Waste Anesthetic Gases (WAG)

Laboratory research often involves sedation of animals. No anesthesia machine system is totally leak-free (Emergency Care Research Institute 1991), and some investigators use the drop-box method so there is a potential for unintentional exposure to anesthesia waste gases. NIOSH and OSHA issued recommended exposure limits for both nitrous oxide and halothane, but have not published exposure limits for the three most currently used anesthetics (isoflurane, desflurane, and sevoflurane). However, the American Conference of Governmental Industrial Hygienist (ACGIH) did assign a threshold limit value-time-weighted average (TLV-TWA) for nitrous oxide, halothane and enflurane.

Potential Health Effects of Overexposure:

Acute Effects:

Workers exposed to waste anesthetic gases can experience difficulty with cognition, perception, and motor skills during and soon after exposure (NIOSH Office of Science and Technology Assessment 2000). These mentation issues can place the exposed person, their co-workers and family members at risk. In addition to mentation, acute exposure can cause dizziness, feelings of light headedness, nausea, fatigue, headache, irritability, and depression. The overall effect is similar to the effects of alcohol ingestion. If you experience any of these symptoms during use of an anesthetic gas stop work, turn off the gas, leave the area, and don't use sharps or operate motorized equipment. Also, notify EHS as described below to assist with limiting exposure in your work area.

Chronic Effects:

Whether or not exposure to waste anesthetic gases causes chronic health effects remains controversial. It remains prudent to limit your exposure as much as possible since several potential long-term health effects have not been completely excluded. The vast majority of available data on chronic health effects comes from studies of workers exposed to nitrous oxide and/or halothane. Isoflurane, the most frequently used anesthetic gas by researchers at UTSW, is considerably less toxic. Human studies from the 1970s described a slight increase in the risk of spontaneous abortion, birth defects, cancer, and hepatotoxicty. These studies suffered from some severe methodological limitations making their conclusions suspect. Since then, human studies have not shown an increased risk of cancer. Also, isoflurane has little to no risk of hepatotoxicity. Better designed human studies have also failed to reproduce the above reproductive toxicities. However, a slight increased risk of spontaneous abortion cannot be completely excluded. Some animal studies do still raise the possibility that these agents can affect the genome. However, other animal studies have not reproduced that risk. Recent animal studies also show a potential for increased neurologic cell death and impaired cognition with chronic exposure. However, these health effects have not been demonstrated in human studies. For a more detailed review of this topic consider the following reviews available from the libraries ejournal list:

Burm AG. "Occupational Hazards of inhalational anaesthetics." *Best Pract Res Clin Anaesthesiol*. 2003;17:147-61.

Byhahn C, Wilke HJ, Westpphal K. "Occupational exposure to volatile anaesthetics: epidemiology and approaches to reducing the problem." *CNS Drugs* 2001;15:197-215.

Rodent Anesthetic Machine Operation

PROCEDURES:

1. Turn on the Active Evacuation System (AES). The switch is located on the bottom of the canister.
2. Turn on the Labconco Fume Adsorber (if used), biological safety cabinet, or back draft surgical table.
3. Check the silicon station hose(s) to ensure at least one is connected (pushed all the way in). **Damage to the machine can occur if at least one station supply hose is not connected.**
4. Turn on the oxygen "E" tank or connect oxygen hose to an oxygen "H" tank or to a wall supply with a Chemetron Connector.
5. Set the main flow meter so that the manometer pressure is reading 1.5 – 3 cm. **This may vary for different applications such as multi-station use or depending on species.**
6. Place the animal in the induction chamber.
7. Set the vaporizer to the percent isoflurane you want to deliver.

Induction Chamber - Animals are commonly induced at 4-5% isoflurane.

After the animal has reached the desired level of anesthesia, open the chamber by lifting the back of the lid off the chamber and keeping the front of the lid on the chamber base. This helps to prevent unnecessary exposure to the operator.

8. Move the animal to a breathing circuit with an appropriate nose cone/diaphragm.
9. Set the vaporizer to the percent isoflurane you want to deliver.

   Breathing Circuit - Animals are commonly maintained on 2-3% isoflurane. The actual percentage used will depend on the level of anesthesia required and individual animals. The patient must be monitored continuously to ensure the proper level of anesthesia.
10. Adjust the isoflurane concentration as required.
11. When using 2 or 4 stations, isoflurane can be delivered at different concentrations, by using the station flow meter to dilute the concentration delivered from the vaporizer.
    Example: When the primary flow meter is delivering a volume of 1 liter per minute to each station and the vaporizer is set on 5%:

Station flowmeter	%Agent Delivered
0.0 LPM	5.00%
0.5 LPM	3.75%
1.0 LPM	2.50%
2.0 LPM	1.25%
3.0 LPM	0.75%

Remember: Isoflurane is being delivered to all connected stations when the primary flow meter is turned on. The individual station flow meter provides additional oxygen to dilute the isoflurane that is delivered from the vaporizer. **If a different concentration to each station is not required, do not use the station flow meters to dilute the concentration.**

12. Monitor the manometer pressure during anesthesia, especially when adjusting flow or adding or removing a station connection.
13. At the end of the procedure turn **OFF**:
    - Isoflurane vaporizer
    - Oxygen tank; bleed out the oxygen until the primary flow meter reads 0. Then turn the flow meter off. (DO NOT over tighten)
    - Station flow meter(s), prior to disconnecting the station hoses.
    - AES system or Pure-Guard system
    - Labconco Fume Adsorber(if used), biological safety cabinet, or back draft surgical table.
14. Fill in the Date, Time In, Time Out, Species, and Number of Animals on the "Anesthetic Machine Use Requisition." Sign the form and leave with machine. Disinfect the induction chamber and nose cone with MB-10. ***DO NOT USE ALCOHOL TO CLEAN THE INDUCTION CHAMBER. THIS RAPIDLY DAMAGES THE CHAMBER TO THE POINT THAT IT CANNOT BE USED***

EMERGENCY CONTACTS:

If you have a problem or a question about the operation of a rodent anesthetic machine, contact:

Central Animal Facility, Med Center, and Combs:

1. Glenn Florence:
   Office: 257-1026 Email: gflor0@uky.edu Pager: 222-5554
2. Jason Oakes:
   Office: 323-6586 Email: jboake2@uky.edu Mobile: 537-0288
3. Wade Washington:
   Office: 323-6027 Email: washing@uky.edu Pager: 222-2301

BBSRB, BioPharm, and MDS:

1. Jason Oakes:
   Office: 323-6586 Email: jboake2@uky.edu Cell: 537-0288

2. Glenn Florence:
   Office: 257-1026 Email: gflor0@uky.edu Pager: 222-5554

3. Wade Washington:
   Office: 323-6027 Email: washing@uky.edu Pager: 222-2301

If you have a problem or a question regarding animal health/care, contact:

Dr. Bernard Doerning:
Office: 323-6014 Email: Bernard.Doerning@uky.edu Cell: (732) 865-1215

Dr. Jeanie Kincer:
Office: 323-5469 Email: jeanie.kincer@uky.edu Cell: (859) 229-8702

Dr. Cheryl Haughton:
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Dr. Jessica Perpich:
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For exposure issues contact EHS:

Karen Jackson:
Office: 257-2924 Email: ksjack4@uky.edu Cell: 606-272-1997

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