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).

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
- Training

VAPORIZER EQUIPMENT
Because inhalant anesthetics have different vapor pressures, precision vaporizers should only be used for the anesthetic agent for which they were manufactured. Alternatively, vaporizers may be converted for use with another anesthetic agent by a certified vendor.

CERTIFICATION
The IACUC guideline for documentation regarding anesthetic vaporizer calibration is a vendor’s calibration due date or a date of calibration sticker attached directly to each vaporizer. The maximum allowable time between vaporizer calibration services will be 2 years. Vaporizers should be recalibrated annually if they are used extensively (>500 hours per year) or are moved to multiple locations. Vaporizers with no documentation of calibration may not be used until certified as accurate by an approved vendor. To maintain calibration accuracy between service intervals, single location vaporizers should be securely attached to the gas delivery apparatus in an upright position. Portable vaporizers must be transported in an upright position, should have a wide, heavy base fixture to prevent tipping, and must be recalibrated before reuse if dropped or tipped over.

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 adsorb halogenated waste gases. Canisters should be dated when put into use. The canisters should be weighed prior to the first use and then monitored after each use 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. Exhaust ports on canisters should not be blocked, and the canister should be oriented according to manufacturer recommendations.

Ducted Biological Safety Cabinet: Biological Safety Cabinets (BSCs) that are exhausted to the outside can be used for anesthetic procedures. Class II Type B1 BCSs that are partially exhausted outside may be used with approval from EHRS and if work is conducted on the back (exhausted) work surface. The exhaust fan or blower on the BSC should be on for all procedures. BSCs should be maintained and evaluated for proper performance in accordance with the manufacturer’s instructions.

MONITORING AND RECORDS
Once recertified, a sticker is usually placed on the vaporizer by the certifying vendor. If no sticker is attached, then current records of certification, calibration and/or maintenance must 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 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.

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