

Anesthetic gases/vapors such as nitrous oxide and isoflurane are commonly used in laboratory animal research protocols. Exposure may occur through inhalation of waste anesthetic gases (WAGs) unintentionally released into the laboratory environment. For the hazards associated with a specific anesthetic gas, consult the Safety Data Sheet (SDS) available from the manufacturer.

Minimizing Exposure Potential

Anesthetic Gas Capture Systems work best in a well-ventilated area with at least 6 room air changes per hour (ACH) regardless of gas capture/scavenging methods in use. Most labs on campus are designed to have air change rates of 6 or greater when occupied. If anesthetic gases are to be used outside of a lab setting, contact the EHS (801) 581-6590 or email to questions@ehs.utah.edu for consultation.

The following controls are listed in order of most effective waste anesthetic gas control:

Active capture/scavenging:

Fume hood: Work in a chemical fume hood for best WAG capture performance.

Active scavenging devices (ducted): WAG collection devices (e.g., snorkel trunk, EVAC-4, VetEquip cube) are recommended to be ducted to the building exhaust system. Contact the EHS at (801) 581-6590 with question or for assistance. Do NOT use the house vacuum as a means of active scavenging.

Active scavenging devices (ductless): Where WAG collection devices (e.g., EVAC-4, VetEquip cube) cannot be ducted to the building exhaust system, use a manufacturer recommended air cleaning extraction system with an activated charcoal adsorption unit to actively scavenge WAG. NOTE: Charcoal adsorption units CANNOT be used with nitrous oxide. Please note that a hooded slide-top induction chamber and a compatible nosecone (e.g., CX-R or Posi-Vac) must be used with active scavenging units to minimize isoflurane exposure and ensure animal welfare.

Passive scavenging

Do NOT use passive scavenging with nitrous oxide.

Charcoal canisters: This method relies on positive pressure from the anesthesia machine and the anesthetized animal's exhalation to push WAGs into gas adsorption units (i.e., canisters). Any leaks in passive scavenging systems, such as an inadequate seal on the induction chamber cover, tubing, or nose cones, can cause WAG to leak into the work area. Passive scavenging is not recommended for small animal surgery of greater than 3 hours or for stereotaxic surgery of any duration. If using passive scavenging systems, connect one charcoal canister to the animal nosecone and another to the induction chamber as shown.

If options for scavenging are limited, personal respiratory protection may be necessary for researcher health protection. Contact the EHS at (801) 581-6590 for consultation.

Possible health effects of overexposure to anesthetic gas may include, but are not limited to:

- **Acute effects:** Drowsiness, irritability, depression, headaches, dizziness, and nausea, as well as problems with coordination, audiovisual ability, and judgment.
- **Chronic effects:** Liver and kidney disease, and adverse reproductive effects.

Safe Work Practices

- Inspect anesthesia equipment (induction chamber, tubing, etc.) and scavenging system before every use. Check for leaks, defects, and damage in anesthesia equipment (including hoses and valves) and scavenging system by pressure testing or by running oxygen through machine and then spraying suspected leaks with soapy water or equivalent.
- Verify equipment (e.g., fume hood and vaporizer) is in proper working condition.
- Ensure vaporizer is filled with the specific anesthetic agent for which it is designed and certified.
- Fill vaporizer using an anti-spill bottle adaptor OR conduct filling in fume hood. When filling, wear chemically-resistant gloves, a lab coat, and eye protection.
- Check for leaks, defects, and damage in anesthesia equipment (including hoses and valves) and scavenging system by pressure testing or by running oxygen through machine and then spraying suspected leaks with soapy water or equivalent.
- Prepare charcoal canisters for use: Charcoal canisters must be weighed before and after each use to ensure they are within manufacturer's specified limits.
- Confirm that the canister is correctly plugged into the breathing system. Use charcoal canisters according to manufacturer's recommendations.
- Ensure the canister holes are not obstructed. Canisters should be used upright, regardless of exit hole location – some canister may require a canister holder to elevate them off the surface.



Anesthetic inductions:

- Anesthetic Inductions:
- Open-drop anesthetic procedures are not recommended but, if necessary, must be conducted within a chemical fume hood.
- Do not turn on the vaporizer until animal is in the induction chamber.
- Purge the induction chamber with oxygen for 5 to 15 seconds prior to opening chamber and retrieving anesthetized animal.
- Keep the vaporizer turned off or the nosecone plugged until the animal is properly positioned in the nose cone.
- Turn off the vaporizer or plug the nosecone before taking the animal out of the nose cone.
- Co-administration of anesthetic and/or analgesic agents may allow lower isoflurane usage. Contact Vet Staff for Guidance

Surgical procedures:

- Select the best fitting nose cone for the animal prior to beginning procedure. To optimize the fit, nose cone diaphragms are often available from manufacturer. A modified diaphragm may be made from the finger of a powder-free nitrile surgical glove to enhance the fit of the nose cone. Modified nosecone with diaphragm is recommended for the passive scavenging system only.
- Oxygen flow rate and anesthetic concentration should be as low as possible to minimize anesthetic gas usage. This is highly variable and dependent on strain, age, sex, analgesics used, and individual animal (e.g., 1-2% isoflurane concentration and 0.5 L/min oxygen flow rate for healthy mice/rats). Contact Vet staff for guidance.
- Keep WAG capture/collection devices positioned as close as possible to potential points of release (e.g., at animal nosecone).
- Keep the researcher's breathing zone at maximal distance away from the animal nosecone, as gas concentrations decrease rapidly with distance.
- Close and seal any unused ports where anesthetic gas may escape.

Personal protective equipment

- Standard PPE for isoflurane users: chemical-resistant gloves, lab coat, and safety glasses.
- Additional PPE may be needed depending on other chemical/physical/biological agents used in the research protocol. Please refer to the Laboratory's Personal Protective Equipment (PPE) Assessment for any additional required PPE.

Unwanted Materials

- Manage unused/expired anesthetic gases and liquids and spent charcoal canisters as unwanted hazardous materials: Submit a pick up request via SAM (<https://lms.oehs.utah.edu/EHSA/>)
- Empty isoflurane containers may be disposed in the regular trash – deface container label before disposal.
- Equipment Maintenance
- Conduct inspections: Frequently inspect the condition of the induction chamber seal and the scavenging system for leaks.

For more information

[Occupational Safety & Health Administration \(OSHA\), U.S. Department of Labor, Waste Anesthetic Gases.](https://www.osha-slc.gov/)

