Product Safety Assessment

**DOW™ Triisopropanolamine**


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**Names**
- CAS No. 122-20-3
- DOW™ triisopropanolamine
- TIPA
- 1,1′,1″-Nitrilotri-2-propanol

**Product Overview**
- DOW™ triisopropanolamine (TIPA) is a white to yellow solid at room temperature. It is completely soluble in water and has a slight, ammonia-like odor. The Dow Chemical Company (Dow) manufactures three TIPA products: TIPA 99 (99% purity), TIPA Low Freeze Grade (LFG), and TIPA 101.¹,² For further details, see Product Description.
- DOW triisopropanolamine is used as an emulsifier, stabilizer, surfactant, and chemical building block. It can neutralize pH, act as a buffer (stabilize pH), or add basicity (alkalinity) to a solution. Major applications include water-based coatings and agricultural products. It is also used in polymer production, textile finishing, electroplating, lubricants, paper, plastics, rubber curing, cement and concrete applications, and personal-care products.³,² For further details, see Product Uses.
- Worker exposure is possible at a triisopropanolamine production site or at facilities using it to manufacture other products. Consumers could contact triisopropanolamine by using personal-care products or other products that contain it.¹ For further details, see Exposure Potential.
- Eye contact with triisopropanolamine may cause moderate irritation and corneal injury. Prolonged skin contact may cause irritation with local redness, and repeated contact may cause a burn. Prolonged contact is not likely to result in absorption of harmful amounts. At room temperature, exposure to vapor is minimal due to low volatility. Inhaling vapor from heated material may cause respiratory irritation or other effects.¹ For further details, see Health Information.
- DOW triisopropanolamine is not likely to accumulate in the food chain and is readily biodegradable and, as a result, is unlikely to persist in the environment. It is practically nontoxic to fish and other aquatic organisms on an acute basis.¹ For further details, see Environmental Information.
- DOW triisopropanolamine is stable at typical storage and use temperatures. Exposure to elevated temperatures can cause the product to decompose. Avoid contact with nitrites.

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strong acids, strong oxidizers, and halogenated organic solvents. Triisopropanolamine reacts with aluminum, carbon steel, zinc, copper, and galvanized metals; do not store in containers made from these metals.\(^1\) For further details, see Physical Hazard Information.

**Manufacture of Product\(^3\)**

- **Capacity** – Global annual capacity for isopropanolamines was estimated at 140,000 metric tonnes (300 million pounds) in 2010. Dow manufactures isopropanolamines at its facility in Plaquemine, Louisiana, in the United States.
- **Process** – DOW™ diisopropanolamines are manufactured by reacting propylene oxide with ammonia. The ratio of ammonia to propylene oxide determines which of the three products—monoisopropanolamine (MIPA), diisopropanolamine (DIPA), or triisopropanolamine (TIPA)—is produced. By increasing the ratio of ammonia to propylene oxide, MIPA and DIPA production is favored. The reaction is as follows:

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\begin{align*}
\text{NH}_3 + \text{H}_3\text{CCH} = \text{CH}_2 & \rightarrow \text{H}_2\text{NCH}_2\text{CHOHCH}_3 \\
\text{H}_2\text{NCH}_2\text{CHOHCH}_2 + \text{H}_3\text{CCH} = \text{CH}_2 & \rightarrow \text{HN(CH}_2\text{CHOHCH}_3)_2 \\
\text{HN(CH}_2\text{CHOHCH}_3)_2 + \text{H}_3\text{CCH} = \text{CH}_2 & \rightarrow \text{N(CH}_2\text{CHOHCH}_3)_3
\end{align*}
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**Product Description\(^1,2\)**

DOW™ triisopropanolamine (TIPA) is the common name for 1,1′,1″-nitrilotri-2-propanol. It is a white to yellow solid at room temperature. It is completely soluble in water and has a slight, ammonia-like odor. Dow manufactures three triisopropanolamine products:

- TIPA 99 – 99% purity
- TIPA Low Freeze Grade (LFG) – a colorless to yellow liquid at temperatures greater than 5°C (41°F), a blend of 85% triisopropanolamine and 15% deionized water
- TIPA 101 – a yellow to brown-colored liquid, a blend of 88% triisopropanolamine and higher molecular weight isopropanolamines and 12% deionized water

Triisopropanolamine (TIPA) is the common name for 1,1′,1″-nitrilotri-2-propanol. TIPA is a white to yellow solid at room temperature. It is completely soluble in water and has a slight, ammonia-like odor. Dow manufactures three TIPA products: TIPA 99 (99% purity); TIPA Low Freeze Grade (LFG); and TIPA 101. TIPA LFG is a blend of 85% TIPA and 15% deionized water. TIPA LFG is a colorless to yellow liquid at temperatures greater than 41°F (5°C). TIPA 101, a yellow to brown colored liquid, is a blend of 88% TIPA and higher molecular weight isopropanolamines and 12% deionized water.
Product Safety Assessment: DOW™ Triisopropanolamine

Product Uses\(^2,3,4\)
DOW™ triisopropanolamine is a versatile chemical that is used as an emulsifier, stabilizer, surfactant, and chemical intermediate. It can neutralize pH, act as a buffer (stabilize pH), or add basicity (alkalinity) to a solution. Major applications include:

- **Coatings** – serves as a cross-linker and acid neutralizer and improves solubility and product stability in water-based coatings, blocks organic acids, and reduces product discoloration

- **Herbicides, algacides, fungicides, and pesticides** – neutralizes acidic herbicide formulations and improves water solubility and freeze stability in many pesticide products

- **Plastics and polymer production** – used as an antistatic agent, polyurethane additive, and polyisoprene production additive

- **Cement and concrete** – serves as a grinding aid and improves strength.

- **Cleaners** – used in all-purpose cleaners, fine fabric washes, and light-duty dishwashing liquids – laurel sulfate salts made with this material have good hard-surface detergency properties (ability to remove dirt)

- **Personal-care products** – used to prepare isopropanolamides, isopropanolamine soaps, and isopropanolamine salts that are used in bubble-bath formulations, shampoos, and waterless hand cleaners

- **Rubber production** – increases cold-curing rates and improves cold-flow properties.

- **Electroplating** – forms complexes with metal ions in cyanide-free zinc plating to give smooth coatings that are strongly adhered, bright, and corrosion-resistant

- **Textile finishing** – used to prepare soaps used as emulsifiers and corrosion inhibitors in the formation of spooling oils and lubricating oils

**Exposure Potential**
DOW™ triisopropanolamine 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**\(^1\) – DOW triisopropanolamine is manufactured in a closed system using engineering controls that prevent the escape of liquid or vapors and minimize release to the environment. Workers who produce triisopropanolamine and those using it as a chemical intermediate or in product formulations could be exposed during maintenance, sampling, testing, or other procedures. Facilities that manufacture or use this material 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 triisopropanolamine** – DOW triisopropanolamine is not sold for direct consumer use, but it is used as a raw material in products used by consumers. Triisopropanolamine or fatty-acid soaps, salts, and alkanolamides derived from it may be used at concentrations well below those causing health effects in animal studies in personal-care products, including bubble bath, shampoo, hair gel, antibacterial hand gel, and many others. See **Health Information**.

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Environmental releases – In the event of a spill, the focus is on containing the spill to prevent contamination of soil, ditches, sewers, waterways, or groundwater. For small spills, absorb with noncombustible materials such as clay, vermiculite, and Zorbball. Do not use sawdust or cellulose. Collect absorbed material in suitable and properly labeled containers. Wear proper protective equipment. Triisopropanolamine is water soluble and degrades, although more slowly than other isopropylamine products. If released to the environment, it will partition to water and degrade. Small releases will be removed by wastewater-treatment facilities. See Environmental, Health, and Physical Hazard Information.

Large release – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, dike the area to contain the spill. Isolate the area and evacuate unnecessary personnel. Ventilate the area, keeping upwind of the spill. Eliminate all sources of ignition. Only properly trained and protected personnel must be involved in clean-up operations. Using appropriate safety equipment, transfer the recovered material into suitable and properly labeled containers. See Environmental, Health, and Physical Hazard Information.

In case of fire – Keep people away and deny unnecessary entry. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. Avoid contact with this material during firefighting operations. Use water fog or fine spray, dry-chemical or carbon-dioxide fire extinguishers, or foam. Do not use a direct water stream as it may spread the fire. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

For more information, see the relevant Safety Data Sheet.

Health Information

Eye and Skin Contact – Eye contact with concentrated triisopropanolamine may cause moderate irritation with moderate corneal injury. Prolonged skin contact may cause irritation with local redness. Repeated skin contact or contact with broken skin may cause a burn with possible pain, severe local redness, swelling, and tissue damage. Prolonged skin contact is not likely to result in absorption of harmful amounts. Triisopropanolamine has not been reported to cause allergic skin reactions.

Inhalation – At room temperature, exposure to vapor is minimal due to low volatility. Inhaling vapor from heated material may cause respiratory irritation and other effects.

Ingestion – Triisopropanolamine has very low toxicity if swallowed. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury.

Other – Based on available data, repeated exposures to triisopropanolamine are not anticipated to cause significant adverse effects. Triisopropanolamine does not damage genetic material, as in vitro genetic toxicity studies were negative.

For more information, see the relevant Safety Data Sheet.

Environmental Information

DOW Triisopropanolamine is not likely to accumulate in the food chain (bioconcentration potential is low). Triisopropanolamine cannot be considered readily biodegradable according to laboratory test guidelines; however, the biodegradation rate under laboratory conditions is significant and is likely to increase in the environment. As a result, it is unlikely to persist in the

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environment and will be removed during normal wastewater-treatment processes. Triisopropanolamine is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).

For more information, see the relevant Safety Data Sheet.

Physical Hazard Information

DOW™ triisopropanolamine is stable at typical storage and use temperatures. Exposure to elevated temperatures can cause the product to decompose. Generation of gas during decomposition can cause pressure build-up in closed systems. Avoid contact with nitrites, strong acids, strong oxidizers, and halogenated organic solvents.

Triisopropanolamine reacts with aluminum, carbon steel, zinc, copper, and galvanized metals; do not store in containers made from these metals. Heating triisopropanolamine above 60°C (140°F) in the presence of aluminum can result in corrosion and generation of flammable hydrogen gas.

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™ triisopropanolamine. 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.

Additional Information

- Safety Data Sheet (http://www.dow.com/webapps/msds/msdssearch.aspx)
- Contact Us (http://www.dow.com/amines/contact/index.htm)

For more business information about DOW isopropanolamines, visit the Dow Amines website at www.dow.com/amines/.

References

1 Triisopropanolamine 99 Material Safety Data Sheet, The Dow Chemical Company, ID No. 50065/1001
2 DOW™ Triisopropanolamine (TIPA): TIPA 99, TIPA Low Freeze Grade (LFG), & TIPA 101, Technical Data Sheet, The Dow Chemical Company, Form No. 111-01414-1104 AMS

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4 Isopropanolamines: Basic Chemicals with Surfactant Properties for Personal Care Products, Product Information Sheet, The Dow Chemical Company, Form No. 111-01344-1198 AMS
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