Environmental Health & Safety Policy Manual		
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Isoflurane Use and Exposure Control Procedures		

1.0 PURPOSE:

LSUHSC is committed to keeping all exposures to hazardous materials below statutory or recommended levels, minimizing to the lowest achievable levels the risks of adverse health and safety outcomes associated with these exposures.

2.0 SCOPE:

Isoflurane is a halogenated anesthetic gas commonly used in university animal research facilities and individual laboratories. At standard temperature and pressure, it is a clear, colorless, volatile liquid with a mild ether-like odor. Isoflurane vapors are heavier than air. A harmful concentration can be reached very rapidly on evaporation at 20°C.

The anesthetic gases that leak out and into the surrounding room during medical and research procedures are considered waste anesthetic gases. Waste anesthetic gases are known to cause serious eye irritation, and human exposure to them has been associated with liver and kidney disease and reproductive effects.

Signs of acute exposure include CNS effects *(*nausea, vomiting, headache, dizziness, drowsiness, confusion), nose/throat/respiratory irritation, and skin irritation.

Signs of chronic exposure include hypotension (low blood pressure), tachycardia (increased heart rate), respiratory depression, elevated blood glucose.

The American Conference of Governmental Industrial Hygienists (ACGIH) recommends an exposure limit of 50 ppm for isoflurane exposure over an 8-hour workday. The National Institute of Occupational Safety and Health (NIOSH) recommends that no worker should be exposed to more than 2-ppm of any halogenated anesthetic agent (including isoflurane) over a 1-hour period (ceiling limit).

This document establishes procedures for the safe handling and use of 1-chloro-2,2,2-trifluoroethyl difluoromethyl ether (CAS# 26675-46-7), commonly known as isoflurane or Forane®. It applies to users of isoflurane as an anesthetic in all animal procedures. It specifically seeks to decrease potential user exposures through proper use of administrative and engineering controls.

3.0 RESPONSIBILITIES:

Principal Investigators

- Ensure all personnel are aware of the hazards of isoflurane use and trained by qualified personnel to follow the guidelines listed in this policy, explicitly implementing proper safe handling and exposure control techniques and procedures.
- Isoflurane must be used via a vaporizer designed for its use. Ensure that the equipment is working correctly and calibrated according to the manufacturer's recommendations.
- Identify isoflurane as a chemical used in any submitted IACUC protocol.
- Dispose of unused quantities of isoflurane via the EH&S hazardous waste program.

Environmental Health & Safety (EH&S)

- Perform personal monitoring of isoflurane exposure as deemed necessary.
- Aid Principal Investigators in selecting administrative controls, engineering controls, and personal protective equipment.
- Dispose of unused isoflurane via the licensed hazardous waste contractor.

4.0 PROCEDURES:

Based on the risk associated with the use of waste anesthetic gases, the safety procedures outlined below are required by all Animal Care and researchers when working with isoflurane.

Administrative Controls

- IACUC protocols, which include isoflurane use, should reference this policy's standard operating procedures.
- Laboratory personnel handling isoflurane must review the lab used Isoflurane Safety Data Sheet (SDS) before starting work with isoflurane.
- Contact EH&S at 568-6585 or safety@lsuhsc.edu if laboratory personnel exhibit signs or symptoms of isoflurane exposure.
- EH&S recommends avoiding the use of isoflurane if pregnant or trying to become pregnant. At a minimum, use should occur only after consulting with the individual's personal physician.
- EH&S strongly recommends that isoflurane use always be in the presence of two or more persons.
- Immediately stop procedures if the isoflurane odor is detected or the user experiences acute exposure signs or symptoms. Notify EH&S immediately to evaluate if either occurs. Work shall not restart until approved by EH&S.

Pre-Procedure Systems Checks

- 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 is more than one year from the certification

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

- Weigh scavenger canisters weekly. Each canister has a maximum weight, and once it reaches this maximum weight, it **must** be disposed of as a hazardous material via EH&S. The disposal weight depends on the size of the canisters. Dispose of small charcoal canisters when their weight increases by 50g and large canisters after an increase of 200g. If its weight has increased more than the allowable increase for that canister, discard it immediately and connect a new canister to the scavenger line.
- Verify the isoflurane fill level in the containment reservoir before commencing work. If the isoflurane level is below the fill line, add isoflurane to the vaporizer reservoir using the attachment provided on the bottle, closing the bottle and reservoir as quickly as possible. If working outside a chemical fume hood or ducted biological safety cabinet, use the EH&S-provided local exhaust system, locating it as near the vaporizer as possible.
- If using a compressed oxygen cylinder, ensure an adequate /flow supply is available to last the entire procedure. Check for any leaks in the anesthetic circuit.
- Inspect induction chambers for wear/damage and ensure that gasket seals are in good condition. Tighten all tubing connections as needed.
- Adjust the stop cock on the y-piece tubing so that the isoflurane/oxygen mixture will flow into the induction chamber, returning to the scavenger canister and not through the tubing going to the nose cone.
- Leak check system by using a KimWipe air flow test or equivalent.
- Users must wear appropriate personal protective equipment during the procedure, which includes a lab coat or yellow animal care gown, safety glasses, and sterile chemical-resistant gloves.

Delivery of Anesthesia

- Isoflurane use should always be in a well-ventilated room.
- The ideal set-up location for delivery and use of isoflurane in a small animal procedure is inside a chemical fume hood or a ducted biological safety cabinet (Note that “ducted” means connected to one of the building’s ventilation systems. Most biocabinets at LSUHSC are not ducted and recirculate air after it passes through a HEPA filter). No additional controls are needed if the vaporizer, nose cone set-up, and induction box are inside a chemical fume hood or ducted biological safety cabinet.
- Use an EH&S-provided local exhaust ventilation system if either the vaporizer, nose cone set-up, or induction box are located outside of the cabinet or fume hood (to include procedures using intubation).
    - EH&S has tested and verified that the Sentry Air Systems local exhaust units (Sentry Air Systems Floor Sentry (lab bench side-mounted snorkel hood) and Sky Sentry (wall mounted snorkel hood)) are able to maintain exposures below allowable limits when used correctly.
    - Unit Selection will depend on the lab space and bench configuration and the researcher's needs.

- The 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 waste gas release (i.e., animal face mask, induction box).
  - Keep the user's breathing zone at a maximal distance away from the waste gas source. Gas concentrations decrease rapidly with distance away from the source.
- Filters shall be changed after every 300 hours of use. Some local exhausts contain a built-in use-time counter, which must be reset with each filter replacement. A time log must be maintained to track filter use when using units without a built-in counter. Contact EH&S to obtain a local system and for replacement filters.

- Barrier class work performed within Animal Care facilities using laminar flow hoods has been evaluated and determined to be a low exposure risk activity. No additional exposure controls beyond the use of the laminar flow hood are required during these activities. Modified barrier activities, performed outside of the laminar flow hood, will require the use of the local exhaust system.
- Bell jars can only be used in a chemical fume hood or a ducted biological safety cabinet for euthanasia as approved in your IACUC protocol.
- Animal care recommends that the isoflurane vaporizer percentage should be 3-5% for induction and 1-3% for maintenance during the procedure. Contact Animal Care for with questions or for further guidance.
- Once ready to induce, place the animal in a clean induction chamber, making sure to close the chamber securely. If working outside of a chemical fume hood or biological safety cabinet, a local exhaust system shall be used and located as near the induction chamber as possible and between the users. The local exhaust must be in use when the induction chamber is open.
- When the animal loses righting reflex and its respiration rate slows slightly**,** turn off the isoflurane flow and flush the induction chamber with oxygen until confident the chamber has been purged of isoflurane.
- Remove the animal from the induction chamber and place onto a clean procedure surface; snugly attach a nose cone or intubate then turn the isoflurane flow on. If performing surgical procedure outside of a chemical fume hood or ducted biological safety cabinet, the local exhaust should be situated as close to the procedure as possible and remain in place and active until the isoflurane supply flow is stopped.
- Turn off the vaporizer when not administering anesthetic to animals.

5.0 MAINTENANCE OF ISOFLURANE SYSTEM EQUIPMENT

- Precision vaporizers must be calibrated annually by the manufacturer or other authorized party, with verification provided by an attached sticker or other readily accessible documentation. Fittings, tubing, and connections must be checked routinely, replacing seals and damaged components as necessary. A refrigerant leak detector or soap bubble test should be periodically used to check for gas leaks. Maintenance and repairs should be performed by a certified technician.

- Induction chambers and breathing circuits must be appropriately sanitized after each use. Alcohol should not be used to sanitize induction chambers, as it may weaken the structure of acrylic and cause clouding.

6.0 INJURIES AND SPILLS

- If isoflurane is splashed on the skin or in the eyes, flush for 15 minutes with copious quantities of water and follow up with a medical evaluation.
- For direction on small and large spill clean-ups, see Policy EHS—200-02, Chemical Spill Response Policy and Procedures.
- Subsequent to exposure events, an incident/accident investigation shall be completed. For investigation and reporting instructions, see Policy EHS-400.06, Incident and Accident Reporting and Investigation.