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Active Scavenging of Waste Anesthetic Gases in Veterinary Facilities

What are waste anesthetic gases (WAGs)?

WAGs are anesthetic vapors that escape from the patient of anesthetic system and enter the environment. They consist of halogenated hydrocarbons such as Isoflurane, Sevoflurane and Desflurane. Note that N₂O is not a halogenated hydrocarbon.

Where to WAGs occur?

WAGs can occur at EACH piece of equipment involved in delivery of inhalation anesthetic agent. This includes not only the anesthesia machine and vaporizer but also breathing bags, circuits, endotracheal tubes, all adapters and sampling lines as well as WAG delivery tubing itself. They also occur when filling the anesthetic vaporizer.

How do we limit WAG exposure?

Removal of WAGs is one of the primary functions of the anesthesia machine. The excess gas passively exits the system via the pop off valve (aka adjustable pressure limiting valve) and out the WAG delivery tubing.

The WAGs need to be directed to a charcoal WAG adsorbing canister or through an active scavenging system.

What are the effects of WAG exposure?

According to the CDC short term effects of WAG exposure at high concentrations are headaches, irritability, fatigue, nausea, drowsiness and difficulties in judgement and coordination.

Studies researching long term effects of exposure at a low concentration have suggested links to liver and kidney disease, miscarriages birth defects and neoplasia. Other conflicting studies show no evidence of negative effects.

What is acceptable?

Anesthetic gases cannot be detected by odor until concentrations are high. Isoflurane levels can indicate 2,000 ppm when detected by scent (office of research services, WAG 2019, DOHS WAG program manager).

Waste gas dosimeters are commercially available for periodic monitoring and according to NIOSH, less than 2ppm during an 8-hour period is acceptable for isoflurane and sevoflurane (N₂O is even less).

How to prevent WAG exposure

Supervisor/mgmt should have minimal knowledge of health hazards of WAGs and standards should be in place. Employees should have adequate knowledge of these hazards and funding to maintain WAG equipment. This equipment should be checked for function and efficacy on a regular basis.

According to the general duty clause, employers must provide their employees with a workplace free from recognized hazards likely to cause harm. These employers can be cited BUT failure to implement the OSHA WAG guidelines are not in itself a violation.



The responsible approach to worker health and safety is to minimize exposure to the lowest practical level.

See guidelines and position statement on “Control of Waste Anesthetic Gas” at acvaa.org

[Guidelines and Position Statement - American College of Veterinary Anesthesia and Analgesia \(acvaa.org\)](http://acvaa.org)

Daily check in and check out procedures should be implemented. Use of face mask induction or “boxing down” patients with an induction chamber should be the exception and not the rule. Anesthetic machine leak testing is essential daily if not in between every patient.

Some other tips to decrease exposure to WAGs are; 5 minutes of O₂ flow to patient after procedure completion and discontinuation of anesthetic agent, routine filling of anesthetic vaporizers preferably at the beginning and ending of a shift so minimal personnel are present and anti-spill adapters are also commercially available and highly recommended.

Scavenge systems

These are 90% effective in WAG reduction.

They must not leak or be directed outside to an area where reentry is possible.

Passive or Active???

Passive scavenging will involve the use of charcoal adsorbent canisters. These canisters adsorb halogenated anesthetics and let air flow through. The airflow holes are on the bottom of the canister and should NOT be occluded by standing it on its end. This can cause an outflow obstruction leading to a buildup of pressure in the anesthetic system and can negatively affect your patient. Positioning it on its side is also not effective as the WAGs take the path of least resistance in the space across the top where there is no charcoal therefore will not be scavenged exposing the surrounding staff members to WAGs.

User compliance is a huge issue with these canisters. They must be weighed after every use and replaced after 50gm weight gain. Pole mounted or table top holders are available to increase proper use and compliance.

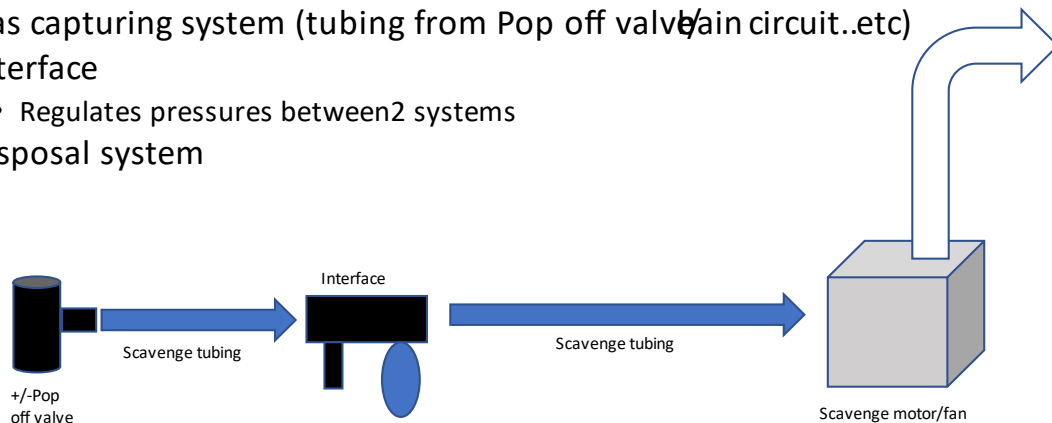
Active scavenging is ideal as there is little maintenance and user compliance needed. These systems involve a fan or motor with PVC piping throughout the facility. Each potential anesthesia station should have an outlet whether it is a ceiling outlet or a wall outlet. Many (not all) active scavenging systems require the use of a balancing interface for each anesthesia machine. These interfaces bring in room air through a down tube or vent to balance the pull between the anesthetic system and the fan. In the absence of an interface with a system that is designed to have one in place, the fan can result in a collapsed reservoir bag and reduced delivery of anesthetic to your patient.

Gases are actively pulled by the fan and directed outside of the building. Alternatively, quick connects with scavenge or vacuum lines are available for a WAG evac system combined with a liquid aspiration system. This type of system usually for larger surgical facilities that need medical suction as well as WAG evacuation.

See slide below for a schematic diagram of the basic components of an active scavenge system.

Active

- 3 components to active scavenge system
 - Gas capturing system (tubing from Pop off valve/main circuit..etc)
 - Interface
 - Regulates pressures between 2 systems
 - Disposal system



Common troubleshooting with active scavenging

A good anesthesia machine service person should be checking your system for adequate pull and cleaning out the interface (if present) with your yearly anesthesia machine service

The interfaces can collect hair and dust and cause blockages which can result in increased pull on your anesthetic machine and a collapsed reservoir bag. They can be cleaned with a cotton tip swab and canned air.

If a blockage gets downstream of the pop off valve it can result in increased pressures in the system and a distended reservoir bag. If the blockage is downstream of the interface it will reduce or stop the pull on the system. Simply blowing through the tubing can often dislodge the blockage.

Occasionally the motor or fan can burn out (rare) and can be addressed with technical support from the manufacturer.

Call or email me with any questions! Thank you! Kelligill.vts@gmail.com 678-626-7098