

IACUC Policy

on

Ether and Chloroform Use

ASC Policy:

The use of ether or chloroform for animal anesthesia or euthanasia is prohibited.

Background:

Ether and chloroform are obsolete anesthetic agents that are no longer used in human or companion animal medicine. Superior inhalant agents (such as isoflurane and sevoflurane) or suitable parenteral agents are recommended for use in research animals.

Ether (ethyl ether, diethyl ether, CAS # 60-29-7) is highly explosive and presents a hazard even when stored and used properly. Ether is highly irritating to mucous membranes throughout the airways. Administration of ether is stressful to animals and stimulates catecholamine release. Some reports also indicate stimulation of the pituitary-adrenal axis during anesthetic induction using ether in rats. Respiratory problems caused by secretion of fluid in the lungs and bronchial passages in response to ether may be fatal in small rodents. The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for ether is 400 ppm (1200 milligrams per cubic meter (mg/m^3)) as a ceiling limit.

Chloroform (trichloromethane, CAS #67-66-3) is a severe cardiovascular depressant and a potent hepatotoxin, causing both liver toxicity and neoplasia. The current OSHA permissible exposure limit (PEL) for chloroform is 50 ppm (240 milligrams per cubic meter (mg/m^3)) as a ceiling limit. A worker's exposure to chloroform must not exceed this ceiling level. The 50 ppm PEL of chloroform is the same PEL as the OSHA limit for carbon monoxide exposure.

Guidelines:

See other institutional guidelines for animal anesthesia and euthanasia. A comparison of inhalant anesthetic agents and ether follows.

| Agent | Vapor pressure mmHg (Torr) at 20°C | Max. % in air | Useable range | Blood-gas solubility at 37°C ^a | Rat/mouse MAC ^b (%) |
|------------------|------------------------------------|---------------|---------------|---|--------------------------------|
| Ether | 450 | 59 % | 0 - 15 % | 15 ^c | 3.2 |
| Halothane* | 243 | 33 % | 0 - 4 % | 2.3 | 0.92 - 1.1 |
| Methoxyflurane** | 23 | 3 % | 0 - 3 % | 12.0 | 0.22 |
| Isoflurane | 250 | 31 % | 0 - 5 % | 1.4 | 1.4 |
| Sevoflurane | 157 | 21% | 0 – 8 % | 0.86 | 2.6 |

* No longer manufactured as of 2005. Non-expired supplies may continue to be used.

** No longer manufactured as of March 1999.

^a Ratio of the concentration of the agent in blood divided by the concentration of the agent in alveolar spaces (lung) at equilibrium. This ratio is also known as the partition coefficient. The blood-gas coefficient is a useful indicator of the **speed of anesthetic induction** (the **lower** the coefficient, the **faster** the induction).

^b Minimum alveolar concentration (MAC) is that anesthetic concentration required to prevent gross muscular movement in response to a painful stimulus in 50% of a tested population. It is a useful standard for comparing the **potency** of inhalation anesthetics. The MAC may be considered the effective dose-50% (ED₅₀). The alveolar concentration of an anesthetic needed to achieve surgical anesthesia must be equal to or greater than MAC.

^c Observations of “rapid induction” with ether are not supported by the blood-gas coefficient (15) for this compound. There are other possible explanations for rapid onset of unconsciousness in animals exposed to ether. Breath-holding, which has been well documented during anesthetic induction with ether, may cause unconsciousness in animals due to hypoxia. When ether is inhaled at high concentrations (i.e., in an open drop system), paralysis of the respiratory centers may also cause hypoxia and unconsciousness.

Citation of Applicable Regulation(s):

Section 2.33 Attending veterinarian and adequate veterinary care.

(b) Each **research facility shall establish and maintain** programs of **adequate veterinary care** that include:

(4) **Guidance** to principal investigators and other personnel involved in the care and use of animals regarding handling, immobilization, anesthesia, analgesia, tranquilization, and euthanasia;

Animal Welfare Act. 7 U.S.C. 2131 *et seq.*