AIR PRODUCTS

Nitrogen

Product Stewardship Summary

Nitrogen makes up 78 percent of the air we breathe. Nitrogen has many commercial uses. In fact, more nitrogen is sold by volume than any other inorganic chemical. Nitrogen is used in oil and gas industries, metalworking, electronics, food processing and many manufacturing processes.

Chemical Identity

- *Chemical Formula: N_2*
- *Other names: nitrogen gas, gaseous nitrogen (GAN), liquid nitrogen (LIN)*

Uses and Benefits

Industries use both liquid nitrogen and nitrogen gas. Nitrogen helps make many industrial processes safer for workers and the public. Refineries, petrochemical plants and marine tankers use gaseous nitrogen to clean out vapors and gases from the equipment they use. Industries also use gaseous nitrogen to "blanket," or maintain an inert protective atmosphere over chemicals in process and storage equipment.

Metal fabricators use liquid nitrogen to help control process temperatures in thermal spray coating, making the process more efficient. Machine shops use liquid nitrogen instead of cutting fluids in machining operations, which eliminates the need for oil-based products.

Manufacturers use liquid nitrogen to cool soft or heat-sensitive materials so they can grind them. They use cryogenic grinding to produce medicines, spices, plastics and pigments.

Recyclers use liquid nitrogen to cool polymers including plastic and rubber so they can grind them and recover key raw materials used to manufacture new products. For example, they use nitrogen to turn rubber scrap tires into useable products, such as synthetic running tracks, instead of discarding the rubber in a landfill.

Many of the foods we eat are frozen in nitrogen-cooled freezers. Because the nitrogen is so cold, it often improves the quality of the frozen food products. The liquid nitrogen replaces traditional refrigerants, such as fluorocarbons and ammonia, which may cause environmental or health concerns when they leak from processing equipment. After the nitrogen cools the food, the nitrogen goes safely back into the air.

Physical and Chemical Properties

Nitrogen has no color or smell. It does not burn. It's slightly lighter than air and slightly water soluble. Nitrogen is inert, which means that it does not react with many materials. However, it can form compounds under certain conditions. For example, at high temperatures, nitrogen reacts with oxygen to form various oxides of nitrogen. It can also form other compounds in the presence of catalysts.

When cooled to extremely low temperatures (-321°F/-196°C), nitrogen exists in liquid form. To put that temperature into perspective, water freezes at 32°F/0°C.

Health Effects

The air we breathe is 78 percent nitrogen. The balance is primarily oxygen, at roughly 21 percent. Oxygen is the only element in the air that supports life. Our body doesn't use the nitrogen we breathe. We exhale about the same amount of nitrogen as we inhale.

Higher levels of nitrogen or other gases in the air lower the amount of oxygen available to breathe. This can lead to dizziness, nausea, vomiting, loss of consciousness and death. No one should enter an area with less than 19.5 percent oxygen without special breathing equipment to prevent suffocation.

Liquid nitrogen is so cold that it can burn your skin, just like when a doctor uses it to remove a mole or a wart from your skin.

Environmental Effects

We can manufacture and use nitrogen safely without harming the environment. In a way, we are only "borrowing" the nitrogen from the air. Most industrial applications can simply return the nitrogen to the air when they are finished using it. Plants and animals use nitrogen from the environment, and then they return it to the atmosphere. This nitrogen cycle is a critical process for life.

Exposure Potential and Risk Management Measures

Industrial Use

We ship nitrogen as a high-pressure gas or a cold liquid. We often ship and store gases in liquid form, because they occupy much less space that way.

We store and ship nitrogen gas in two different container sizes. Depending on how much our customer uses, we provide the gas in high-pressure cylinders and tubes. Industry guidelines cover the storage and handling of compressed gas cylinders. Workers should use sturdy work gloves, safety glasses with side shields and safety shoes when handling compressed gas cylinders.

We also store and ship liquid nitrogen in three different types of containers—dewars, cryogenic liquid cylinders and cryogenic liquid tanks. These containers are similar to heavy-duty vacuum bottles used to keep your coffee hot or your water cold. Because of its low temperature, liquid nitrogen should not come in contact with skin. For workers who handle containers of liquid nitrogen, it is important to wear a full face-shield to protect the eyes and face. Workers should also wear clean, loose-fitting, thermal-insulated gloves; a long-sleeved shirt and pants without cuffs; and safety shoes.

To prevent suffocation, it is important to have good ventilation when working with nitrogen. Confined workspaces must be tested for oxygen levels prior to entry. If the oxygen level is lower than 19.5 percent, personnel, including rescue workers, should not enter the area without special breathing equipment that provides an independent source of clean breathing air.

Consumer Use

The only use of nitrogen directly by customers is to inflate the tires on their cars. This operation is typically done at a service station or tire dealer, and does not generally involve direct handling of the nitrogen by the consumer. We do not sell nitrogen directly to consumers.

Regulatory Information

Several regulations govern the manufacture, sale, transportation, and use of nitrogen. These laws vary by country and geographic region. You can find general regulatory information in the Material Safety Data Sheet.

Sources for Additional Information

- Air Products – MSDS
- Compressed Gas Association
- National Fire Protection Association
- Air Products Safetygrams

Conclusion

A wide variety of industries use nitrogen. They can handle it safely without harming the environment when industry and company guidelines are followed.

Contact Information

Emergency Response System

- Tel 1-800-523-9374
  (Continental U.S. and Puerto Rico)
- Tel 1-610-481-7711 (other locations)
- 24 hours a day, 7 days a week
- For assistance involving Air Products and Chemicals, Inc. gases and equipment

Technical Information Center

- Tel 1-800-752-1597 (U.S.)
- Tel 1-610-481-8565 (other locations)
- Fax 1-610-481-8690
- E-mail gasinfo@airproducts.com
- Monday–Friday, 8:00 a.m.–5:00 p.m. EST

We developed this Product Stewardship Summary to give you a general overview of the chemical. This Summary is not meant to provide emergency response or medical treatment information. You can find in-depth safety and health information on the Material Safety Data Sheet for the product.

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