

## Sources of Exposure

## Toxicokinetics and Normal Human Levels

## Biomarkers/Environmental Levels

# ToxGuide™

for

# Ammonia

# NH<sub>3</sub>

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U.S. Department of Health and  
Human Services  
Public Health Service  
Agency for Toxic Substances  
and Disease Registry  
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# NH<sub>3</sub>



### General Populations

- Ammonia is found naturally in the environment. The general population is most likely to be exposed through inhalation of contaminated indoor air, although exposure can also occur through ingestion of contaminated food or water, or through dermal contact.
- In indoor air, exposure may occur through use of household products such as window cleaners, floor waxes and smelling salts.
- In outdoor air, exposure may occur as a result of gas leaks and spills at production plants and storage facilities or from pipelines, tank trucks, railcars, ships and barges that transport ammonia.
- Ammonia is released into the atmosphere naturally by decaying organic matter, animal excreta and volcanic eruptions. It is released anthropogenically through fertilizer usage, spills or leaks, and loss from waste water effluents.

### Occupational Populations

- Farmers, cattle ranchers and individuals who raise livestock and/or poultry may be exposed to ammonia from decaying manure.
- Farmers may also be exposed to ammonia during the application of fertilizers on fields.

### Toxicokinetics

- Absorption occurs by inhalation and ingestion, with less certainty of absorption through skin.
- The majority of inhaled ammonia is retained in the upper respiratory tract and eliminated in expired air.
- Exogenous ammonia is readily absorbed in the intestinal tract.
- Ammonia that reaches circulation is distributed to all compartments of the body. Metabolism occurs in the liver, where it is transformed into urea and glutamine.
- Ammonia is predominantly excreted from the body in urine, although some is excreted in feces.

### Normal Human Levels

- Levels of ammonia in the blood of healthy humans range from 0.7–2 mg/L.

### Biomarkers

- No biomarkers have been identified that can be used to quantify exposure to ammonia.

### Environmental Levels

#### Air

- The average global concentration in the atmosphere is 0.3–6 ppb.

#### Sediment and Soil

- In a study of an open field, ammonia concentrations of 1–5 ppm were measured.

#### Water

- Ammonia concentrations of 0.031–6 ppm have been measured in some rivers and bays.

### Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2004. Toxicological Profile for Ammonia. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

## Chemical and Physical Information

## Routes of Exposure

## Relevance to Public Health (Health Effects)

### Ammonia is a gas

- Ammonia is a colorless gas with a very sharp odor.
- Ammonia is naturally occurring and is manufactured.
- Ammonia is found in water, soil and air and is a source of nitrogen for plants and animals.
- Eighty percent of all commercially manufactured ammonia is used as fertilizer.

- Inhalation – Predominant route of exposure for general population
- Oral – Minor route of exposure for the general population through ingestion of contaminated drinking water.
- Dermal – Minor route of exposure through dermal contact with cleaning products containing ammonia.

### Ammonia in the Environment

- Ammonia is recycled naturally and does not last very long in the environment. Plants and microorganisms rapidly take up ammonia in soil and water.
- In the atmosphere, ammonia can produce ammonium salts, which can be subject to wet or dry deposition.
- In water, ammonia can volatilize, be removed by microbial processes, or adsorb into sediment.
- In soil, ammonia can volatilize, adsorb to soil particles, undergo microbial transformation to nitrate or nitrite, or be taken up by plants.
- Ammonia is continually recycled in the environment and does not bioaccumulate.

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

### Minimal Risk Levels (MRLs)

#### Inhalation

- An MRL of 1.7 ppm has been derived for acute-duration inhalation exposure ( $\leq 14$  days).
- No MRL was derived for intermediate-duration inhalation exposure (15–364 days).
- An MRL of 0.1 ppm has been derived for chronic-duration inhalation exposure ( $\geq 1$  year).

#### Oral

- No acute-, intermediate- or chronic-duration MRLs were derived for oral exposure to ammonia.

### Health Effects

- Ammonia is an upper respiratory irritant in humans, causing immediate irritation to the nose and throat upon exposure.
- Acute accidental exposure to ammonia gas can lead to human death as a result of airway obstruction or infections and other secondary complications.
- The skin is extremely sensitive to airborne ammonia or ammonia dissolved in water and exposure can produce cutaneous burns, blisters, and lesions.
- Ammonia has not been classified for carcinogenic effects by the DHHS, or IARC or EPA.

### Children's Health

- Effects of exposure are likely to be similar to those seen in adult.