

## **n-HEXANE**

### **Characteristics**

n-Hexane (C<sub>6</sub>H<sub>14</sub>) is a colourless, clear, highly volatile and flammable liquid and its odour has been described as gasoline-like and disagreeable. It is a naturally occurring component of crude oil and natural gas, and also may be a metabolic by-product of certain types of fungi, marine phytoplankton and terrestrial vegetation. The majority of n-hexane is obtained from the controlled fractional distillation of petroleum mixtures and other refinery-based processes. Commercial and laboratory grades of hexane are widely used as solvents and extractants in numerous industrial, commercial and domestic applications.

The principal industrial sectors in Alberta that release n-hexane to air are food manufacturing (vegetable oil), the oil and gas sector (including oil sands operations, and some gas plants), and petroleum products manufacturing. For the majority of these facilities, fugitive emissions comprise the largest portion of n-hexane emissions to air, although depending on the facility, stack emissions, and releases during storage and handling also can contribute appreciably to n-hexane air emissions. Hexane is measured in Alberta by gas chromatography and mass spectrometry of a canister-captured sample with an overall detection limit of 0.044 µg m<sup>-3</sup>. From 1993 to 2003, the Edmonton East air quality monitoring station (at 17 St. and 105 Ave.) recorded 24-hour average hexane concentrations ranging from 1.36 µg m<sup>-3</sup> to 186.54 µg m<sup>-3</sup>, with an average of 17.44 µg m<sup>-3</sup>.

### **Effects**

Inhaled n-hexane is readily absorbed in the lungs, and rapidly distributed to fatty tissues within the body. Symptoms of short-term human inhalation exposure to higher concentrations include vertigo, dizziness, light-headedness, drowsiness, nausea, headache, eye and throat irritation, and paraesthesia (pins and needles). In general, n-hexane appears to be of relatively low toxicity following short-term exposure to both humans and animals. High atmospheric concentrations are required to produce adverse health effects. Animal studies with short-term exposures have demonstrated various adverse effects at concentrations above 7,040 mg m<sup>-3</sup> (2,000 ppm). It is well established that long-term human and animal exposure to n-hexane results in motor and sensory peripheral nerve damage. Long-term animal studies have reported No-Observable-Adverse-Effect-Levels in the range of 352 to 10,560 mg m<sup>-3</sup> (100 to 3,000 ppm), and Lowest-Observable-Adverse-Effect-Levels in the range of 1,408 to 10,560 mg m<sup>-3</sup> (400 to 3,000 ppm).

No effects on vegetation were identified by the assessment report.

## Objectives in Other Jurisdictions

The majority of the existing air quality objectives are derived from either the U.S. Environmental Protection Agency reference concentration (An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime (U.S. EPA 2002)) of  $0.2 \text{ mg m}^{-3}$  (57 ppb), or the American Conference of Governmental Industrial Hygienists Threshold Limit Value–Time Weighted Average of  $176 \text{ mg m}^{-3}$  (50 ppm) (either of which are adjusted by the specific agency with various modifying and uncertainty factors). Odour thresholds for n-hexane are highly variable and have been reported to range from 106 to  $873 \text{ mg m}^{-3}$  (30 ppm to 248 ppm). The California Environmental Protection Agency's chronic reference exposure level of  $7,000 \text{ } \mu\text{g m}^{-3}$  (continuous daily exposure over a lifetime) is based on nervous system effects. Agencies reviewed in the assessment report have set a variety of objectives:  $35,000 \text{ } \mu\text{g m}^{-3}$  (9930 ppb) for half-hour,  $1,760 \text{ } \mu\text{g m}^{-3}$  (499 ppb) for 1-hour,  $4,190 \text{ } \mu\text{g m}^{-3}$  (1189 ppb) for 8-hour, 200 to  $17,628 \text{ } \mu\text{g m}^{-3}$  (57 to 5001 ppb) for 24-hour, and 10 to  $7,000 \text{ } \mu\text{g m}^{-3}$  (3 to 1986 ppb) for annual objectives.

## Alberta Ambient Air Quality Objectives

Alberta ambient air quality objectives are issued by Alberta Environment, under Section 14 (1), the *Environmental Protection and Enhancement Act, 1992* (EPEA). Based upon the available information, Alberta hereby adopts:

- Derived by ratio from the 24-hour California objective, an Alberta Ambient Air Quality Objective for n-hexane of  $21,000 \text{ } \mu\text{g m}^{-3}$  (5,958 ppb) as a 1-hour average concentration.
- From California, an Alberta Ambient Air Quality Objective for n-hexane of  $7,000 \text{ } \mu\text{g m}^{-3}$  (1,986 ppb) as a 24-hour average concentration.

## Reference

Cantox Environmental Inc. in conjunction with RWDI West Inc., 2004: *Assessment Report on Hexane for Developing Ambient Air Quality Objectives*. Prepared for Alberta Environment. Edmonton, Alberta, Canada. 101 pp.

U.S. EPA. 2002. A Review of the Reference Dose and Reference Concentration Process. U.S. Environmental Protection Agency, Washington, DC. EPA/630/P-02/002F URL:

