

LC₅₀ and Head Space Vapor

Hazardous waste criteria

Reference:

Title 22 CCR §66261.24(b) 22 CCR

Title 22 CCR §66261.24(a)(5)]

Head Space Vapor Concentration Calculation for waste with compounds that have inhalation LC₅₀s < 10,000 ppm

A waste that contains one or more compounds that have inhalation LC₅₀s < 10,000 ppm may be classified as nonhazardous if:

- does not exhibit any other listed or characteristics of a hazardous waste **and**
- does not contain any concentrations of the compound(s) in a head space vapor that exceed their respective acute inhalation LC₅₀s or LC_{LOS}

In other words, a waste is a hazardous waste if

- it contains a listed hazardous waste **or**
- exhibits a characteristics of a hazardous waste **or**
- it contains a compound concentration in a head space vapor concentration that is greater than its respective acute inhalation LC₅₀s or LC_{LOS}

Extremely hazardous waste criteria

Reference: Title 22 CCR §66261.110(a)(3)

No Head Space Vapor Concentration Calculation

Waste with compounds that have inhalation LC₅₀s < 100 ppm are extremely hazardous waste

A head space vapor analysis is performed according to SW-846 and the quantity of each compound is determined in the head space vapor and reported in milligrams. The concentration of the compound (in ppm) is calculated using the equation:

$$C_A = \frac{Q_A}{MW} \times \frac{29.8 \text{ ml}}{\text{mmole}} \times \frac{1}{2 \times 10^{-6} \text{ M}^3}$$

C_A = the concentration in ppm of the compound (that has a LC₅₀ < 10,000)

Q_A = milligrams of the compound (from laboratory analysis of the head space vapor)

MW = molecular weight of the compound in milligrams per millimole.

When this calculation is completed, the concentration of the compound (C_A) is compared to its respective 8-hour acute inhalation LC_{50} or LC_{LO} . If an 8-hour LC_{50} or LC_{LO} is not available, another time may be used to convert to an 8-hour LC_{50} or LC_{LO} by the equation:

$$8\text{-hour } LC_{50} = \left(\frac{\text{time}}{8} \right) \times (\text{time-hour } LC_{50})$$

Example:

A waste has methyl hydrazine (CH_3NHNH_2). A head space vapor analysis was conducted and the certified laboratory determined that 0.001 mg is present in the head space vapor. The molecular weight of methyl hydrazine is 46.07 milligrams/millimole. To determine the ppm of methyl-hydrazine:

$$C_A = \frac{0.001\text{mg}}{46.07\text{mg/mmole}} \times \frac{29.8\text{ml}}{\text{mmole}} \times \frac{1}{2 \times 10^{-6} \text{M}^3}$$

$$C_A = \frac{0.000021706 \text{ mmole}}{\text{mmole}} \times \frac{29.8\text{ml}}{\text{mmole}} \times \frac{1}{2 \times 10^{-6} \text{M}^3}$$

$$C_A = 323.4 \text{ mL/M}^3 \text{ or ppm}$$

The acute inhalation LC_{50} of methyl hydrazine is reported as 34 ppm when measured by a 4-hour procedure. To convert this number to an 8-hour equivalent:

$$8\text{-hour } LC_{50} = \left(\frac{\text{time}}{8} \right) \times (\text{time-hour } LC_{50})$$

$$8\text{-hour } LC_{50} = \left(\frac{4}{8} \right) \times (34 \text{ ppm})$$

$$8\text{-hour } LC_{50} = 17 \text{ ppm}$$

Conclusion: The waste containing methyl hydrazine is hazardous because its head space contains 323.4 ppm, which is greater than the converted 8-hour inhalation LC_{50} of 17 ppm.