



# *n*-Hexane

## Substance Technical Guidelines

UCSC Laboratory Safety Services  
Providing a little slug of information on . . .

### Chemical Information Overview

#### GENERAL OVERVIEW

Exposure usually occurs by inhalation. N-hexane may be absorbed orally or percutaneously. Hexane inhalation may cause mild irritation to the eyes, nose, throat, and respiratory tract. Acute exposure to high concentrations may result in severe CNS depression, respiratory arrest, and death. Repeated exposure to airborne levels as low as 500 ppm (or probably lower) of n-hexane can produce progressively worsening damage to the peripheral nerves. Hexane is highly flammable and poses a dangerous fire and explosion risk. Inhalation exposures should be kept below 50 ppm.

#### USES/FORMS/SOURCES

- A. Hexane is used as a solvent (in adhesives, coatings, paints and paint thinner, as well as in vegetable oils), desorbent, and chemical reaction medium; it is also used in determining the refractive index of minerals and, when dyed red or blue, as a filling for low-temperature thermometers (instead of mercury) (AAR, 1996; ACGIH, 1991; Ashford, 1994; Budavari, 1996; Lewis, 1993; Lewis, 1998).
- B. Commercial hexane is a mixture of hexane isomers and contains small amounts of cyclopentane, cyclohexane, pentane, and heptane. It may contain a range of normal hexane from 20-80% (ACGIH, 1991).
- C. Hexane is derived by fractional distillation from petroleum (molecular sieve process) (Lewis, 1993; Lewis, 1998).

#### ACUTE CLINICAL EFFECTS

- A. n-Hexane can cause severe degeneration of the PERIPHERAL NERVOUS SYSTEM. It can be absorbed by the dermal and inhalation exposure routes (ILO, 1983).
- B. In acute exposure, n-hexane is a skin, mucous membrane, and upper respiratory irritant, a CNS depressant, and an anesthetic (Clayton & Clayton, 1994; Hathaway et al, 1991). Symptoms of CNS depression include headache, nausea, weakness, dizziness, giddiness, loss of coordination and judgement, and coma or death in respiratory arrest. In humans, exposure to an airborne concentration of approximately 1,500 ppm for 5 minutes produced nausea, headache, eye and throat irritation, and exposure to 5,000 ppm produced giddiness and dizziness (ACGIH, 1992).
- C. Pulmonary aspiration of the liquid can cause potentially fatal chemical pneumonia (NIOSH/OSHA; Clayton & Clayton, 1994). It may also vaporize in the lungs, diluting oxygen to below a critical level, and resulting in asphyxiation, brain damage, or cardiac arrest (HSDB). When in contact with the skin, n-hexane causes immediate irritation, with itching and burning sensations, followed by formation of blisters after approximately 5 hours (Hathaway et al, 1991).
- D. The major feature n-hexane toxicity, however, is DAMAGE TO THE PERIPHERAL NERVES, even with acute exposure, characterized by numbness in the extremities (Schardein, 1985). Splashing the liquid into the eye can cause clouding of the cornea (HSDB).
- E. n-Hexane reduced the threshold for ventricular fibrillation in rats, and lowered levels of myocardial magnesium and potassium. The fibrillation threshold was still low after supplementation with magnesium and potassium. Electron microscopy revealed cellular changes after n-hexane treatment which could explain the decreased threshold (Khedun et al, 1996).

- F. n-Hexane is metabolized by the cytochrome P-450 system to hydroxylated derivatives (Clayton & Clayton, 1994).

## CHRONIC CLINICAL EFFECTS

- A. Repeated exposure to airborne levels as low as 500 ppm (or probably lower) of n-hexane can produce progressively worsening damage to the peripheral nerves (polyneuritis or polyneuropathy) (Paulson & Waylonis, 1976; ACGIH, 1992). Typical neurological findings are MOTOR DEFICIENCY involving dorsal extension of the foot, affecting the anterior tibial nerve, and PARALYSIS of the lower limbs, thigh and less frequently the upper limbs (ILO, 1983). Generally, the peripheral neuropathies are bilateral and symmetrical. Significant muscle atrophy can occur (Inoue et al, 1970), together with decreased or absent reflexes (Chauplannaz et al, 1982).
- B. In some cases, SENSORY NERVE LOSS can occur as well
- C. CNS DAMAGE may also be seen, and usually involves visual dysfunction and memory loss.
- D. Paralysis is reversible, generally within 1 to 8 months after exposure ceases, and full resolution may be noted over 3 to 21 months (ILO, 1983). Recovery may be accelerated by treatment with vitamins, steroids, and gangliosides (Malizia et al, 1983).
- E. Hexane-induced peripheral polyneuropathy is more common in WOMEN than in men (Abbritti et al, 1976).
- F. Parkinsonism has been reported in association with n-hexane exposure
- G. Repeated skin contact can produce a defatting dermatitis with dryness and cracking (NIOSH/OSHA).

## MINIMUM LETHAL EXPOSURE

- A. ACUTE
  - 1. Ingestion of about 50 g of hexane may be fatal to humans (Clayton & Clayton, 1994).
  - 2. The most common acute toxic effects are CNS depression and asphyxia following inhalation. 500 to 1000 for 3 minutes - No effect to Fatigue, loss of appetite, 6 months paresthesias (A skin sensation, such as burning, prickling, itching, or tingling, with no apparent physical cause.)

## WORKPLACE STANDARDS

- A. **ACGIH-TLV:** Listed (ACGIH, 1999) n-Hexane: 50 ppm TWA; no STEL Other isomers: 500 ppm TWA; 1000 ppm STEL
  - 1. Notation(s):
    - a. Skin Notation: Listed
    - b. Carcinogenicity: Not Listed
  - 2. TLV Basis - Critical Effect(s): Neuropathy; central nervous system corrosion; irritation
- B. **OSHA PEL:** Listed (OSHA, 1997a) The PELs are 8-hour TWAs unless otherwise noted; a (CEILING) designation denotes a ceiling limit. They are to be determined from breathing-zone air samples.
  - 1. Limit(s) for Air Contaminant (Table Z-1): Listed
    - a. 500 ppm TWA Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 torr.

- C. **NIOSH VALUES:** (NIOSH, 1998)
1. REL (as n-Hexane): 50 ppm (180 mg/m(3)) TWA; no STEL
    - a. REL (as Other isomers): 100 ppm (350 mg/m(3)) TWA; 510ppm (1800 mg/m(3)) (15 minute) CEILING
    - b. Skin Notation: Not Listed
    - c. NOTE: A TWA concentration is for up to a 10-hour work-day during a 40-hour workweek. A STEL value is a 15 minute TWA exposure that should not be exceeded at any time during a workday. A Ceiling value should not be exceeded at any time.
  2. **IDLH VALUE** (as n-Hexane): 1100 ppm (LEL)
    - a. IDLH VALUE (as Other isomers): Not Yet Determined
    - b. Carcinogen: Not Listed

## CHEMICAL AND PHYSICAL PROPERTIES ▲

**Molecular Weight:** 86.2

**Boiling Point:** 156°F

**Solubility in Water:** 0.002%

**Flash Point:** -7°F

**Ionization Potential:** 10.18 eV

**Specific Gravity:** 0.66

**Flammability Class:** Class IB Flammable Liquid

**Vapor Pressure:** 124 mmHg

**Freezing Point:** -219°F

**Upper Explosive Limit in air (% by volume):** 7.5%

**Lower Explosive Limit in air (% by volume):** 1.1%