

Vetamac Vapors

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Exposure to WAG-When, How, What?

The previous two issues of Vapors discussed the proper methods of waste anesthetic gas (WAG) evacuation. (Past issues can be found on our website). This issue will discuss the risks and acceptable limits of exposure to WAG.

When is the Greatest Risk of Exposure?

Just because an effective evacuation system is in place does not mean there will be no exposure. The most prevalent source of exposure is the presence of leaks in the anesthetic machine. This is why it is important to have daily maintenance and periodic service procedures in place for the anesthetic machine. Another source of exposure is when the vaporizer is filled. Most vaporizers in the United States are the funnel-fill style. There are also many vaporizers that are the key-fill style. The funnel-fill requires both the vaporizer and the bottle containing the agent to be opened to the air. When using this method, an anti-spill adapter attached to the bottle will greatly reduce the time required to fill the vaporizer and also prevent spillage of the agent. The key-fill method does not eliminate exposing the bottle of agent to the air but the opening in the key-fill adapter is smaller than the one in the anti-spill adapter. There is also a possibility that a small amount of agent will remain in the tip of the key-fill adapter resulting in agent escaping into the air.

Another opportunity for exposure is during recovery. Any agent that remains in the patient after the machine is disconnected is exhaled into the air. This exposure can be greatly reduced by allowing the patient to remain connected to the machine as long as possible. If the bag is emptied into the evacuation system and refilled several times after the vaporizer is turned off, the agent will be eliminated very quickly.

The use of masks and induction boxes can present some of the highest risks of exposure. Masks should be sized properly for the patient so the mask fits tightly around the nose and also minimizes the mechanical dead space. A tight fit does not mean that it is a perfect fit. Even with the optimal size and fit, a mask will still have a small leak. There is also exposure when the mask is removed. Induction boxes are also a source of exposure. Many boxes will not hold pressure even at 2-3cm H₂O. A few boxes do not have an evacuation port on the box and depend on the leak around the top to evacuate gas from the box. The necessity of high flow rates with induction boxes increases the risk of exposure unless the box will not leak when pressurized to 4-5cm H₂O. To minimize the risk of exposure when the box is opened to remove the patient, pure oxygen should be flushed into the box for

20-30 seconds. Once again, if the box will not pressurize to 4-5cm H₂O, more WAG will escape around the lid when this flush occurs.

How Do You Know You've Been Exposed?

There is a common misconception that if there is no odor of anesthetic gas, the risk of exposure is minimal to none. The threshold level for detection by smell is far above the recommended minimum level for exposure. There are several methods that accurately determine the concentration of WAG in the work environment. Most are cumbersome, expensive, and impractical in most veterinary practices. The most practical and economical way to monitor the concentration of WAG is the use of an organic vapor badge. This badge is worn for one day by a person working in an area of potential risk for exposure. The badge, along with a form providing information about the work area, is sent to a lab for analysis. This provides a time-weighted average of exposure-a video instead of a snapshot-to WAG. This is the most objective way to determine the level of exposure to WAG in the work area.

What is an Acceptable Limit of Exposure?

The National Institute for Occupational Safety and Health (NIOSH) is responsible for conducting and funding research and education and for preparing criteria documents to be used for the development of standards. The NIOSH standard for halogenated agents is two parts per million (PPM). The Occupational Safety and Health Administration (OSHA) has never enacted these standards. However, OSHA, under the "general duty clause", does have the authority to inspect workplaces to determine whether employers are providing a workplace free from hazards, even in the absence of a relevant standard. Even though OSHA does not have a standard for exposure, they use the NIOSH recommended standard for exposure. It should be noted that the American Conference of Governmental Industrial Hygienists (ACGIH) has recommended 50ppm as an 8 hour time-weighted average for a threshold limit for exposure to WAG. For additional information and discussion, please visit our website at www.vetamac.com following the links for Services and Periodic Monitoring of Waste Anesthetic Gases.

In summary, 1) Zero exposure is not possible; 2) All personnel should be educated about potential exposure; 3) Maintenance and service of all equipment minimizes exposure; and 4) Periodic monitoring of the work area should be performed to assure the efficacy of all equipment, techniques, and protocols minimizing exposure.

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