

vapor, mist, or dust which, administered by continuous inhalation for one hour to both male and female young adult albino rats, causes death within 14 days in half of the animals tested. If the material is administered to the animals as a dust or mist, more than 90 percent of the particles available for inhalation in the test must have a diameter of 10 microns or less if it is reasonably foreseeable that such concentrations could be encountered by a human during transport. The result is expressed in mg/L of air for dusts and mists or in mL/m<sup>3</sup> of air (parts per million) for vapors. See § 173.133(b) for LC<sub>50</sub> determination for mixtures and for limit tests.

(i) When provisions of this subchapter require the use of the LC<sub>50</sub> for acute toxicity on inhalation of dusts and mists based on a one-hour exposure and such data is not available, the LC<sub>50</sub> for acute toxicity on inhalation based on a four-hour exposure may be multiplied by four and the product substituted for the one-hour LC<sub>50</sub> for acute toxicity on inhalation.

(ii) When the provisions of this subchapter require the use of the LC<sub>50</sub> for acute toxicity on inhalation of vapors based on a one-hour exposure and such data is not available, the LC<sub>50</sub> for acute toxicity on inhalation based on a four-hour exposure may be multiplied by two and the product substituted for the one-hour LC<sub>50</sub> for acute toxicity on inhalation.

(iii) A solid substance should be tested if at least 10 percent of its total mass is likely to be dust in a respirable range, e.g. the aerodynamic diameter of that particle-fraction is 10 microns or less. A liquid substance should be tested if a mist is likely to be generated in a leakage of the transport containment. In carrying out the test both for solid and liquid substances, more than 90% (by mass) of a specimen prepared for inhalation toxicity testing must be in the respirable range as defined in this paragraph (b)(3)(iii).

(c) For purposes of classifying and assigning packing groups to mixtures possessing oral or dermal toxicity hazards according to the criteria in § 173.133(a)(1), it is necessary to determine the acute LD<sub>50</sub> of the mixture. If a mixture contains more than one ac-

tive constituent, one of the following methods may be used to determine the oral or dermal LD<sub>50</sub> of the mixture:

(1) Obtain reliable acute oral and dermal toxicity data on the actual mixture to be transported;

(2) If reliable, accurate data is not available, classify the formulation according to the most hazardous constituent of the mixture as if that constituent were present in the same concentration as the total concentration of all active constituents; or

(3) If reliable, accurate data is not available, apply the formula:

$$\frac{C_A}{T_A} + \frac{C_B}{T_B} + \frac{C_Z}{T_Z} = \frac{100}{T_M}$$

where:

C = the % concentration of constituent A, B ... Z in the mixture;

T = the oral LD<sub>50</sub> values of constituent A, B ... Z;

T<sub>M</sub> = the oral LD<sub>50</sub> value of the mixture.

NOTE TO FORMULA IN PARAGRAPH (c)(3): This formula also may be used for dermal toxicities provided that this information is available on the same species for all constituents. The use of this formula does not take into account any potentiation or protective phenomena.

(d) The foregoing categories shall not apply if the Associate Administrator has determined that the physical characteristics of the material or its probable hazards to humans as shown by documented experience indicate that the material will not cause serious sickness or death.

[Amdt. 173-224, 55 FR 52634, Dec. 21, 1990, as amended at 56 FR 66268, Dec. 20, 1991; Amdt. 173-234, 58 FR 51532, Oct. 1, 1993; Amdt. 173-261, 62 FR 24732, May 6, 1997; 62 FR 45702, Aug. 28, 1997; 65 FR 58629, Sept. 29, 2000; 66 FR 45379, 45382, Aug. 28, 2001; 69 FR 76155, Dec. 20, 2004; 72 FR 55692, Oct. 1, 2007; 76 FR 43529, July 20, 2011]

**§ 173.133 Assignment of packing group and hazard zones for Division 6.1 materials.**

(a) The packing group of Division 6.1 materials shall be as assigned in column 5 of the § 172.101 table. When the § 172.101 table provides more than one packing group or hazard zone for a hazardous material, the packing group and hazard zone shall be determined by applying the following criteria:

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(1) The packing group assignment for routes of administration other than in-  
halation of vapors shall be in accordance with the following table:

Packing group	Oral toxicity LD <sub>50</sub> (mg/kg)	Dermal toxicity LD <sub>50</sub> (mg/kg)	Inhalation toxicity by dusts and mists LC <sub>50</sub> (mg/L)
I .....	≤5.0 .....	≤50	≤0.2
II .....	>5.0 and ≤50 .....	>50 and ≤200	>0.2 and ≤2.0
III .....	>50 and ≤300 .....	>200 and ≤1000	>2.0 and ≤4.0

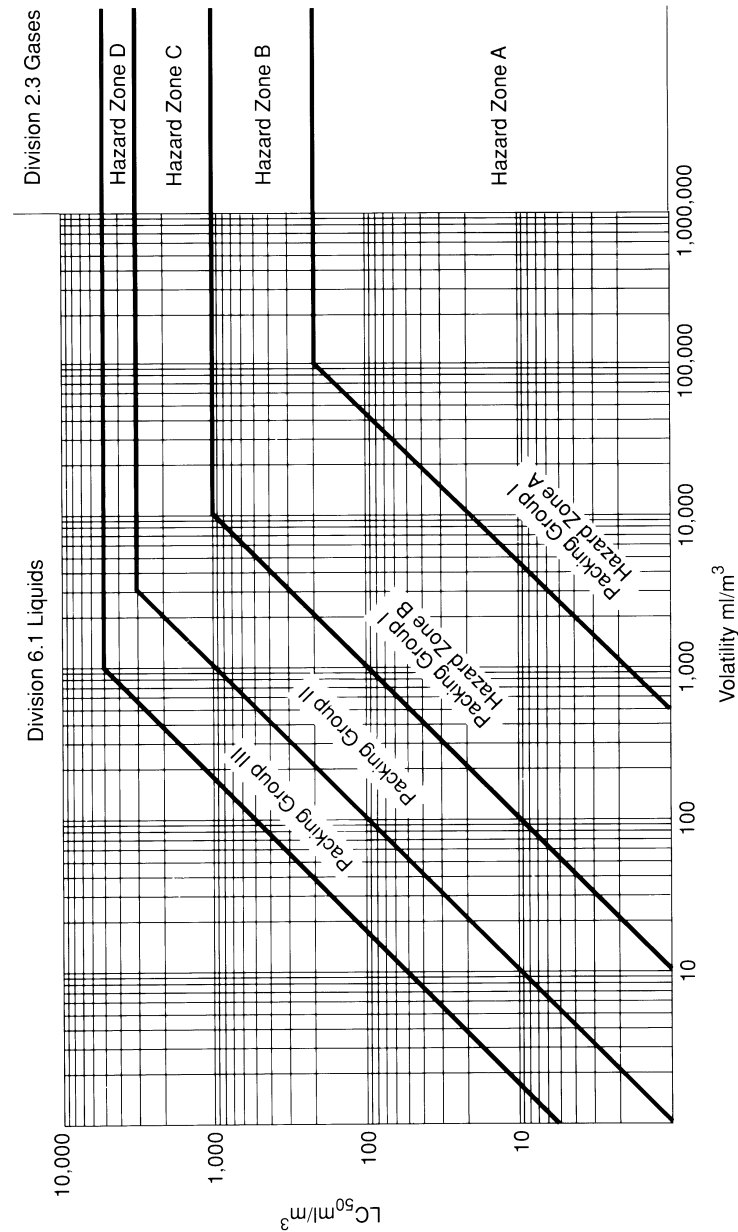
(2)(i) The packing group and hazard zone assignments for liquids (see §173.115(c) of this subpart for gases) based on inhalation of vapors shall be in accordance with the following table:

Packing Group	Vapor concentration and toxicity
I (Hazard Zone A) .....	V ≥500 LC <sub>50</sub> and LC <sub>50</sub> ≤200 mL/M <sup>3</sup> .
I (Hazard Zone B) .....	V ≥10 LC <sub>50</sub> ; LC <sub>50</sub> ≤1000 mL/m <sup>3</sup> ; and the criteria for Packing Group I, Hazard Zone A are not met.
II .....	V ≥LC <sub>50</sub> ; LC <sub>50</sub> ≤3000 mL/m <sup>3</sup> ; and the criteria for Packing Group I, are not met.
III .....	V ≥.2 LC <sub>50</sub> ; LC <sub>50</sub> ≤5000 mL/m <sup>3</sup> ; and the criteria for Packing Groups I and II, are not met.

NOTE 1: V is the saturated vapor concentration in air of the material in mL/m<sup>3</sup> at 20 °C and standard atmospheric pressure.  
NOTE 2: A liquid in Division 6.1 meeting criteria for Packing Group I, Hazard Zones A or B stated in paragraph (a)(2) of this section is a material poisonous by inhalation subject to the additional hazard communication requirements in §§ 172.203(m), 172.313 and table 1 of § 172.504(e) of this subchapter.

(ii) These criteria are represented graphically in Figure 1:

**Figure 1**  
**Inhalation Toxicity: Packing Group and**  
**Hazard Zone Borderlines**



(3) When the packing group determined by applying these criteria is different for two or more (oral, dermal or inhalation) routes of administration,

the packing group assigned to the material shall be that indicated for the highest degree of toxicity for any of the routes of administration.

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(4) Notwithstanding the provisions of this paragraph, the packing group and hazard zone of a tear gas substance is as assigned in column 5 of the §172.101 table.

(b) The packing group and hazard zone for Division 6.1 mixtures that are poisonous (toxic) by inhalation may be determined by one of the following methods:

(1) Where  $LC_{50}$  data is available on each of the poisonous (toxic) substances comprising the mixture—

(i) The  $LC_{50}$  of the mixture is estimated using the formula:

$$LC_{50}(\text{mixture}) = \frac{1}{\sum_{i=1}^n \frac{f_i}{LC_{50i}}}$$

where

$f_i$  = mole fraction of the  $i^{\text{th}}$  component substance of the liquid.

$LC_{50i}$  = mean lethal concentration of the  $i^{\text{th}}$  component substance in mL/m<sup>3</sup>

(ii) The volatility of each component substance is estimated using the formula:

$$V_i = P_i \times \frac{10^6}{101.3} \text{ mL/m}^3$$

where:

$P_i$  = partial pressure of the  $i^{\text{th}}$  component substance in kPa at 20 °C and one atmospheric pressure.  $P_i$  may be calculated according to Raoult's Law using appropriate activity coefficients. Where activity coefficients are not available, the coefficient may be assumed to be 1.0.

(iii) The ratio of the volatility to the  $LC_{50}$  is calculated using the formula:

$$R = \sum_{i=1}^n \frac{V_i}{LC_{50i}}$$

(iv) Using the calculated values  $LC_{50}$  (mixture) and  $R$ , the packing group for the mixture is determined as follows:

Packaging group (hazard zone)	Ratio of volatility and $LC_{50}$
I (Hazard Zone A) ..	$R \geq 500$ and $LC_{50}(\text{mixture}) \leq 200 \text{ mL/m}^3$ .
I (Hazard Zone B) ..	$R \geq 10$ and $LC_{50}(\text{mixture}) \leq 1000 \text{ mL/m}^3$ ; and the criteria for Packing Group I, Hazard Zone A are not met.
II .....	$R \geq 1$ and $LC_{50}(\text{mixture}) \leq 3000 \text{ mL/m}^3$ ; and the criteria for Packing Group I, Hazard Zones A and B are not met.

Packaging group (hazard zone)	Ratio of volatility and $LC_{50}$
III .....	$R \geq 1/5$ and $LC_{50}(\text{mixture}) \leq 5000 \text{ mL/m}^3$ ; and the criteria for Packing Group I, Hazard Zones A and B and Packing Group II are not met.

(2) In the absence of  $LC_{50}$  data on the poisonous (toxic) constituent substances, the mixture may be assigned a packing group and hazard zone based on the following simplified threshold toxicity tests. When these threshold tests are used, the most restrictive packing group and hazard zone must be determined and used for the transportation of the mixture.

(i) A mixture is assigned to Packing Group I, Hazard Zone A only if both the following criteria are met:

(A) A sample of the liquid mixture is vaporized and diluted with air to create a test atmosphere of 200 mL/m<sup>3</sup> vaporized mixture in air. Ten albino rats (five male and five female) are exposed to the test atmosphere as determined by an analytical method appropriate for the material being classified for one hour and observed for fourteen days. If five or more of the animals die within the fourteen-day observation period, the mixture is presumed to have an  $LC_{50}$  equal to or less than 200 mL/m<sup>3</sup>.

(B) A sample of the vapor in equilibrium with the liquid mixture is diluted with 499 equal volumes of air to form a test atmosphere. Ten albino rats (five male and five female) are exposed to the test atmosphere for one hour and observed for fourteen days. If five or more of the animals die within the fourteen-day observation period, the mixture is presumed to have a volatility equal to or greater than 500 times the mixture  $LC_{50}$ .

(ii) A mixture is assigned to Packing Group I, Hazard Zone B only if both the following criteria are met, and the mixture does not meet the criteria for Packing Group I, Hazard Zone A:

(A) A sample of the liquid mixture is vaporized and diluted with air to create a test atmosphere of 1000 mL/m<sup>3</sup> vaporized mixture in air. Ten albino rats (five male and five female) are exposed to the test atmosphere for one hour and observed for fourteen days. If five or more of the animals die within the fourteen-day observation period, the

mixture is presumed to have an  $LC_{50}$  equal to or less than  $1000 \text{ mL/m}^3$ .

(B) A sample of the vapor in equilibrium with the liquid mixture is diluted with 9 equal volumes of air to form a test atmosphere. Ten albino rats (five male and five female) are exposed to the test atmosphere for one hour and observed for fourteen days. If five or more of the animals die within the fourteen-day observation period, the mixture is presumed to have a volatility equal to or greater than 10 times the mixture  $LC_{50}$ .

(iii) A mixture is assigned to Packing Group II only if both the following criteria are met, and the mixture does not meet the criteria for Packing Group I (Hazard Zones A or B):

(A) A sample of the liquid mixture is vaporized and diluted with air to create a test atmosphere of  $3000 \text{ mL/m}^3$  vaporized mixture in air. Ten albino rats (five male and five female) are exposed to the test atmosphere for one hour and observed for fourteen days. If five or more of the animals die within the fourteen-day observation period, the mixture is presumed to have an  $LC_{50}$  equal to or less than  $3000 \text{ mL/m}^3$ .

(B) A sample of the vapor in equilibrium with the liquid mixture is used to form a test atmosphere. Ten albino rats (five male and five female) are exposed to the test atmosphere for one hour and observed for fourteen days. If five or more of the animals die within the fourteen-day observation period, the mixture is presumed to have a volatility equal to or greater than the mixture  $LC_{50}$ .

(iv) A mixture is assigned to Packing Group III only if both the following criteria are met, and the mixture does not meet the criteria for Packing Groups I (Hazard Zones A or B) or Packing Group II (Hazard Zone C):

(A) A sample of the liquid mixture is vaporized and diluted with air to create a test atmosphere of  $5000 \text{ mL/m}^3$  vaporized mixture in air. Ten albino rats (five male and five female) are exposed to the test atmosphere for one hour and observed for fourteen days. If five or more of the animals die within the fourteen-day observation period, the mixture is presumed to have an  $LC_{50}$  equal to or less than  $5000 \text{ mL/m}^3$ .

(B) The vapor pressure of the liquid mixture is measured and if the vapor concentration is equal to or greater than  $1000 \text{ mL/m}^3$ , the mixture is presumed to have a volatility equal to or greater than  $\frac{1}{5}$  the mixture  $LC_{50}$ .

(c) *Transitional provisions.* The criteria for packing group assignments in effect on December 31, 2006, may continue to be used until January 1, 2012.

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#### § 173.134 Class 6, Division 6.2—Definitions and exceptions.

(a) *Definitions and classification criteria.* For the purposes of this subchapter, the following definitions and classification criteria apply to Division 6.2 materials.

(1) *Division 6.2 (Infectious substance)* means a material known or reasonably expected to contain a pathogen. A pathogen is a microorganism (including bacteria, viruses, parasites, and fungi) or other agent, such as a proteinaceous infectious particle (prion) that can cause disease in humans or animals. An infectious substance must be assigned the identification number UN2814, UN2900, UN3291, UN3373, or UN3549 as appropriate, and must be assigned to one of the following categories:

(i) *Category A:* An infectious substance in a form capable of causing permanent disability or life-threatening or fatal disease in otherwise healthy humans or animals when exposure to it occurs. An exposure occurs when an infectious substance is released outside of its protective packaging, resulting in physical contact with humans or animals. A Category A infectious substance must be assigned to identification number UN2814, UN2900, or UN3549, as appropriate. Assignment to UN2814, UN2900, or UN3549 must be based on the known medical