Guidelines for Safe Anesthetic Use
The University of Texas at Austin
Institutional Animal Care and Use Committee (IACUC)

These guidelines have been written to assist faculty, staff, and students in performing vertebrate animal procedures in a humane manner and complying with pertinent regulatory requirements. Under some circumstances deviations from these procedures may be indicated but such variances must be approved in advance by the IACUC.

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This document provides information to be used when planning and performing procedures using anesthesia in vertebrate animals used for research, teaching, or other purposes at The University of Texas at Austin. It is organized into five sections:

Section A – Proper Scavenging
Section B – Safe Working Practices
Section C – Requirements
Section D – Resources
Section E – Acknowledgements

Exposure to anesthetic gases can result in toxicity to humans. Some potential effects of exposure to waste (exhaled) anesthetic gases are nausea, dizziness, headaches, fatigue, and irritability. More serious potential sequelae of 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.

Section A – Proper Scavenging

Because there will always be anesthetic gases present in the waste air exhaled by the animal, it is absolutely necessary to use anesthetics in a setting that includes some mechanism for removing toxic components from the air stream or venting the exhaled air safely out of the room. This process is called "scavenging" and there are two main options:

1. **Active scavenging**

   This is the preferred method, and it involves using low-pressure highflow ventilation to create a suction that captures contaminated air and safely discharges it from the room and the building.

   The simplest form of active scavenging is to actually deliver the anesthetic to the animal while it is placed within a properly functioning fume hood. The fume hood will evacuate all exhaled gases and discharge them from the roof of the building. Similar functionality can be obtained by working on a downdraft table approved for hazardous gas/vapor use.

   Many operating rooms are designed to provide active scavenging by including small wall ports that serve as local exhaust connections for the exhaust tubing coming from an anesthetic machine. In a research lab, a similar approach can be taken by running the exhaust hoses from the anesthesia machine into a fume hood and having

them discharge within the hood.

Active scavenging can be provided in areas that do not have access to a fume hood or to scavenger ports by installing a small specially-designed scavenging device that acts as an intermediate blower which connects the exhaust lines from the anesthesia machine to the exhaust ducts or another conduit which exits the building directly.

NOTE: When connections are made from an anesthesia machine to any active scavenging system, it is important to consult with the ARC veterinary staff and the Office of Environmental Health and Safety (EHS) to assure appropriate design. Improper use could cause impaired function of the anesthesia machine or inappropriate routing of toxic gases within the building ventilation or vacuum system.

2. **Passive scavenging**

This method is less foolproof than active scavenging, but when done properly it will protect workers from gas exposure. Passive scavenging relies on the positive pressure from the anesthetic gas delivery system and/or the exhalation effort of the animal to drive contaminated exhaled air through a specially designed activated charcoal filter, which will adsorb and remove the halogenated hydrocarbon anesthetic agent molecules before the air is discharged back into the room. As is the case with any filter cartridge, excessive flow through the filter can result in decreased performance, so gas flows should be set to the lowest rate that will allow adequate ventilation of the animal and proper function of the vaporizer. In addition, the absorptive capacity of the cartridge will eventually be exhausted, which will result in filter failure and the discharge of toxic gases into the room. To prevent this occurrence, manufacturers provide an estimate of the safe loading capacity of the filter expressed in grams. In use, the cartridge must be weighed frequently to assess the degree of loading that has occurred and discarded when the weight increase reaches the threshold provided.

Section B – Safe Working Practices

Even when proper scavenging is in place, personnel exposure can occur if the equipment is not in good working condition or is not properly adjusted. Careful handling of the anesthetic in liquid form is also very important. Common causes of inadvertent exposure include:

- Leaks from gas supply lines and connections
- Leaks within the anesthesia machine and breathing system
- Leaks between subject and facemask
- Leaks from around the tracheal tubing
- Spills of liquid anesthetics

Section C – Requirements

1. All anesthetic equipment and scavenging devices must be maintained according to the manufacturers recommendations.

2. Anesthetic vaporizers are examples of precision equipment that require routine servicing and calibration by professionally-trained service technicians to assure both human and animal safety. Unless specific manufacturer recommendations to the contrary are available, all vaporizers must be serviced on an annual basis. Recommendations for service vendors and information on group scheduling of maintenance (which may have some cost or convenience benefits) can be obtained from the veterinary group.

3. Adequate scavenging (either active or passive) must be in place any time anesthetic gases are used.

4. When charcoal canisters are used for passive scavenging, documentation of routine weight monitoring for loading must be maintained in the laboratory.

5. All personnel must be properly trained in the safe and effective use of anesthetic gases. Careful attention must be given to eliminate leaks and spills.

6. Equipment that involves direct animal contact (anesthetic masks, nose cones, induction chambers, scales, and balance baskets) must be inspected, cleaned and disinfected before and after use to ensure a proper fit and working condition and to prevent microbial cross-contamination.

Section D – Resources

Training in proper anesthetic and animal handling techniques and methods for pressure-testing anesthetic machines for leaks are available from the Animal Resources Center (ARC).

Questions or concerns about gas exposure, proper handling and disposal of anesthetic liquids, or other safety components should be directed to Environmental Health and Safety (EHS).

Section E – Acknowledgements

This document contains content that was adapted from materials obtained from Stanford University.