SAN DIEGO STATE UNIVERSITY

IACUC Guidelines

Volatile Anesthetic Use and Appropriate Scavenging

IACUC approved: 06/12/17

PURPOSE/BACKGROUND

This Standard Operating Procedure (SOP) is to ensure the proper scavenging of volatile (inhalation) anesthetics. This document is relevant to all investigators, technicians, and animal care staff using inhalation anesthetics for anesthesia of their research animals, with or without a precision vaporizer.

SAFETY

Standard

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) both have established recommended maximum limits for personnel exposed to waste anesthetic gases to be 2ppm over any 1 hour period. If you can smell isoflurane, then levels are above acceptable thresholds.

Health Effects

Overexposure to anesthetic gases can result in toxicity to humans. Some potential acute effects of exposure to waste anesthetic gas are nausea, dizziness, headaches, fatigue, and irritability. More serious potential long-term exposure in those with frequent workplace use of anesthetics include liver and kidney disease, cancer, sterility, miscarriages, and birth defects in offspring. Although modern agents such as isoflurane pose less of a risk of toxicity than some of the agents used historically, it is still necessary to minimize human exposure when working with anesthetic gases. Employers and employees should be aware of these potential health effects and be advised to take appropriate precautions.

Pregnancy and Anesthetic Agents

Women of childbearing age should be aware that, although the risks are not completely understood, exposure to anesthetic gases such as halothane and isoflurane may pose risks to a developing fetus and therefore exposure during pregnancy is not recommended. For more information, contact EHS at (619) 594-2865.

DEFINITIONS

Volatile (inhalation) anesthetic - liquid chemical anesthetic that readily vaporizes into the atmosphere and takes effect when inhaled by the subject to be anesthetized. Examples include

isoflurane, sevoflurane, etc.

Precision vaporizer - an apparatus designed specifically to provide controlled vaporization of a volatile anesthetic in order to safely deliver effective doses of the anesthetic to the subject to be anesthetized.

Open drop technique - a procedure for anesthetizing or euthanizing subjects with a volatile anesthetic that involves placement of the volatile anesthetic into an absorbent material (e.g. – cotton balls, e.g., gauze), with the anesthetic soaked material present within a chamber into which the subject is also placed. This must always be done in a chemical fume hood with measures that prevent the direct contact of the anesthesia subject with the liquid anesthetic or liquid anesthetic-soaked absorbent material. Note: While this method is appropriate for anesthesia with methoxyflurane (metaphane), it is not intended for controlled anesthesia with certain volatile anesthetics such as isoflurane as it will vaporize to lethal levels when administered in this fashion. However the use of this technique with isoflurane is an approved method of euthanasia by the AVMA panel on euthanasia.

MATERIALS

Volatile gas anesthetic scavenging charcoal canisters
Chemical fume hood

PROCEDURE - Use of charcoal canisters for scavenging volatile anesthetics used with a precision vaporizer

1. Charcoal canisters are designed for the removal of excess volatile anesthetic (e.g., isoflurane) gas wastes associated with inhalation anesthetic machines. These canisters have a finite volume of anesthetic gas that they can absorb, beyond which they are non-functional. Consequently, the canister use should be appropriately weighed and recorded and the canisters replaced as necessary to prevent user exposure to anesthetic that might otherwise escape into the working space.
    1.1 Various commercial canisters are available, e.g., F/air, VaporGuard
2. The life use of charcoal canisters is considered an increase in weight of 50 grams. The preferred method for documenting use is regular weighing of the canister and this method should be employed throughout the life of the canister.
3. Any canister in an animal procedure area, in a surgery area or associated with an anesthesia machine is considered “in use” and should be weighed and labeled accordingly. Canisters not in use should be stored in a separate area so that there is no confusion as to which canisters are being actively used.
4. Upon receipt each canister is weighed and the starting weight prior to any use is recorded on the canister in the area provided (scales are located in the procedure areas).
5. Each individual lab is responsible for purchasing and maintaining their own scavenging canisters. As such, upon receipt each canister should also be labeled with the PI name written in permanent marker on the canister so it is clear who has primary responsibility for maintaining and monitoring the canister.
6. Any OLAC maintained scavenging canisters will be weighed and labeled as described above with the word “OLAC” written on the canister in permanent marker.
7. The F/air canisters have the ventilation holes on the bottom such that the canisters should

be elevated or placed on their sides so as not to block the holes and thus allow for free gas flow through the canisters, whereas the VaporGuard canisters have the holes on the top and can be set upright when in use.

8. Prior to inhalation anesthesia being used, the canister should be weighed and the weight recorded on the canister in the space provided. The most recent weight should be compared with the recorded starting weight.
9. When the increase in canister weight approaches 50 grams the canister should be replaced. Dispose canisters through EHS.
10. When the procedure is complete weigh the canister and record the weight and date on the side of the charcoal canister. The canister must not have gained more than 50 grams from the initial weight as recorded on the canister. Replace canister if necessary. Dispose canister through EHS.

PROCEDURE - Volatile gas anesthesia inside a chemical fume hood

As an alternative to use of charcoal canisters for scavenging anesthetic gases during use with a precision vaporizer, the whole precision vaporizer, assorted gas lines, and the anesthesia subject as well, all can be placed in, and worked with in, a chemical fume hood.

PROCEDURE - Volatile anesthetic scavenging during use of open drop technique

1. Though use of a precision vaporizer is the preferred technique for use of volatile anesthetics, occasionally people use volatile anesthetics in an open drop method, with the anesthetic placed in absorbent material within a sealed container, into which the animal is placed in a way that protects it from direct contact with the anesthetic liquid or soaked material.
2. Such use should only be carried out in a way that prevents operator exposure to the gas as well. This must be done in a chemical fume hood.
3. If a chemical fume hood is not available, the principle investigator should contact the Environmental Health and Safety department in order to have their use of the volatile anesthetic reviewed to assure operator safety.

EXPOSURE MONITORING

EHS can perform air monitoring to determine anesthetic gas concentration in the work area. Two types of monitoring can be performed: personal and area. Personal monitoring is conducted at the employee's breathing zone to determine anesthetic gas exposure for the employee. The monitoring is performed using a 3M Organic Vapor Diffusion Monitor and analyzed by the 3M Company. Area monitoring is conducted in the work area to determine anesthetic gas exposure in work areas. Comprehensive leak testing on the equipment to determine if gas is escaping from various locations in the machine shall be performed by a qualified contractor. Preventive maintenance should be performed by trained individuals according to the manufacturer's recommendations and at intervals determined by equipment history and frequency of use.

Monitoring environmental concentration of anesthetic gases determines effectiveness of the waste gas control program and aids in identifying sources of leaks.

EHS shall report the results of anesthetic gas monitoring to the person(s) monitored within fifteen calendar days of the date on which the area supervisor receives the results. If the threshold limit value has been exceeded, the Principal Investigator or lab manager should refer to this document to review and implement any of the applicable control measures which may help reduce the exposure to anesthetic gases. The affected employees should be notified of any corrective action taken.

MEDICAL SURVEILLANCE

Individuals working with anesthetic gas will complete an Occupational Health and Safety Risk Assessment Form and indicate their potential exposure to halogenated anesthetics as part of Medical Surveillance.

EMERGENCY SPILL RESPONSE

- Small volumes of liquid anesthetic agents, such as isoflurane, evaporate readily at normal room temperature, and may dissipate before any attempts to clean up or collect the liquid are initiated.
- In the event a spill of any volume, laboratory personnel are to vacate the room immediately and are to secure the room from general access by closing all doors leading to the spill area. The spill is to be reported to EHS x46778. Campus spill response representatives will respond to the scene to further evaluate the release and determine when the area is safe for re-entry.

EMERGENCY EXPOSURE

Refer to Safety Data Sheet

WASTE DISPOSAL

Containers of expired or unused liquid anesthetic agents and spent waste anesthetic gas canisters must be properly labeled with a hazardous waste sticker and disposed through the EHS Hazardous Waste Program by contacting x46778 for proper disposal.

RECORD KEEPING

Maintenance logs of inspection, service, testing, and calibration should be kept for each anesthetic machine, vaporizer, and ventilator. Information that must be maintained includes:

- Date of last service and calibration
- Initials of the person who performed the service and calibration
- Service and calibration results

Documentation of service and calibration must be affixed to each anesthesia machine or vaporizer that is available for use.