METHYL ISOCYANATE

Methyl isocyanate is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 624-83-9 CH_3NCO

Molecular Formula: C_2H_3NO

Methyl isocyanate is a colorless liquid with a pungent odor. It is reactive with water (HSDB, 1991).

Physical Properties of Methyl Isocyanate

Synonyms: isocyanic acid, methyl ester; iso-cyanatomethane

Molecular Weight:	57.06
Boiling Point:	59.6 ^oC
Melting Point:	-45 ^oC
Flash Point:	< -6.6 ^oC (20 ^oF)
Vapor Density:	1.42 (air = 1)
Density/Specific Gravity:	0.9599 at 20/20 ^oC (water = 1)
Vapor Pressure:	348 at 20 ^oC
Conversion Factor:	1 ppm = 2.33 mg/m^3

(HSDB, 1991; Sax, 1987; Sax, 1989)

SOURCES AND EMISSIONS

A. Sources

Methyl isocyanate is used as a chemical intermediate in pesticide synthesis (HSDB, 1991). Recent research has indicated that methyl isocyanate is a breakdown product of methyl isothiocyanate (Geddes, 1995). Methyl isothiocyanate obtains its pesticidal activity from its parent compound metam sodium.

B. Emissions

No emissions of methyl isocyanate from stationary sources in California were reported, based on data received from the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

No information about the natural occurrence of methyl isocyanate was found in the readily-available literature.

AMBIENT CONCENTRATIONS

After a ground injection of metam sodium in Kern County, the Air Resources Board (ARB) conducted ambient air monitoring for two breakdown products: methyl isothiocyanate and methyl isocyanate. Samples were collected before, during and for 72 hours after the start of the application. The methyl isothiocyanate levels ranged from 0.24 micrograms per cubic meter ($\mu g/m^3$) to 250 $\mu g/m^3$ while methyl isocyanate ranged from 0.2 $\mu g/m^3$ to 5.8 $\mu g/m^3$. Both compounds were detected throughout the monitoring period, including the 12 ½ hour background sampling prior to the application. The source of this background could not be determined, but was assumed to be an upwind application of metam sodium (ARB, 1997a).

INDOOR SOURCES AND CONCENTRATIONS

No information about the indoor sources and concentrations of methyl isocyanate was found in the readily-available literature.

ATMOSPHERIC PERSISTENCE

No information about the atmospheric persistence of methyl isocyanate was found in the readily-available literature.

AB 2588 RISK ASSESSMENT INFORMATION

Since no emissions of methyl isocyanate from stationary sources in California have been reported under the AB 2588 program, it was not listed in any of the risk assessments reviewed by the Office of Environmental Health Hazard Assessment.

HEALTH EFFECTS

Probable routes of human exposure to methyl isocyanate are inhalation and dermal contact.

Non-Cancer: Methyl isocyanate vapors are extremely irritating to the respiratory tract, eyes, and skin. It is a sensitizing agent in humans. In 1984, in Bhopal, India, an industrial gas leak of methyl isocyanate resulted in the deaths of 2,000 people and adverse health effects in greater than 170,000 survivors. Pulmonary edema was the primary cause of death, with many others resulting from secondary respiratory infections such as bronchitis and bronchial pneumonia. Other effects from acute inhalation exposure in humans include damage to the eyes, nausea, gastritis, sweating, fever, chills, and liver and kidney damage (U.S. EPA, 1994a). Allergic reactions may occur and trigger asthmatic response in sensitized individuals (Sittig, 1991).

A chronic non-cancer Reference Exposure Level (REL) of 3.6×10^{-1} $\mu g/m^3$ is listed for methyl isocyanate in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered are the respiratory system and skin (CAPCOA, 1993).

No information is available on the effects of chronic exposure to methyl isocyanate in humans or animals. The United States Environmental Protection Agency (U.S. EPA) has determined that there are inadequate data for the establishment of a Reference Concentration (RfC) for methyl isocyanate, and has not set an oral Reference Dose (RfD) (U.S. EPA, 1994a).

After the Bhopal, India accident, an unusually high percentage of survivors had disorders of the reproductive system, including leukorrhea, pelvic inflammatory disease, excessive menstrual bleeding, and suppression of lactation. Other adverse effects included increases in the number of stillbirths and spontaneous abortions (U.S. EPA, 1994a).

Cancer: No information is available on the carcinogenic effects of methyl isocyanate in humans. Male rats, exposed by inhalation, were found to have marginally increased rates of pancreatic tumors in one study. The U.S. EPA has classified methyl isocyanate in Group D: Not classifiable as to human carcinogenicity (U.S. EPA, 1994a). The International Agency for Research on Cancer has not classified methyl isocyanate for human carcinogenicity (IARC, 1987a).