



Waste Anesthetic Gas (WAG)

Inhaled anesthetic agents such as nitrous oxide and halogenated gases/vapors are used in medical and surgical procedures. The halogenated anesthetic agent, isoflurane, is commonly used in animal research. Users are exposed primarily through inhaling waste anesthetic gas (WAG) while performing a research procedure. WAG is unintentionally released into the workspace when there are leaks in the equipment or if the WAG is not effectively scavenged.



In California, Cal/OSHA has set a **legal limit on isoflurane** in workplace air. The Permissible Exposure Limit (PEL) is the maximum level of an agent that a worker is allowed to be exposed to, averaged over an 8-hour day. **The PEL for isoflurane is 2 parts per million (ppm)**. For more information about **isoflurane exposure monitoring** in your work area, contact EHS at (949) 824-6200.

What is Waste Anesthetic Gas (WAG)?

Common anesthetic gases and vapors used during medical or surgical procedures are **nitrous oxide** and halogenated agents such as **isoflurane**.

Waste Anesthetic Gas (WAG) refers to anesthetic gas/vapor that is released into the work area during a medical or surgical procedure. Workers in the area can be exposed to WAG if there are leaks in the equipment, there is poor ventilation, or scavenging is not used or is ineffective.

Sources of WAG Exposure

Conditions that may increase a worker's exposure risk to WAG include:

- Leaks in the anesthesia system (e.g., loose-fitting connections; worn/defective seals, gaskets, hoses, tubing; cracked induction box)
- Leaks between the subject and facemask/nosecone, around tracheal tubing
- Filling the vaporizer or spills of liquid anesthetic
- Opening the induction box before flushing with oxygen

- Charcoal canister misuse or oversaturation
- Poor ventilation or reliance on a passive scavenging system

For assistance in setting up your **gas anesthesia equipment** or for routine maintenance, contact **ULAR Vet Services (949) 824-5079**.

Health Effects of WAG Exposure

- **Acute effects** (short-term): Nausea, dizziness, headaches, fatigue, irritability, drowsiness
- **Chronic effects** (long-term): Sterility, miscarriages, birth defects, cancer, liver/kidney disease

For hazards associated with a specific anesthetic gas, consult its Safety Data Sheet (SDS). Some SDS are available here:

<https://www.ehs.uci.edu/sds/index.php>

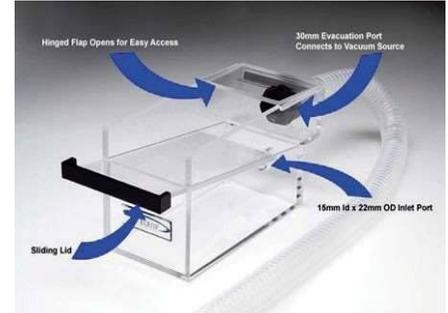
If you experience symptoms of WAG exposure or have reproductive health concerns, **notify your supervisor** and **contact EHS Occupational Health** at 949-824-6200

Waste Anesthetic Gas Capture Systems

WAG must be scavenged using a gas capture system:

Active Capture/Scavenging (PREFERRED)

- **Fume hood, hard-ducted biosafety cabinet, or down draft/necropsy table (highly preferred).** *Note: Most biosafety cabinets on campus are not hard-ducted.* Required for open-drop method (bell jar).
- **Building ventilation exhaust or vacuum system:** The waste exhaust hose can be hooked into the building ventilation exhaust system via a snorkel trunk. Users must match input flow with exhaust flow if hooked up directly or use a non-direct hookup, such as with a snorkel or thimble connection.
- **Non-ducted active scavenging device:** Vacuum devices designed to pull/push WAGs through a charcoal filter system.



Active Scavenging Chamber



Non-ducted Active Scavenging

Passive Scavenging (LESS EFFECTIVE)

- Passive scavenging relies on positive pressure from the anesthesia machine and the anesthetized animal's exhalation to push WAGs to gas adsorption units. Activated charcoal canisters, like f/air canisters, are used to adsorb the halogenated waste gases.
- When tubing or a nose cone is used, a **secondary scavenging system** is recommended to prevent WAGs from escaping around the tubing or nose cone. **Nose cones are not one-size-fits-all.** Using a tight-fitting nose cone will minimize the release of WAG in the work area.



Activated Charcoal Canisters



DO NOT use charcoal filter systems for **nitrous oxide** adsorption!

Safe Work Practices/Minimizing Exposure

Bell jars:

- ✓ Fill and open **inside** a certified fume hood or hard-ducted biosafety cabinet, or on a downdraft table.

Anesthetic Equipment:

- ✓ Users must be **trained** in the proper use of anesthetic machines and vaporizers prior to operation.
- ✓ **Before each use**, all components of the anesthetic system, including tubing, flow meters, valves, gaskets, scavenging system, etc., should be **inspected** by the user to ensure that they are correctly set up and functioning properly **without any leaks in the system**.
- ✓ Vaporizers are **anesthetic specific**. It is recommended that **anti-spill bottle adapters** are used for filling.
- ✓ The **oxygen flow rate** should be as low as possible to minimize the total amount of anesthetic gas usage. Most vaporizers need a **minimal flow rate of 500-800 ml/min** to ensure a proper percentage of gas output.

All vaporizer units on campus must be **maintained and certified** according to manufacturer's recommendations. In the absence of these recommendations, they must be tested **at least once every three years**. Refer to the Office of Research IACUC Use and Maintenance of Gas Anesthesia Equipment Policy for more information:

<https://tinyurl.com/2yd74hjp>

Induction chambers:

- ✓ Should be used in a fume hood.
- ✓ If the chamber is the hooded type, a vacuum line must be attached to the hood.
- ✓ If the chamber is a simple box type (no collection hood area), a hose can be attached to allow WAG to flow into a charcoal canister passively.
- ✓ At all times, the induction chamber's opening (both time and frequency) should be minimized.

Activated charcoal canisters:

- ✓ Use to adsorb halogenated anesthetic gas. **DO NOT** use to adsorb nitrous oxide!
- ✓ **Weigh before and after use** to ensure it is within the manufacturer's saturation limits. Record the date and weight on the side of the container.
- ✓ **Do not block air ports**. Depending on the model, these can be located on the canister's top or bottom.
- ✓ **Once the canister has reached the saturation limit, it should be immediately discarded**. Using the canister after saturation limits are met will lead to WAG leaking out of the canister and into the workspace.
- ✓ Follow the latest recommendations from the canister's manufacturer on the allowed maximum time and weight.

Exposure and Spill Procedures

Seek medical attention if irritation persists or signs of toxicity occur:

- **Eyes:** Use an emergency eye wash to immediately flush eyes with copious amounts of water **for at least 15 minutes**.
- **Skin:** Remove contaminated clothing and immediately wash affected area with soap and water.
- **Inhalation:** Move individuals to fresh air. Call 911 if acute exposure symptoms are observed or if emergency medical attention is required.

Complete an injury/incident report:

<https://www.ehs.uci.edu/forms/report-injury/>

- Do not attempt to clean up a spill if you feel unsure of your ability to do so or if you perceive the risk to be greater than normal laboratory operations.
- Small volumes (a few milliliters) of isoflurane will evaporate readily at average room temperature and may dissipate before any attempt to clean up is initiated. If a small spill occurs, wear appropriate PPE, absorb any residual liquid with absorbent material, and place in a chemical fume hood for safe evaporation.
- If a large spill occurs (e.g., stock bottle), notify others in the area and evacuate the area immediately. Do not attempt to clean up the spill.

Report spills by contacting EHS at 949-824-6200 during and after working hours. **Call 911 for emergency medical attention.**

Waste Management

- Unused or expired solutions of anesthetic liquids, bottles with residual isoflurane, and isoflurane-saturated charcoal canisters **must be disposed of as hazardous waste** through EHS. It is recommended that the canisters are sealed in a plastic bag while awaiting pickup.
- Use the appropriate hazardous waste container. Refer to the EHS website for a container guide and empty bottle flowchart: <https://ehs.uci.edu/enviro/haz-waste/>

Schedule a pick-up of hazardous waste:

<https://ehs.uci.edu/enviro/haz-waste/text-a-pickup.php>

Contact Information

- EHS: (949) 824-6200 or visit <https://www.ehs.uci.edu/>
- ULAR Vet Services: (949) 824-5079
- Anesthesia Equipment Vendors:
 - South Coast Anesthesia southcoastanesthesia@cox.net
 - Vet Equip <http://www.vetequip.com/>
 - E-Z Anesthesia <https://www.ezanesthesia.com/>
 - Vet-Tech Active Scavenging Unit <https://www.vet-tech.co.uk/product-category/anaesthesia-supplies/anaesthesia-accessories/scavenging/>

