WASTE ANESTHETIC GASES

Anesthetic gas and vapors that leak into the surrounding room during medical or research procedures are considered waste anesthetic gases (WAGs). Waste anesthetic gases and vapors that create health effects from over-exposure include nitrous oxide and halogenated agents such as isoflurane or halothane. University faculty, staff and students must be aware of the potential risks of WAGs and are advised to take appropriate precautions to reduce exposures.

Workers acutely exposed to excess amounts of anesthetic gas can experience symptoms of drowsiness, headache, nausea, poor judgement and loss of coordination. Chronic symptoms of over-exposure can include liver, kidney, and reproductive effects. Information on the specific health effects of each anesthetic gas can be found on the Safety Data Sheet.

To prevent unnecessary exposure to waste anesthetic gas, the following instructions help identify the potential for WAG exposure and provide guidance on leak test procedures, medical surveillance, air monitoring, worker training and waste disposal.

The principal sources of waste anesthetic gas exposure are induction chambers, leakage from anesthesia equipment or improper use of anesthetic gas scavenging systems. University employees who work in hospital operating rooms, dental operators, exam rooms, and/or animal surgery areas should also take steps to reduce their exposure to WAGs.

A safe exposure concentration for any halogenated anesthetic agent is less than 2 parts per million (ppm) collected over a one-hour period, or 25 ppm of nitrous oxide over an 8-hour time weighted average.

When nitrous oxide is used in combination with halogenated gas, control of nitrous oxide to 25 ppm during anesthesia should limit concentrations of the halogenated gases to less than 0.5ppm. Charcoal filters/canisters will not work with nitrous oxide. Active scavenging is required.

1. Engineering Controls:

A scavenging system is the basic engineering control for WAGs. These systems include a collecting device (scavenging adapter) to capture gases and vapors from the anesthesia breathing system at the site of overflow. Although some gas scavenging systems are elaborate and costly, an inexpensive system consisting of a flexible exhaust duct and Plexiglas hood, if well designed and properly installed, can dramatically reduce gas concentrations in the work area.

Animal face masks that are not tight fitting should have a sealing diaphragm to control leakage areas and must be designed for the species of animal being anesthetized.

Modern anesthesia equipment is manufactured with active scavenging systems that include a scavenging nasal mask. When possible select a compact double chambered mask system with a shroud large enough to capture exhausted anesthetic gas exiting from the subject's nose and mouth. The inner mask is contained within a slightly larger outer mask and a slight vacuum is present in the space between the masks.

The HVAC system for the room should not be relied upon for waste gas scavenging. While it is important to have adequate supply and exhaust ventilation (15 air changes per hour), active scavengers should be used to capture and exhaust gas at the point of release.

1.1 Preferred methods to capture WAGs are to work within a certified chemical fume hood or certified Class II Type B2 (hard-ducted) biosafety cabinet, work near a slotted vent exhaust, or use a snorkel exhaust, or backdraft or downdraft table. If you have questions about engineering controls, contact EH&S. For humans and large animals, sealed intubation cuffs are recommended.

1.2 Other approved methods to capture WAGs are using an active scavenging device such as a nose cone, intubating the animal, using house vacuum, or using a manufactured scavenging system that will pull the WAG away from your breathing zone.

1.3 Passive scavenging via the use of charcoal canisters often results in elevated WAG exposures and should only be utilized when engineering controls and active scavenging systems are not feasible. Passive scavenging relies on the positive pressure of the aesthesia machine and the animal exhaling to push the anesthetic gas in to a charcoal canister for neutralization.

1.3.1 Charcoal canisters must be weighed before and after use to ensure they are within the manufacturer specifications. If the weight of the charcoal canister is out of manufactures specifications, a new canister must be used.

1.3.2 Charcoal canisters that are placed upright on the bench do not allow air to pass through; therefore, canisters should be placed on their side so the air can flow freely out of the openings in the bottom.

2. Work Practice Controls:

The anesthesia machine owner must implement a routine maintenance program to check for and fix leaking equipment and to assure that ventilation requirements are met. Steps taken before surgery to reduce gas leakage should include:

2.1 Check the vaporizer for current certification.

2.2 Fill the vaporizer inside a chemical fume hood or use an anti-spill bottle adaptor.

2.3 Make sure that waste gas disposal lines are connected, and that fittings and hoses are not defective or leaking.

2.4 Avoid turning on nitrous oxide or halogen vaporizer until the circuit is connected to the subject. Switch off the nitrous oxide and halogen vaporizer when not in use.

2.5 If an induction chamber is used, it must be opened in a chemical fume hood or Class II Type B2 biosafety cabinet, or immediately adjacent to a local exhaust device, or be connected to the house vacuum system to evacuate the chamber. If a passive system is being used, turn off the vaporizer and use oxygen to push the WAG into the charcoal filter. Do not open induction chamber until it has been flushed with oxygen.

2.6 Make sure that the mask properly fits the subject.

2.7 Use the lowest gas flow rates possible.

2.8 Maintain oxygen flow until scavenging system is flushed.

3. Air Monitoring

Users must contact EH&S for air monitoring prior to using any active or passive scavenging setup for the first time. Users must also contact EH&S for monitoring if changes are made to the scavenging system.

Passive capture systems have higher potential exposures to WAG's and must be monitored prior to initial use AND ANNUALLY thereafter.

Air monitoring will be performed on both worst case and routine exposures for each job class.

Sampling results of the air monitoring along with any necessary exposure reduction measures are reported to the supervisor and should be shared with the monitored employee(s). Air monitoring is completed by EH&S at no cost to your department/laboratory.

4. Medical Surveillance

Faculty, staff and students with symptoms of over-exposures to WAGs should be directed to promptly visit Employee Health Services for a clinical consultation.

5. Personal Protective Equipment

Personal protective equipment is required when filling the vaporizer with an anesthetic agent. Wear appropriate gloves that provide chemical protection, safety glasses or face shield, and laboratory coat. Respiratory protection is typically not necessary or recommended if adequate controls for WAGs are in place. Respiratory protection equipment should only be utilized as an interim measure when air monitoring shows control measures are currently inadequate to limit worker exposures.

6. Training

Supervisors are responsible to assure that workers involved with waste anesthetic gases are trained to recognize, understand and reduce health and safety risks of exposure to WAGs. Training and questions can be supported by EH&S.

7. Disposal of anesthetic gas and charcoal canisters

7.1 Do not allow anesthetic gas containers to evaporate in a chemical fume hood before disposal.

7.2 For empty anesthetic gas containers that are glass, deface the label and dispose in the broken glass box.

7.3 For expired or unwanted anesthetic gas containers, place a chemical waste label on container and dispose as chemical waste.

7.4 Used charcoal canisters must be disposed through the chemical waste stream after a chemical waste label has been applied to the canister and filled out.