

ISOFLURANE ANESTHESIA MACHINES

Background:

Anesthetic gases/vapors such as isoflurane are commonly used in laboratory animal research protocols. Occupational exposure occurs primarily through inhalation of waste anesthetic gas (WAG) unintentionally released into the laboratory environment. Possible health effects of overexposure to WAG may include, but are not limited to:

1. Acute effects: drowsiness, irritability, depression, headache, dizziness, nausea, and problems with coordination, audiovisual ability, or judgement.
2. Chronic effects: liver and kidney disease, adverse reproductive effects or cancer.

Purpose:

1. To describe proper procedures for the use, operation, maintenance, quality control, and calibration of the ARC's isoflurane anesthesia machines.
2. To ensure ARC staff have received adequate training on work practices and controls needed to prevent exposure to WAG.

Responsibilities:

1. The ARC Manager and Campus Veterinarian (or designee) shall provide documented training on the procedures described in this SOP.
2. Personnel using the anesthesia machine are responsible for following the procedures described during training and in this SOP.

Procedures:

1. Prior to use, the following procedures shall be performed:
 - a. Review the Safety Data Sheet (SDS) for isoflurane. A copy of the SDS is found in the Environmental Health and Safety binder.
 - b. Verify that the anesthesia machine is not out-of-service by checking the certification sticker on the anesthesia machine. The anesthesia machine shall **NOT** be used if the date of use will be more than one year from the

certification date. Contact the ARC Manager if the anesthesia machine lacks a certification sticker.

- c. Check for adequate isoflurane anesthetic liquid in the vaporizer (see photo below).
 - Ensure that the oxygen flow through the vaporizer is turned off.
 - Refill the anesthetic liquid directly from the bottle by removing the reservoir screw cap and decanting into the reservoir using a pouring adapter. Watch the fluid level rise in the reservoir window and stop adding fluid when it reaches the “full” line or spot.
- d. Check for sufficient flow/supply of compressed oxygen and check for any leaks in the anesthetic circuit:
 - Ensure that the machine is connected to the oxygen source and open the oxygen line.
 - Turn on the oxygen flow by turning the flow meter knob on the anesthetic counter-clockwise and observing the flow probe rising to between 1-2 L/min.
 - Cover the corrugated anesthetic hose at the point where it connects to the face mask and observe an increase in the pressure gauge. When it reaches 20 cm of water, turn off the oxygen flow. If there are no leaks that increased pressure should be maintained until you uncover the anesthetic hose.
- e. Connect an induction chamber and/or face mask to the non-rebreathing circuit appropriate for the patient and procedure to deliver the oxygen anesthetic gas mixture to the patient, and to reduce anesthetic gas leakage. If you are unfamiliar with the induction chamber and the non-rebreathing circuits, or how to connect them to the anesthetic machine, please ask for assistance.
- f. Connect an activate carbon filter (i.e. F-Air canister) to the induction chamber and breathing circuit. Activated carbon filters are not necessary if working on a down draft table, however, ensure that the exhaust port of the induction chamber and breathing circuit is located over the table.

- Make certain to weigh the activated carbon filter to ensure that its adsorptive capabilities have not been exhausted. Each filter canister must list an initial weight that was taken when the canister was unpacked, and a maximum absorbency weight listed on the canister by the manufacturer. For example, if the filter canister weighed 270 g when unpacked and can adsorb 50 g of waste anesthetic gas, then it must be discarded when it weighs more than 320 g.
 - Maintain the carbon filter in an upright/vertical position and do not block the holes on the bottom of the canister that allow for filtered air to vent out.
- g. Active scavenging systems use a fan to capture and exhaust the WAG and are available in some of our rodent surgery stations. Examples of active scavenging systems include down-draft tables, self-contained evacuation systems (Extract-All), and snorkel ducts that connect directly to the exhaust ventilation system. The ARC has both down-draft tables and Extract-All systems available for use in the Bio2 vivarium, and snorkels in the BioE vivarium. ARC staff are responsible for maintaining these units in the shared procedure areas of the vivarium. Use of the self-contained Extract-All systems is as follows:
- Turn on the fan in the Extract-All scavenging system,.
 - Position ducts as close as possible to potential points of WAG release (i.e., animal face mask, induction box).
 - Keep user's breathing zone at maximal distance away from the WAG source. Gas concentrations decrease rapidly with distance away from the source.
 - Record the use on Extract-All scavenging system (L/min, % isoflurane concentration, and duration of anesthesia) on the log sheet. ARC staff will periodically review the log and based on usage of the system will replace the activated carbon, as needed and per the manufacturer's recommendation.

2. During use, the following procedures will be performed with the anesthesia machine.
 - a. Adjust the gas flow rate using the oxygen flow meter to provide adequate patient ventilation and anesthetic vapor delivery.
 - Flow rates between 1-2 L/min are generally sufficient for ventilation of rodent species using a non-rebreathing circuit.
 - b. Adjust the anesthetic concentration by turning the dial on the vaporizer until the desired level of anesthesia is achieved.
 - Induction of anesthesia generally requires 3-5% anesthetic concentration.
 - Maintenance of anesthesia generally requires 1-2% anesthetic concentration
3. After use, the following procedures shall be performed to clean and maintain the anesthesia machine and non-rebreathing circuit in good working condition.
 - a. Clean the anesthesia machine, induction box, and working surfaces (e.g. surgery table or down-draft table) to remove any surface contamination using an approved disinfectant.
 - b. Dismantle the patient non-rebreathing circuit and clean the components, especially the nose cone, with an approved disinfectant.
 - c. Return the cleaned breathing circuit, and induction box to the storage cabinet.
4. Once per year, the ARC shall have a qualified service representative certify the anesthesia machine, calibrate the vaporizer (if needed) and perform a vaporizer efficacy test for the anesthesia machines in the shared procedure rooms of the vivarium. The service representative shall document that this service was performed by placing a certification and calibration sticker on the anesthesia machine, which lists the service date.

