

Guidance for the Control and Monitoring of Waste Anesthetic Gases in Animal Research

I. Background

Many animal research procedures involve the use of the anesthetic gases. Isoflurane for example is an anesthetic gas commonly used in animals and humans to achieve a reliable plane of anesthesia that is quickly reversed and is considered safe with few side effects. Other anesthetic gases are also used in animal research such as sevoflurane and enflurane. These products replaced the use of halothane which had negative side effects.

Waste anesthetic gases are considered a potential reproductive hazard. Long term exposure to waste anesthetic gases has been associated with adverse reproductive outcomes in women and spouses of men exposed to anesthetic gasses. Other adverse effects associated with anesthetic gases include liver and central nervous system impacts. Some anesthetic gases have specific workplace exposure limits such as for halothane (50 ppm) and enflurane (75 ppm). However, other anesthetic agents do not have specific national guidelines. The national Occupational Safety and Health Administration (OSHA) does not currently have permissible exposure limits regulating isoflurane and other inhaled anesthetic agents; however, the California Division of Occupational Safety and Health (CAL/OSHA) has recently institute a Permissible Exposure Level (PEL) of 2 ppm averaged over an 8-hr. Time Weighted Average (TWA). Isoflurane PELs vary between countries. Countries with isoflurane PELs are noted below for reference:

Country/Organization	8-hr TWA (ppm)
ACGIH	50
CAL-OSHA	2
Denmark	5
Finland	10
Ireland	50
Netherlands	20
Norway	2
Spain	50
Sweden	10
Switzerland	10
United Kingdom	50

II. *Recommendations*

The UW Environmental & Occupational Health Program recommends waste anesthetic gas exposure levels be kept as low as reasonably achievable and when possible below the 2 ppm level. Personnel who are considered higher risk (pregnant or planning pregnancy) do not have a recommended exposure level due to uncertainty associated with safe levels of exposure for the fetus. Staff should make a determination on the level of precaution to be taken based on consultation with their personal physician, Environmental & Occupational Health Unit and/or UW Occupational Medicine staff.

III. *Procedure:*

- A. The Environmental & Occupational Health (EOH) Unit periodically surveys representative vivariums in which isoflurane is utilized. EOH staff will consult with veterinarians, veterinary technicians, and PI's to select which rooms and/or procedures will be monitored. Facility surveys are also performed at investigator, veterinary, IACUC or EOH request.
- B. A written report will be sent to the principle investigator or lab manager.
- C. If the anesthetic gas machine is past the calibration due date or the charcoal scavenger weight indicates it is saturated, the sampling will not be done until the anesthetic gas machine meets these requirements. Scavenging devices should be installed and used as the manufacturer recommends. A new weight tracking sheet should be used each time a new charcoal canister is used. Weight tracking sheets must be maintained and should be easily accessible to users.
- D. When waste anesthetic gas concentrations are found to be above 2 ppm or are above specific national exposure guidelines, engineering controls will be evaluated. If it is determined that reasonably available controls can further reduce exposure levels, a corrective action request will be submitted to the person in charge of the facility. The EOH Unit shall work with persons in charge to find a cost-effective means of reducing exposure using readily available technologies or products. If the exposure is not effectively reduced in a reasonable period of time, EOH shall bring the issue to the appropriate unit director for resolution.
- E. If individual personal sampling isoflurane concentrations above 2 ppm are recorded or are above specific national exposure guidelines, results will be communicated to employees within 5 working days of EOH receiving results. Where exposure results are above 2 ppm, the employee shall be given the option to wear a respirator and enroll in a respiratory protection program to further reduce exposure until engineering controls are instituted.
- F. Staff who are or may be pregnant should be advised about the uncertainty regarding health effects associated with waste anesthetic gases and the benefits and

limitations of respirator use. The decision of what level of exposure to accept during pregnancy is a personal one and should be made in consultation with the employee's personal physician. The Environment & Occupational Health Unit can provide further consultation including workplace exposure monitoring, respiratory protection support and referral to occupational medicine consultation.

IV. Prohibition of Open Bench Work

Use of anesthetic gases on an open bench shall not occur without the use of properly maintained scavenging equipment or local exhaust. Even with use of this equipment, exposure may exceed 2 ppm at times. Use of a respirator should be considered in these situations where further reduction in exposure is desired.

V. New Lab Design

Where lab space is being designed that may involve the use of anesthetic gases, capacity shall be provided for adding local exhaust.

VI. Related Documents

- A. Waste Anesthetic Gas (WAG) Scavenging System Guidance