Anesthetic Gases in Veterinary Clinics

As an owner or employee of a veterinary clinic, we have all had questions regarding the safety of anesthetic gases. (1) Are these agents toxic? (2) Are there consequences to long term anesthetic gas exposure? (3) Is there anything that can be done to minimize these exposures? This fact sheet serves to answer these questions and more specifically in regards to isoflurane and sevoflurane. It also serves as a guide on minimizing, to the greatest extent possible, employee exposure to these chemicals so as to comply with OSHA standards.

Understanding what an industrial hygienist, the occupational health professional who evaluates inhaled exposures to chemicals, would look for in a veterinary clinic is important. Any part of the anesthesia process that allows gases to enter workplace air needs to be evaluated. The first part of the anesthesia process is the anesthesia circuit. This is the equipment used during inhalation anesthesia to regulate concentrations of inhaled gases, includes a reservoir bag and usually directional valves, breathing tubes and a carbon dioxide absorber. There are other sources of exposure. The veterinary clinic’s challenge is to use the tools available so staff understands how anesthetic gases are emitted into the workplace atmosphere. Knowledge is power. Clinic staff that understand how anesthetic gases are being emitted have opportunities to reduce them. The resources listed at the end of this article are intended to be educational for all clinic staff and helpful in developing a program that addresses all aspects of employee exposures to anesthetic gases.

Communicate about the chemicals. OSHA’s Hazard Communication standard requires that employers: (1) have written programs that address how they will implement a hazard communication program, (2) maintain and provide access to the safety data sheet (SDS) for the chemicals to which employees are exposed, (3) make sure labels1 on chemical containers are legible and in good condition, and (4) use the SDSs to provide training to employees about the health and physical hazards of the chemicals before they have exposure to the anesthetic gases.

OSHA has an excellent publication called the Small Entity Compliance Guide for Employers That Use Hazardous Chemicals (OSHA 3695-2014) that explains the various aspects of the Hazard Communication standard. A PDF of the publication is also available on the OSHA website.

Reproductive Health. Because halogenated anesthetic gases like isoflurane and sevoflurane can interfere with fertility and even harm an unborn child, it is extremely important that employee exposures to these chemicals be kept to a minimum. Each veterinary practice should have a clear and well-communicated policy about pregnancy in the workplace. The policy should clearly state that it is the employee’s responsibility to inform employers that they are trying to become pregnant, are pregnant, or need reasonable accommodations.

Pressure test your anesthesia machine. Every day that the machine is used, it should be pressure tested to make sure it is in good working order. This test will also indicate whether there is a leak. The process for doing this test should be in writing and required to be followed by all anesthesia staff. An example of such a checklist with instructions for setting up, pressurizing, and checking for leaks is available from a company called Sonopath. There also are videos that provide guidance on how to pressure test

1 The Food and Drug Administration determines what information belongs on the labels of pharmaceuticals.
veterinary anesthesia equipment. One video produced by Oscar Chavez, DVM, was reviewed by the Alliance committee and demonstrates one method of conducting a pressure/leak test (see Resources).

**Check for leaks on a regular basis.** Leak testing is good for initial system checks and for troubleshooting a high personal exposure result. Exposures to anesthetic gases can occur when (1) the equipment used to administer the gas has a leak, (2) anesthetic gases leak from the patient’s breathing mask into the air of operating or recovery rooms, (3) no masks or scavenging devices are used, and gases are leaked directly from the delivery system into room air, and (4) gases are exhaled by patients recovering from anesthesia. Additional sources of uncontrolled exposure occur when the anesthetic liquid reservoir is inadvertently overfilled or a supply bottle is left open after using it.

A halogen detector, such as a TIF refrigerant leak detector, can be used to conduct a simple, qualitative survey of where leaks may be occurring in your clinic. TIF leak detectors are handy and readily available in a wide range of price points (some are ~$100). Simply hold the device’s sample inlet near locations where leaks would be expected, such as anesthetic tubing, connections, exhaust filters, etc. Leak checks should also be conducted during actual veterinary procedures and while the patient is in recovery. The device will show you where your anesthesia process needs to be adjusted or your protocols need to be changed.

If a quantitative result is desired, a field portable IR would be the instrument of choice. These devices are bulky and **very** expensive (~$80K), but enable real-time measurement of leak concentrations.

The definition of “regular” checks hinges on many factors. If, for instance, you do your initial leak tests and find that some part of the system is always leaking, you might want to increase your leak tests to a weekly schedule. If you test monthly and, after a year, have found minimal leaks, then perhaps a yearly check is sufficient. Instances when the anesthesia process should **ALWAYS** be leak tested include: (1) following installation of a system prior to first use, (2) when new tubing or connections have been made or changed, (3) during veterinary procedures, and (4) when there is active suspicion of a leak.

**Get staff members involved.** Encourage Certified Veterinary Technicians that use the anesthetic machines to help develop the leak survey checklists and to be the leak testers. Survey checklists should be created for each anesthesia circuit used and each veterinary procedure done. Both developing the checklists and using them are educational processes, and provides a message to staff that *everyone* in the clinic is responsible for reducing anesthetic gas emissions.

**Check your employees’ breathing zone exposure.** Representative personnel exposure monitoring is required by OSHA to measure employee exposures. Personal exposure monitoring can be done using passive dosimeter badges or the recommended OSHA sampling procedures. We suggest that clinics contact their insurance risk managers for assistance with the monitoring or the free and confidential Wisconsin On-site Consultation Program (contact them directly at 800-947-0553). They also can work with the Wisconsin Occupational Health Laboratory to do the surveys themselves.

To obtain a “representative” exposure, choose the staff person(s) who have the most exposure to the anesthetic gases and conduct monitoring as they go about their full day, working with the inhalant gases. If they are not overexposed, then the people with less exposure are probably not either. Different staff may have different roles in the anesthesia process and monitoring should be done for each. For instance, the veterinarian conducting the procedure should be monitored, as should the veterinary technician who might not assist in surgery, but oversees the patient’s recovery.
The personal exposure monitoring results are compared to established guidelines. While OSHA does not have workplace exposure limits for halogenated anesthetic agents, other creditable organizations do. These guidelines can serve as a reference point for determining whether further action to reduce exposure needs to be taken.

<table>
<thead>
<tr>
<th>Anesthetic Gas</th>
<th>Occupational Exposure Limit (OEL), parts per million</th>
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<tbody>
<tr>
<td>Isoflurane</td>
<td>2.0 ppm</td>
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<tr>
<td>Sevoflurane</td>
<td>2.0 ppm</td>
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The isoflurane OEL is referenced from the American Conference of Governmental Industrial Hygienists (ACGIH) and is an 8-hour time-weighted average. The sevoflurane OEL is referenced from the National Institute of Occupational Safety and Health (NIOSH) and is a time-weighted average for the duration of the procedure.

Keep the records of the surveys in case an OSHA compliance officer asks. Although there are no OSHA permissible exposure limits for anesthetic gases, clinics can still be cited by OSHA for not evaluating the levels to which employees are exposed. Other countries do have standards for isoflurane and sevoflurane.

**Respiratory Protection.** A negative-pressure, high-efficiency particulate air (HEPA) filter used for infection control is not appropriate to protect workers from anesthetic gases. Air-supplied respirators with a self-contained air source are ideal for eliminating exposure but are not a practical alternative. If respiratory protection is used, then the employer needs to develop a full respiratory protection program. OSHA’s publication titled Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA 3384-09 2011) provides guidance to small employers in developing such a program (Attachment 4: Sample Program is available on page 101 of the Small Entity Guide).

**Maintain your survey records.** SDSs, leak inspection records, and personnel exposure records are considered employee exposure records and must be preserved and maintained for 30 years. These can be maintained electronically and must be made available to employees who are exposed to anesthetic gases upon request.

**Sidebar**

**Personal Exposure Monitoring**

Clinics can choose to have a third party conduct the air survey or they can do it on their own. If the clinic works through the Wisconsin On-site Consultation Program, their staff will do the survey at no cost. Clinics can also use the Wisconsin Occupational Health Laboratory (WOHL) to obtain the sampling media and equipment to do it themselves. A sampling guide with a list of analytical services and a fee schedule are available on WOHL’s web site, http://www.slh.wisc.edu/occupational/wohl/.

**Passive sampling.**

This method uses a badge similar to the radiation badges worn by x-ray technicians. Following the direction of the laboratory from which it is ordered, the badge is placed in the breathing zone of the employee (on their collar) for the specified period of time and then returned to the lab. The cost of analysis is included in the price. The drawback is that the badges are validated for isoflurane but not sevoflurane, so if sevoflurane exposure needs to be monitored, the OSHA method must be used.

**OSHA Method.**
This method uses a calibrated, battery operated sampling pump, tubing and media. OSHA’s methodology for isoflurane and sevoflurane require the same sampling media (Anasorb 747) and analytical method. The pumps can be loaned pre-calibrated from the WOHL at no cost, but the vet clinic would pay for the analysis of the sampling media.

Note: When using the WOHL, communication is the most important aspect of the survey. Tell them you are new to this type of monitoring and need assistance with the specifics.

Resources


A link to an MSWord version of the Small Entity Compliance Guide’s hazard communication program template is linked here, Sample Hazard Communication Program.doc.


An Oscar Chavez, DVM, video on pressure/leak testing veterinary anesthesia machines is linked here, https://www.youtube.com/watch?v=FrlT8DjHhao (9 minutes).


Wisconsin On-site Consultation Program is free and confidential and can be contacted directly at 800-947-0553 or 608-226-5249. A link to information about the services they provide is here, https://www.osha.gov/dcsp/smallbusiness/consult.html and here, http://www.slh.wisc.edu/occupational/wiscon/

The Wisconsin Occupational Health Laboratory is available to help clinics conduct their surveys of employees’ exposures to anesthetic agents. A link to their web site is here, http://www.slh.wisc.edu/occupational/wohl/.


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