Waste Anesthetic Gas (WAG) Management

Reducing the Risk of Exposure

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Chronic exposure to waste anesthetic gas (WAG) has been linked to a number of human health maladies with trace amounts of halogenated anesthetics posing a health issue.[1] The prudent approach by regulatory agencies sets mandate compliance to a maximum of no more than two ppm in one hour.[2,3] Workplace exposures to WAG occurs in research laboratories, surgical suites, and veterinary medical hospitals.[5]

Reducing risk of exposure is provided by management controls, engineering controls, selection of anesthesia systems with accessories, and training techniques.

Identifying and monitoring for leaks in anesthesia equipment systems, components, and accessories are essential ongoing activities. The goals are to identify the high-risk areas of exposure, reduce the level of WAG in the workplace, and minimize the risk of exposure.

TWO BASIC MODALITIES FOR WAG MANAGEMENT

It is important to differentiate the action of passive and active WAG management.[8,9]

Passive means that the fresh gas supply entering the anesthetic delivery device (nose cone or face mask, induction chamber, etc.) "pushes" the anesthetics towards the WAG management system. In other words, when fresh gas enters a coaxial non-rebreathing system, fresh gas enters the face mask and flushes the WAG towards the evacuation system of choice. There is no negative pressure generator that pulls away the fresh gas delivery system.

Active means that there is a negative pressure generator in-house vacuum, or other flow that is going from inside the room to outside the building (chemical fume hood, down draft table, room exhaust, etc.) that removes the WAG from the workplace.

Every active system includes a passive component plus the negative pressure generator. Negative pressure cannot be applied directly to the fresh gas delivery because the fresh gases will be removed and the subject will not become anesthetized.

HIGHER RISK AREAS

Filling the Anesthetic Vaporizer

There are two basic fill types: 1) funnel fill and 2) key fill (or pin-indexed). If spillage occurs, neither are 100% effective in preventing exposure. The funnel fill type can be used with an anti-spill device to help prevent spillage. This is a spout mechanism that is inserted into the funnel portion of the fill.

Even with this precaution, if the operator's breathing space is close to the funnel fill, then there can be no guarantee that the two-ppm tolerance will not be breached. Since the key fill is used with a fill device that is ostensibly a completely closed system, the use of the key fill has advantages if used properly. Exposure results will occur with improper use of the key fill device.

Following exact instructions and repetitive training, spillage can be reduced to a minimum.

Induction Chambers

It is extremely challenging to avoid risk of exposure to anesthetic while using induction chambers. The highest risk of exposure occurs when high concentrations (up to 5%) of anesthetic are used in a hinged chamber. As the chamber is opened, the physical act of lifting the top will draw the anesthetic in the chamber up and into the workplace. A sliding top chamber helps to reduce the anesthetic being lifted into the user's breathing space. Exhaust hooded induction chambers, used with in-house vacuum, greatly reduces the level of anesthetic released into the workplace.

In addition to proper technique in using the chamber, as the user lifts the animal out of the chamber, this can draw anesthetic into the workplace. To help avoid this phenomenon, the opening of the sliding top and hinged induction chambers should be opposite the user's breathing space. The animal should be positioned as far away as possible from the user's breathing space.

Anesthetic Face Masks

Many anesthetic face masks do not have diaphragms, or if they do, they are not fitted or cut properly. The face mask should fit snugly around the subject's muzzle such that there is a "seal" to help prevent the WAG from entering the workplace.

If the face mask does have a seal, then its diaphragm should be cut properly with a circle. An "X" or a "+" should not be used. Gases will follow the path of least resistance around the subject's muzzle. The diaphragm should have a

circular hole that is appropriate for the size of the muzzle.

An important safety consideration of face masks is that the diaphragm material is either severely deteriorated and/or missing altogether. In this case, there is no WAG containment.

In addition, users often will cut a surgery glove to use as a diaphragm. This is not the best way to manage WAG because the glove does not have the elasticity to "grasp" around the subject's muzzle. The recommendation is 12 mil (thickness) latex material. This is commercially available from a number of sources. If one has allergic reactions to latex, a comparable silicone rubber material can be used.

See Figure 1 for a properly cut diaphragm.

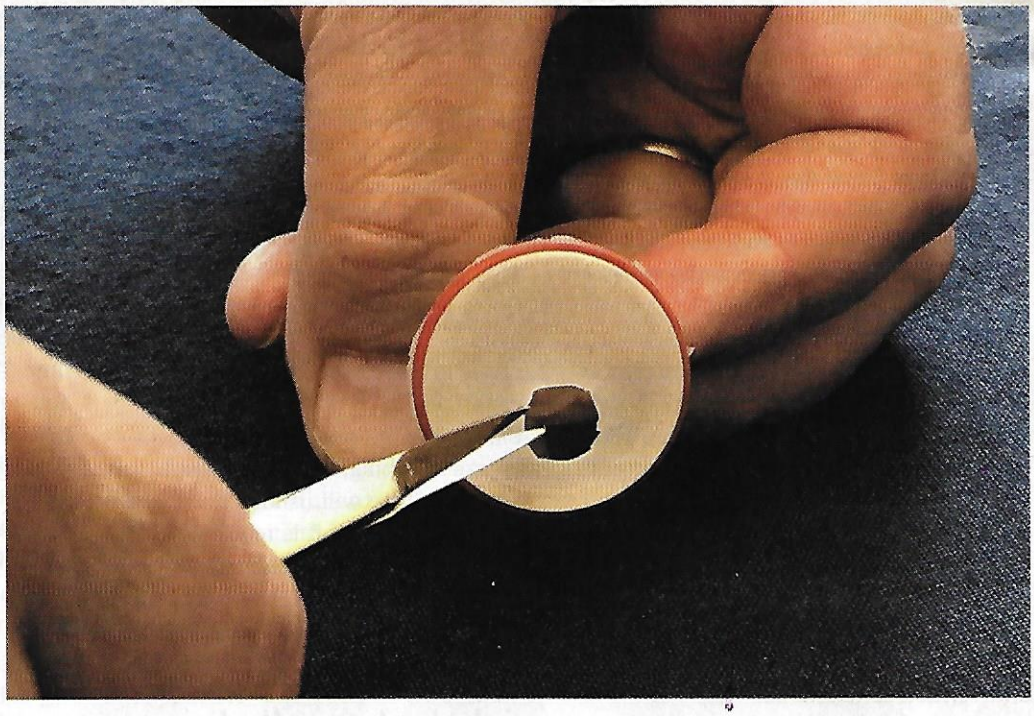

Figure 1: A properly cut diaphragm.