW\textsuperscript{™} aminoethylpiperazine is used to produce:

- **Epoxy hardener agents** – to enhance the performance and application of epoxy coatings, adhesives, laminates, castings, and grouts
- **Polyamides** – for adhesives and coatings
- **Urethane chemicals and foams** – to manufacture certain polyols and catalysts for use in urethane systems for automotive, appliance,
Exposure Potential

DOW™ aminoethylpiperazine is used in the production of industrial and consumer products. Based on the uses for this material, the public could be exposed through:

- **Workplace exposure** – Exposure can occur either in an aminoethylpiperazine manufacturing facility or in the various industrial or manufacturing facilities that use this material. It is produced, distributed, stored, and consumed in closed systems. Those working with aminoethylpiperazine in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. Each manufacturing facility should have a thorough training program for employees and appropriate work processes, ventilation, and safety equipment in place to limit unnecessary exposure. See Health Information.

- **Consumer exposure to products containing DOW aminoethylpiperazine** – Dow does not sell aminoethylpiperazine for direct consumer use, but it can be a component of materials that may be handled by the public. Curing agents for some epoxy products, such as those used in automotive and home-repair applications, may contain this material. Always read the product information before use and follow the label/use instructions. Also, small residual levels of aminoethylpiperazine may be present in products made using it as a chemical intermediate. Because aminoethylpiperazine is a very reactive molecule, these products are not expected to have significant levels of residual aminoethylpiperazine; and because these products are often crosslinked, any residuals are not expected to be mobile. See Health Information.

- **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil and surface or ground water. Eliminate all sources of ignition and ground and bond all containers and handling equipment. For small spills, aminoethylpiperazine should be absorbed with sand, clay, or dirt. Do not absorb spills with organic absorbents such as peat moss, ground corn cobs, cellulose, or sawdust. If the material is hot or present as a spray or mist, use an approved air-purifying respirator with an organic vapor cartridge and a particulate prefilter or an air-supply full-face respirator. This material is considered slightly toxic to aquatic organisms on an acute basis. It would not be expected to persist in the environment and would be removed by normal wastewater-treatment processes. See Environmental, Health, and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, the material should be captured, collected, and reprocessed or disposed of according to applicable governmental requirements. An approved air-purifying respirator with an organic vapor cartridge and a particulate prefilter is recommended for emergency work. Eliminate all sources of ignition immediately. Use only explosion-proof equipment; ground and bond all containers and handling equipment. See Environmental, Health, and Physical Hazard Information.

- **In case of fire** – Deny unnecessary entry into the area. Burning liquids may be extinguished by diluting with water, but use of a direct water stream may spread the fire. Use a water fog or fine spray, dry-chemical or carbon-dioxide extinguishers, or foam. Alcohol-resistant foams are preferred. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing and avoid contact with aminoethylpiperazine. If contact is likely, firefighters should wear chemical-resistant clothing in addition to SCBA gear. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

For more information, see the relevant Safety Data Sheet.
Health Information

**Eye contact** – Aminoethylpiperazine may cause severe irritation or chemical burns with corneal injury, which could result in permanent vision impairment.

**Skin contact** – Brief contact may result in burns. Symptoms may include pain, severe local redness, and tissue damage. Prolonged or widespread contact may result in absorption of harmful amounts. Skin contact may cause an allergic reaction, particularly for people who have had allergic reactions to similar materials in the past.

**Inhalation** – At room temperature, the vapor pressure of aminoethylpiperazine is too low to be an inhalation risk. However, if the material is heated or dispersed as a spray or mist, concentrations may be obtained that could cause respiratory irritation. Heated vapor or mist inhalation may cause severe irritation to the upper respiratory tract (nose and throat) and lungs. Excessive exposure could aggravate preexisting asthma.

**Ingestion** – Aminoethylpiperazine has low toxicity when swallowed, but can cause burns to the mouth and throat, as well as gastrointestinal irritation or ulceration. Swallowing or vomiting could result in aspiration of material into the lungs and consequent lung and tissue damage.

**Other** – Some components of this material have caused birth defects and fetal death in laboratory animals. *In vitro* and animal genetic toxicity studies have yielded generally negative results. One positive result is believed to be related to the test medium rather than the test material.¹¹

For more information, see the relevant Safety Data Sheet.

Environmental Information

DOW™ aminoethylpiperazine is slightly toxic to aquatic organisms. Its bioconcentration potential is low and potential for mobility in soil is medium. It biodegrades very slowly in the environment. It would not be expected to persist in the environment and would be removed by normal wastewater-treatment processes.

For more information, see the relevant Safety Data Sheet.

Physical Hazard Information

DOW™ aminoethylpiperazine is stable under normal conditions of storage and use. Elevated temperatures can cause aminoethylpiperazine to decompose, with the possible release of ammonia, ethylenediamine, or other volatile amines. It can also react with carbon dioxide in the air to form amine-carbamate salts, which tend to plug vent and relief lines, compromising pressure-relief systems and introducing solid contaminants into the storage system.

Avoid contact with oxidizing materials, acids, acrylates, alcohols, aldehydes, ketones, halogenated hydrocarbons, nitrites, and metals such as brass, bronze, copper, and copper alloys. Avoid using organic absorbents such as ground corn cobs, sawdust, cellulose or peat moss.

For more information, see the relevant Safety Data Sheet.
Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of DOW™ aminoethylpiperazine. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Safety Data Sheet, Technical Data Sheet, or Contact Us.

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Additional Information

- Safety Data Sheet (www.dow.com/webapps/msds/msdssearch.aspx)
- Contact Us (www.dow.com/amines/contact/index.htm)
- Ethyleneamines: Storage and Handling, The Dow Chemical Company, Form No. 108-01350 November 2001

For more business information about DOW™ aminoethylpiperazine, visit the Dow Amines web site at www.dow.com/amines/

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References

1 Aminoethylpiperazine Technical Data Sheet, The Dow Chemical Company, Form No. 108-01357-1001 AMS
3 Aminoethylpiperazine Safety Data Sheet, The Dow Chemical Company

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