SAN DIEGO STATE UNIVERSITY

IACUC Guidelines

ISOFLURANE GAS ANESTHESIA MACHINE OPERATION

IACUC approved: 06/12/17

PURPOSE

To ensure the proper use and maintenance of the anesthesia machines to maintain an appropriate level of anesthesia in the patient.

RESPONSIBLE INDIVIDUALS

- Animal Technicians
- Veterinarians
- Principal Investigators (PI)
- Research Technicians
- Office of Laboratory Animal Care (OLAC)

SAFETY STANDARD

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) both have established recommended maximum limits for personnel exposed to waste anesthetic gases to be 2ppm over any 1 hour period. If you can smell isoflurane, then levels are above acceptable thresholds.

MATERIALS

- Portable oxygen tanks (E-tanks)
- Anesthesia machine
- Isoflurane
- Induction box and/or nose cone
- Waste gas scavenger system (charcoal canister(s))
- Dual diverter tubing
- Evacuation tubing

PROCEDURE

1.0 Anesthesia machine general use procedures

1.1 Investigators supply all of their own materials for anesthesia machines that they own and maintain. OLAC can provide isoflurane, oxygen tanks, and

charcoal canisters on a recharge basis if the lab has an urgent need and has not acquired these yet. Oxygen and isoflurane will be provided as part of the rental of OLAC anesthesia machines. Investigators will be responsible for providing their own induction box, nose cone, tubing, and charcoal canister when renting OLAC anesthesia machines. Complete set ups may be purchased through OLAC on a recharge basis. Investigators using the OLAC anesthesia machines will be trained in the proper use and cleaning of the induction boxes or nose cones, tubing, and scavenging systems.

1.2 Investigators can use a sign-up sheet to reserve the OLAC anesthesia machines or use direct communication with OLAC staff for use of OLAC owned and maintained units.

1.3 For any Investigator owned/maintained anesthesia machines, it is the responsibility of the Investigator to assure the anesthesia machine is operated and maintained such that:

1.3.1 One Investigator has primary responsibility for maintenance, even if the machine is shared among investigators. Likely this is the Investigator who has purchased the machine and/or is the primary user.

1.3.2 Methods are consistent with this SOP and EH&S Policy and Procedures, and SOP on Anesthetic Gas Use and Scavenging System.

1.3.3 The maintenance and certification of the anesthesia machine is scheduled annually.

1.3.4 All equipment associated with the anesthesia machine is in good working order.

2.0 Anesthesia machine set up

2.1 Anesthesia machines require the use of medical grade oxygen not industrial grade oxygen.

2.2 For machines that require an E-tank:

2.2.1 Ensure that sufficient oxygen is contained in the E-tank. The tank should be replaced if it is at or below 500psi. The tank is considered full at 2000 psi.

2.2.2 To replace a tank, perform the following steps:

- Turn off E-tank to stop the oxygen flow.
- While supporting the tank, turn the T-handle screw to release the empty tank from the machine, remove and set aside.
- Remove protective covering on the outlet of the new tank.
- Replace the used plastic washer with a new washer, align pin index for proper positioning of the tank, and place new tank on machine. Note: placing a tank in an improper position can damage the oxygen connection. Care should be taken to correctly align the tank before tightening the screw.
- Tighten T-handle screw to secure tank to machine.
- Open valve slightly to test the seal on the oxygen tank. If the seal leaks, tighten T-handle screw or realign the E-tank to fit properly on the connection.

2.3 Check the anesthetic level and fill as needed as follows:

- Turn off vaporizer.
- Unscrew fill chamber cap.
- Pour the isoflurane liquid using an anti-spill pour spout. Add isoflurane to a level just below the maximum fill indicator on the chamber.
- Recap the fill chamber and isoflurance bottle to minimize gas exposure.

  NOTE: VAPORIZORS ARE CLEARLY LABELED "FOR ISOFLURANE ONLY". DO NOT USE ANY OTHER VOLATILE ANESTHETIC IN AN ISOFLURANE VAPORIZER.

2.4 Check waste gas scavenger system. Weigh the canister and record the weight and date on the side of the charcoal canister. The canister must not have gained more then 50 grams from the initial weight as recorded on the canister. Replace canister if necessary. Dispose of canister through EHS. Refer to the "Volatile Anesthetic Use and Appropriate Scavenging" SOP for more details on managing scavenging canisters.

2.5 Monitor all tubing and accessories for cracks, splits, or worn areas and replace as needed.

3.0 Anesthesia machine operation

3.1 Connect the tubing to the induction chamber and/or breathing circuit. Ensure that all valves are correctly opened or closed depending on the system being used. Ensure that the scavenger system is correctly connected.

3.2 Turn on oxygen flow by opening the E-tank.

3.3 Place the rodent in the induction chamber (if applicable). Adjust flow meter to deliver 2 liters of oxygen per minute.

3.4 Administer the anesthetic by depressing the release button on the top of the vaporizer and turning the dial to read 4% to 5%. Monitor until rodents are recumbent.

3.5 When the animal is recumbent and breathing deeply, the level of anesthetic can be decreased to 1% - 2%.

- Be sure to frequently assess the patient's depth of anesthesia and adjust the level of anesthetic accordingly. Use the lowest anesthetic gas concentration and oxygen flow rates as needed to maintain anesthesia.

3.6 If necessary, transfer the animal from the induction box to a nose cone after the animal has become recumbent in the induction box.

- When transferring an animal from the induction chamber to a nose cone, minimize exposure to waste anesthetic gas by first turning off the flow of oxygen, open the chamber away from you, then quickly remove the animal from the chamber, close the chamber, place the animal in the nose cone, turn valve of tubing to nose cone to the on position, and then turn the oxygen flow on again.

- Decrease oxygen flow to 0.8 liters of oxygen per minute and isoflurane to 1.5% - 2%.
- In some cases it may be acceptable to place an animal directly into the nose cone if it has received injectable anesthetic or sedatives so that anesthesia can be maintained with isoflurane.
- The oxygen concentration delivered will be ~98% (room air is 20-21%), increasing the combustibility of any material this oxygen-rich atmosphere contacts. Exercise care with any nearby heat or ignition sources e.g. cauterizing device.

4.0 Anesthesia machine take down

4.1 When the procedure is complete turn the vaporizer to the off position. The release button should click, indicating that no more anesthetic is flowing out of the vaporizer.

4.2 Turn the flow meter until it reads 0.

4.3 Turn the oxygen off by closing the valve on the E-tank.

4.4 Bleed off the residual oxygen in the system by turning the flow meter to 3-4L/min until the ball of the flow meter drops to 0 and the regulator pressure gauge reads 0. Turn off the flow meter.

4.5 Replace the E-tank and fill the vaporizer with anesthetic if necessary.

4.6 Weigh the canister and record the weight and date on the side of the charcoal canister. The canister must not have gained more than 50 grams from the initial weight as recorded on the canister. Replace the canister if necessary. Dispose of the canister through EHS. Refer to the "Volatile Anesthetic Use and Appropriate Scavenging" SOP for more details on managing scavenging canisters. Replace if needed.

4.7 Return the machine to its storage location.

5.0 Anesthesia machine use in biocontainment

5.1 A single OLAC anesthesia machine is placed in the biocontainment suite depending on the usage in these areas.

5.2 While in use, the machine must be covered by a clear plastic bag.

5.3 If a machine must be removed from a biocontainment suite, it must be thoroughly sprayed on all surfaces and wiped down with a quaternary ammonium disinfectant prior to removal. Do not use alcohol on the induction box as alcohol will cause the surface to become opaque and obscures observation of the animals.

5.4 To remove the machine from the biocontainment room, remove the plastic cover and spray the wheels with a quaternary ammonium disinfectant as it is rolled into the clean hallway.

5.5 Dual diverter tubing, induction boxes, nose cones, charcoal canisters and associated tubing are not to be moved from the biocontainment suite.

6.0 Maintenance standards

6.1 The anesthesia machine owner (Investigator or OLAC Manager) is responsible for ensuring that the machines are properly maintained and in good general working order. When outside maintenance and certification is required the owner of the machines will arrange for service by a professional service company. OLAC will assist investigators in arranging service of investigator owned machines. The cost for and execution of the service and certification of anesthesia machines is the responsibility of the owner.

6.2 Anesthesia machines will be certified annually by a professional service company.

6.3 Vaporizers will be professionally cleaned and calibrated annually or per manufacturer's recommendation.

6.4 Any anesthesia machine in use (OLAC or Investigator maintained) must be in good working order and the certification must be current.

7.0 Training

7.1 Hands-on anesthesia machine training is available from OLAC staff. This training is offered free of charge on an as needed basis for labs that use their own machines. It is required training for those using OLAC machines and must be taken prior to the first rental. Contact the OLAC Manager to schedule training. Additional information on the principles of the anesthesia machine is provided by this SOP and contained within the "Volatile Anesthetic Use and Appropriate Scavenging" Policies and Procedures, and SOP.

8.0 Waste Anesthetic Gas

8.1 Exposure to waste anesthetic gas can be minimized by adhering to the following:

- Maintain the equipment in good working order
- Operate the equipment in a well-ventilated area with the appropriate scavenging system.
    - For rodent anesthesia a passive scavenging system is typically utilized which consists of the charcoal canister(s) and evacuation tubing. A chemical fume hood or hard ducted biosafety cabinet would be examples of active scavenging systems..
- Transfer the animals in and out of the induction chamber following recommended practices (see item 3.6).
- Keep the nose cone tubing valve in the off position unless there is an animal placed into the nose cone.
- Be sure the vaporizer is off prior to filling. Use an anti-spill pour spout when pouring the liquid anesthetic and avoid overfilling the vaporizer.
- Be sure all waste anesthetic gas scavenging equipment is in good working order and scavenging canisters are weighed

and recorded. Replace canisters as needed. Dispose of the canister through EH&S.

- Review the "Volatile Anesthetic Use and Appropriate Scavenging" Policies and Procedures, and SOP.

8.2 Personnel are encouraged to contact Environmental Health and Safety regarding the use of volatile anesthetics in the workplace and potential exposure to waste anesthetic gas. Individuals are encouraged to talk to their personal physician for any medial advice pertaining to the use of volatile anesthetic gas.

SAFETY

1.0 Exposure/Contact Response

If employee is in need of emergency medical attention, call 911 immediately.

Wash hands and arms with soap and water immediately following any skin contact with anesthetic liquids. Flush eyes with water for 15 minutes following eye contact.

Report exposure, contact, signs and symptoms to your supervisor and EHS within 24 hours. Obtain proper medical treatment and follow-up.

2.0 Spill Response

- Small volumes of liquid anesthetic agents, such as isoflurane, evaporate readily at normal room temperatures, and may dissipate before any attempts to clean up or collect the liquid are initiated.
- In the event a spill of any volume, laboratory personnel are to vacate the room immediately and are to secure the room from general access by closing all doors leading to the spill area. The spill is to be reported to EHS x46778. Campus spill response representatives will respond to the scene to further evaluate the release and determine when the area is safe for re-entry.

3.0 Waste Disposal

Containers of expired or unused liquid anesthetic agents and spent waste anesthetic gas canisters must be properly labeled with a hazardous waste sticker and disposed through the EHS Hazardous Waste Program by contacting x46778 for proper disposal.

4.0 Record Keeping

Maintenance logs of inspection, service, testing, and calibration should be kept for each anesthetic machine, vaporizer, and ventilator. Information that must be maintained includes:

- Date of last service and calibration
- Initials of the person who performed the service and calibration
- Service and calibration results

Documentation of service and calibration must be affixed to each anesthesia machine or vaporizer that is available for use.

ATTACHMENTS

A. Anesthesia Machine Sign-out Sheet

ATTACHMENT A

Anesthesia Machine Sign-out Sheet

Investigator/Lab	Technician	Date	Time frame	Building	Room