IACUC GUIDELINE
ANESTHETIC VAPORIZORS AND GAS SCAVENGING

The University of Pennsylvania’s (Penn) Institutional Animal Care and Use Committee (IACUC) is charged with ensuring that all vaporizer equipment meet the criteria set by the federal regulations, including the Animal Welfare Act (AWA), the Animal Welfare Regulations (AWR), and the Public Health Service Policy (PHS). The PHS requires institutions to comply with the performance-based standards in the *Guide for the Care and Use of Laboratory Animals* (Guide).

“Each research facility shall establish and maintain programs of adequate veterinary care that includes: (4) Guidance to principal investigators and other personnel involved in the care and use of animals regarding handling, immobilization, anesthesia, analgesia, tranquilization, and euthanasia...” [AWR 2.33(b)(4)]

“For anesthesia delivery, precision vaporizers...increase the safety and choices of anesthetic agents for use in rodents and other small species.” Guide (2011)

“...the IACUC shall confirm that the research project will be conducted in accordance with the Animal Welfare Act insofar as it applies to the research project, and that the research project is consistent with the Guide unless acceptable justification for a departure is presented.” [PHS Policy VI.C.1]

The following guideline was developed to help ensure proper functioning of equipment to maintain safety for both animals and the personnel. Training in proper use of equipment and anesthesia of research or teaching animals can be requested from the ULAR Training Department. Concerns regarding possible leakage from an anesthetic system or potential personnel hazards associated with exposure to volatile anesthetics should be directed to the Office of Environmental Health and Radiation Safety (EHRS). This guideline concentrates on the following topics:

- Vaporizer equipment
- Certification
- Scavenging Equipment
- Monitoring and records
- Bell jars
- Training

**VAPORIZER EQUIPMENT**

Precision vaporizers should only be used for the anesthetic agent for which they were manufactured. Though many anesthetics have similar vapor pressures, difference in the vapor pressures to the animals could cause the vaporizer to provide inaccurate or improper doses of inhalant anesthesia.

Older units currently calibrated for use with anesthetics no longer produced may be converted for use with another anesthetic, i.e. a halothane vaporizer may be converted into an isoflurane vaporizer. A simple internet search for “halothane vaporizer conversion” will yield a list of many vendors who perform this service.

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CERTIFICATION
Penn’s IACUC requires that anesthetic vaporizers/machines used in animal research be certified at least once every two years. This frequency may be more often, depending on individual manufacturer’s or the certifying agent’s recommendations. In addition, certification or servicing may need to be performed more often with high frequency of use or in event of suspected equipment malfunctions.

Vendors that offer certification services, and are used by ULAR or other Penn PIs, include:
- Penn Department of Anesthesiology and Critical Care
  http://www.uphs.upenn.edu/dripps/research/vaporizer.html
- Systems Specialties, Inc. (215-443-9293)
- Crainey Technical Services, LLC (888-859-3360)

SCAVENGING EQUIPMENT
Waste gas scavenging systems must also be properly maintained in accordance with manufacturer’s instructions and/or institutional safety policies (EHRS Chemical Hygiene Plan) to ensure health and safety of personnel. The following are examples of scavenging methods:

Dedicated Exhaust: A dedicated exhaust or zone capture exhaust is preferred for removal of waste gases from a surgical area or procedure space. These could include an active ‘vacuum’ waste gas line or an ‘elephant’ trunk exhaust.

Fume Hoods: The use of a fume hood to capture the waste gas is acceptable depending on amount of the agent being used. If an anesthesia machine is being used, then placement of the exhaust gas line inside of the fume hood may be appropriate.

Charcoal Canisters: Charcoal canisters may be used to absorb halogenated waste gases. Canisters should be used vertically (do not lay them on their sides when in use) and the exhaust ports cannot be blocked. The canisters should be weighed prior to the first use and then monitored regularly, once put into service, to assure they have not reached full saturation. These canisters must be used and discarded according to the manufacturer’s instructions.

MONITORING AND RECORDS
Once recertified, a sticker is usually placed on the vaporizer. If no sticker is attached, then current records of certification, calibration and/or maintenance should be retained until the next certification. These certification records should be readily available for inspections and other laboratory site visits.

Records should also be maintained by the laboratory for scavenging equipment (e.g. for charcoal canisters, the weights and dates of weighing or total hours in use should be recorded on the canister or on an associated log sheet). Documentation of weights should be made on the canister and should be readily available for inspections and other laboratory site visits. It is recommended that a function test for leaks in the circuit be performed prior to every use of the vaporizer.
USE OF BELL JARS FOR ANESTHESIA
A bell jar may only be used for sedation of small rodents for euthanasia procedures only, i.e. anesthesia followed by decapitation, cervical dislocation, or other acceptable IACUC approved methods.

Use of a bell jar or other variation of this technique, must be approved in the IACUC protocol prior to using it with live animals. The use of this equipment should be specifically stated in an IACUC protocol, under the “Euthanasia” procedure. The “dose” should be described as “bell jar”, not a %. The methods to avoid contact between the animals and the saturated gauze or cotton ball must be clearly described. Conical tubes may be used for single animals if the method (including the means to separate the animal from the anesthetic solution) is clearly described in the IACUC protocol.

If this method is used, the following practices are required:

1. The equipment must be used in a well-ventilated area (e.g. biosafety cabinet or fume hood).
2. A physical barrier must be used to separate the rodent from the anesthesia soaked cotton or gauze material. The animal should only be exposed to vapors and should never come in contact with the liquid state of the anesthesia as this can be irritating. This separation should be a prefabricated large jar with “shelf” or other durable screening in a container dedicated to this purpose.
3. Sufficient air or oxygen must be provided during the induction period to prevent hypoxemia.
4. The bell jar should not be overcrowded. Only mice originating from the same home cage should be anesthetized and euthanized together. If using the conical tube technique, only one mouse should be anesthetized and euthanized at a time.
5. As with any anesthesia procedure, the animal(s) should be monitored throughout the anesthesia period. The animal should be checked for depth of anesthesia (the absence of reflexes) prior to initiating euthanasia (e.g. cervical dislocation, decapitation).
6. Bell jars should not be used for transport.
7. Euthanasia is the only procedure for which use of a bell jar is authorized. Animal must be euthanized immediately following anesthesia using a bell jar.

If any procedure(s), e.g. blood collection or terminal surgery, are to be performed, a bell jar may not be used—more refined, controlled methods must be used, i.e. the use of a vaporizer to control the amount of inhalant anesthesia to be delivered.

TRAINING
For additional guidance and training in the use of anesthesia equipment, please contact ULAR Training (ular-tr@pobox.upenn.edu).

REFERENCES
Guide for the Care and Use of Laboratory Animals, 8th Edition
Penn Chemical Hygiene Plan
Penn EHRS SOP – Animal Inhalation Anesthetics
OSHA Health Care Workers Guidelines/Chapter 5b