

Anesthetic Gases in Animal Research

Standard Operating Procedure

Revision Date: 06/17/22

Description [Provide additional information as it pertains to your research protocol]

This standard operating procedure (SOP) outlines the handling and use of anesthetic gases in animal research, including: isoflurane, halothane, enflurane, ether, and nitrous oxide. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls and personal protective equipment when handling animal anesthetic gases. All laboratory workers must read and understand the [Laboratory Emergencies SOP](#) prior to commencing any work in a laboratory.

Process [Write the steps for using the chemical in your research protocol]

Procedure Location [Provide additional information as it pertains to your research protocol]

The use of animal anesthetic gases must be performed in an area with good ventilation and controls to capture and exhaust waste anesthetic gases.

Potential Hazards [Provide additional information as it pertains to your research protocol]

Anesthetic gas and vapor that leaks during medical or research procedures are considered waste anesthetic gases (WAG). University faculty, staff and students should be aware of the potential risks of WAG and are advised to take appropriate precautions to reduce exposures. Workers acutely exposed to excessive amounts of WAG can experience symptoms of drowsiness, headache, nausea, poor judgment and loss of coordination. Chronic symptoms of over-exposure can include liver, kidney and reproductive effects. Safety precautions include the use of an approved gas scavenging system, or using the agent inside a certified chemical fume hood.

The use of ether is not recommended because it is flammable and a mutagen. Be certain that there are no ignition sources present when handling ether. There are restrictions concerning the use of ether with animals. Contact Environment, Health & Safety (EHS) at (734) 647-1143 concerning the use of ether.

Engineering Controls [Provide additional information as it pertains to your research protocol]

Chemical fume hoods provide the best protection against exposure to WAG and are the preferred engineering controls when using anesthetic gases.

Another form of engineering control is a scavenging system, which collects WAG that may leak during procedures. There are two types of scavenging systems: active and passive.

- Active scavenging (preferred): suction is applied to draw WAG away from personnel to a fume hood, snorkel exhaust, or other vacuum system, such that it is either captured by an activated charcoal filter (e.g., F/Air canister) or exhausted outside the building without recirculation.
 - If the house vacuum system is used to scavenge, EHS must be consulted to ensure the ventilation system is adequate for removal of WAG.
- Passive scavenging: the animal's exhaled air is directed through non-mechanically assisted means to an activated charcoal filter (e.g., F/Air canister). While active scavenging systems are preferred, passive scavenging may be appropriate in situations where there is limited space or other constraints.

Charcoal canisters must always be positioned upright and in such a manner that the exhaust ports are not blocked. Canisters should be placed below the level of the anesthetic gas vaporizer machine so that the heaviness of the waste gases is exploited. Immediately before using any vaporizer machine, the charcoal canister should be weighed to evaluate the remaining adsorption capacity. Record the date and weight on the side of the canister. Immediately following use, weigh the canister again and record the number of hours the canister was used next to the dated weight information. Canisters that exceed the manufacturer's recommended hours of use or accumulated weight (whichever comes first) must be removed and placed in a sealed plastic bag and disposed of as a hazardous waste through EHS Hazardous Materials Management (HMM) at (734) 763-4568.

Anesthetic gases should not be used for procedures without a scavenging system. In particular, the "open-drop jar" method without scavenging poses a high risk of exposure to WAG. EHS must be consulted to conduct a risk assessment and ensure personnel are not exposed to levels of WAG above recommended limits. When EHS has approved the use of isoflurane without scavenging, a letter will be issued to the PI and must be maintained with the laboratory's Chemical Hygiene Plan binder or another easily accessible location. The letter must be made available to IACUC inspectors upon request.

Special notes:

- Always handle ethyl ether in a chemical fume hood due to the flammable nature of the material. If your research does not permit the handling of ethyl ether in your fume hood, contact EHS to review the adequacy of all special ventilation.
- Activated charcoal filters do not effectively adsorb nitrous oxide vapors. Always use an active scavenging system with nitrous oxide.

Work Practice Controls [Provide additional information as it pertains to your research protocol]

All anesthetic agents must be clearly labeled with the full chemical name. Handwritten labels are acceptable; however, chemical formulas, structural formulas, or abbreviations are not acceptable.

Do not permit containers to remain open on the bench top. The odor thresholds for most liquid anesthetics (except for ether) are well above permissible exposure limits. If you smell the anesthetic, the control procedures you are using are inadequate and must be re-evaluated.

Always keep the flow rate of anesthetics to the animal as low as possible during the procedure. High flow rates can increase your exposure to the anesthetic. It is also important to move the point of potential gas release as close to the exhaust system as possible to increase capture of the chemical.

There are a variety of pathways for the gas to travel besides through the filter, which has a relatively high flow resistance. WAG can leak, particularly around the animal facemask or nosecone as well as when opening and closing induction chambers. It is important to attempt to seal all leaks to ensure there is a tight fit around the animal's nose and to flush out the induction chamber with oxygen for 10 seconds prior to unsealing the lid and retrieving the anesthetized animal. Quickly replace the lid of the chamber, and continue to run oxygen through the chamber for several minutes to help purge the WAG into the scavenger. Thoroughly clean the induction chamber immediately after each use to avoid residual WAG release into the environment (which can continue to be released for up to three hours).

The National Institute for Occupational Safety and Health (NIOSH) has a recommended exposure limit (REL) for halogenated anesthetic gases of 2 ppm as a ceiling limit (average over 1 hour). This may be below the human odor detection limit for isoflurane, so if you can smell it, the exposure level is too high. Contact EHS at (734) 647-1143 to assess your surgical suite or work space to determine any risks of over exposure to WAG. EHS can also provide exposure monitoring to determine whether a worker may be over exposed to WAG.

Personal Protective Equipment [Provide additional information as it pertains to your research protocol]

Eye protection in the form of safety glasses must be worn at all times when handling anesthetic agents. Ordinary prescription glasses do not provide adequate protection.

Single use nitrile or latex gloves must be worn when handling anesthetic agents as well as lab coats, closed toed shoes and pants. Additional protective clothing should be worn if the possibility of skin contact is likely.

Transportation and Storage [Provide additional information as it pertains to your research protocol]

Ethers form potentially explosive peroxides after exposure to air and light. Since these chemicals are packaged in an air atmosphere, peroxides can form even though the containers have not been opened.

Write the date received and date opened on all containers of ether. Opened containers of ether should be discarded within 12 months of opening. Even closed containers of ether must be discarded by the expiration date through EHS-HMM (734) 763-4568.

Halogenated liquid anesthetic agents (i.e. halothane, enflurane, isoflurane) are not flammable but do have limited shelf life. Be certain to date the chemical when it is opened and to check expiration date before use.

Always purchase the smallest quantity required for use. Ether used for anesthetic purposes should be purchased in the smallest quantity available (typically 150 cc, Fisher Scientific E136-150) due to its short (12 month) shelf life after it is opened.

Waste Disposal [Provide additional information as it pertains to your research protocol]

Anesthetic agents are hazardous wastes. Contact EHS-HMM at (734) 763-4568 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also refer to EHS's [Hazardous Waste webpage](#) for more information.

Training of Personnel

All personnel are required to complete the **General Laboratory Safety Training** session (**BLS025w** or equivalent) via [EHS's My LINC](#) Web site. Furthermore, all personnel shall read and fully adhere to this SOP when handling animal anesthetics.

Certification

I have read and understand the above SOP. I agree to contact my Lab Director if I plan to modify this procedure.

[illegible]

Laboratory Director

Revision Date

Major Revisions (Tracking purposes only -- Do not print as part of SOP)

DATE	REVISION
09-13-18	EHS name and logo were added, updated the formatting, and revised the content under Exposure/Unintended Content (AKJ).
03-01-19	Reviewed and updated. (BR)
06-17-22	Reviewed and updated. (BR)