

**POLICY NUMBER: A-001**

**TITLE: WASTE ANESTHESIA GASES AND VAPORS EXPOSURE CONTROL POLICY**

**1.0 PURPOSE**

Waste inhalation anesthetic gases and vapors are those that are released into rooms used for surgical and other procedures utilizing volatile anesthetics. The waste anesthetic gases and vapors of concern are nitrous oxide and halogenated agents (vapors) such as isoflurane, enflurane, and desflurane. Employees working in these surgical areas may be subject to environmental exposure associated with the administration of the anesthetic gases. This document outlines the policies and procedures to be utilized by the VA Pittsburgh Healthcare System (VAPHS) Animal Research Program to control and monitor employee exposure to Waste Anesthetic Gases (WAG) and vapors.

**2.0 REVISION HISTORY**

R&D Committee Approval Date	Revision #	Change	Reference Section(s)	Effective Date
10/23/2012	2.2	Revised to reflect changes in procedure	All Sections	11/01/2012
12/7/2010	2.1	Revised to reflect changes in procedure	Sections 4.0, 6.1, and 6.5	12/8/2010
7/14/2009	2.0	Updated policy	Formatting Standardized throughout document; All sections updated/revised	7/15/2009

**3.0 SCOPE**

This policy applies to all VAPHS Animal Research Program employees who may be exposed to waste anesthetic gases and vapors. The policies are applicable to both those employees who work directly in the VAPHS Animal Research Facility (ARF) and those who may be exposed to waste anesthetic gases and vapors during the conduct of VA research being performed in off-site locations.

**4.0 RESPONSIBILITIES**

1. Engineering Service will be responsible for preventative maintenance of affected HVAC systems and scavenging systems.
2. Industrial Hygienist will coordinate all industrial hygiene monitoring, conduct the WAG training sessions, review the procedures used during surgeries when an overexposure occurs, and provide trace gas testing when necessary.
3. Research Service will be responsible for ensuring that all employees within the Animal Research Program have undergone WAG training regarding work practices designed to reduce ambient waste anesthetic gases during the administration of anesthesia. Research Service will keep records on the training dates, topics and attendees. In addition, the Research Service will be responsible for notifying employees of results from the monitoring badges and ensuring that any exposed employee is identified for baseline and annual medical surveillance through Employee Health. Exposure records are also forwarded to Employee Health to be placed in medical records. The Research Service is responsible for preventative maintenance of anesthesia delivery units (both vaporizer and flow meter). If needed, the Research Service will coordinate third-party trace gas testing and keep records of the sampling.

## 5.0 POLICY

The VAPHS Animal Research Program recognizes that anesthetic gases must be utilized in the conduct of animal research. Liquid anesthetic agents are converted into the anesthetic gas or vapor through the use of vaporizers. The vapor is administered and delivered to animals in a volume greater than that required by the animal's metabolic rate. These non-flammable substances vaporize at room temperature. The VA, Occupational Safety and Health Administration (OSHA), the National Institute of Occupation Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) concur that there is insufficient data to establish safe occupational exposure levels for nitrous oxide and anesthetic gases. NIOSH and the ACGIH, however, have established recommended exposure limits. The VAPHS Animal Research Program has developed exposure control methods to reduce or maintain exposure below these recommended limits.

For surgical procedures that utilize anesthesia, most employees use isoflurane (Forane<sup>®</sup>). Isoflurane is a clear, colorless, stable liquid and has a mildly pungent, musty ethereal odor. There is no specific work exposure limit established for isoflurane by OSHA. However, NIOSH recommends that employees should not be exposed to ceiling concentrations greater than 2 parts per million (ppm) of any halogenated anesthetic agent over a sampling period not to exceed one hour. All research employees must wear a sampling badge for halogenated agents for every procedure. If an employee is exposed to a concentration above the exposure limit of 2 ppm, then the employee must cease work with the isoflurane, report to Employee Health for a medical exam, and the Industrial Hygienist will meet with the individual to retrain and discuss potential issues with the anesthesia system.

A carrier gas must be used when converting liquid anesthetic agents into a gas or vapor. Most employees use oxygen as the only carrier gas, however, several investigators use a combination of nitrous oxide and oxygen. Nitrous oxide is a colorless gas at room temperature with a slightly sweet odor and taste. Like halogenated gases, there is no specific work exposure limit established for nitrous oxide by OSHA. However, the ACGIH states that the exposure limit for nitrous oxide is 50 ppm as a Time Weighted Average (TWA). All research employees must wear a sampling badge for nitrous oxide for every procedure. At the VA Medical Center, an action limit will be set at 25 ppm (concentration during course of nitrous oxide use). If an employee is exposed to a concentration above the action limit (25 ppm) but below the exposure limit (50 ppm), the employee will be re-trained by the Industrial Hygienist until the concentration is under the action limit. In addition, the nitrous oxide system will be checked for leaks by the Industrial Hygienist. If an employee is exposed to a concentration above the exposure limit over the 8 hour TWA (50 ppm), then the employee must cease work with the nitrous oxide, report to Employee Health for a medical exam, and the Industrial Hygienist will meet with the individual to retrain and discuss potential issues with the anesthesia system. In addition, the nitrous oxide system will have to be shut down until the problem is identified. The Industrial Hygienist will check the anesthesia system for leaks before nitrous oxide can be used in the room again.

## 6.0 PROCEDURES

The VAPHS Animal Research Program has developed the following procedures to minimize employee exposure to WAG.

1. Equipment Certification Requirements & Monitoring
2. Employee Information and Training
3. Medical Surveillance
4. Labels and Posting
5. Record keeping

### 6.1. Equipment Certification & Monitoring Requirements

#### A. Equipment Certification:

All anesthesia equipment used in conjunction with the Animal Research Program must be maintained in good working condition. The primary standard for vaporizing recalibration/certification is to be governed by manufacturer's recommendations. Certification consists of the inspection and approval of all mechanics associated with the vaporizer and anesthesia machine. Calibration consists of the scientific analysis of the emitted gas and insuring the accuracy of the concentration settings and any subsequent correction, if needed.

1. Procedures within the VAPHS:

All vaporizers and flow meters must be shipped out to the manufacture and calibrated on an annual basis. All anesthesia equipment must be serviced by qualified personnel or by an authorized service center. Qualified personnel must be experienced in clinical equipment maintenance, service and certification.

2. Procedures within VA Leased Space Locations:

Facilities from which the VA leases space are expected to adhere to their own local policy regarding certification of anesthesia equipment. The VAPHS Research Office requires that such facilities provide semi-annual reports to the VAPHS Administrative Officer for Research.

B. Exposure Monitoring:

Potential effects of exposure to WAGs are nausea, dizziness, headaches, fatigue, and irritability, as well as sterility, birth defects, miscarriages, cancer, and liver and kidney disease. In order to ensure that the concentrations of WAGs are maintained below the NIOSH and ACGIH recommended limits, the following environmental monitoring procedures will be utilized. The purpose of these procedures is to determine the airborne concentration of WAG and verify that all equipment is safe to use.

1. Personal Monitoring Badges. The Research Service provides personal monitoring badges for employees who perform surgeries for the Animal Research Program. This requirement applies to those employees working on VAPHS property. Monitoring badges are available for both halogenated gases (i.e., isoflurane) and for nitrous oxide. Employees who work in rooms in which WAGs are utilized are required to monitor their exposure during each procedure involving WAG. In addition, for employees that utilize nitrous oxide as a carrier gas, a nitrous oxide badge must be worn during every surgical procedure. The badges, both for halogenated gases and nitrous oxide, are used to monitor a single procedure or time frame not to exceed 8 hours. The badges are located in a box outside of the procedure room GA119 in the Animal Research Facility. Within 24 hours after procedure completion, the badges are to be returned to the Animal Research Facility Supervisor (or Acting Supervisor) or designee when the Animal Facility Supervisor is not available. The Animal Facility Supervisor (or designee) then sends the monitoring badge to an accredited laboratory for determination of acceptable NIOSH limits. Procedures related to employee notification of monitoring results are described in section 6.5.
2. Trace Gas Tests. Within the VAPHS, trace gas tests had previously been performed quarterly by an outside consulting firm. Since the Research Service now requires badges to be worn while utilizing nitrous oxide, the trace gas testing is not necessary on a quarterly basis. However, trace gas testing can be performed by the VAPHS Industrial Hygienist using a Miran SapphIRe if results from the badges come back with elevated results. In addition, if continual problems arise with the equipment, reinstatement of quarterly trace gas testing will occur.
3. Environmental (room air) Monitoring. The VA Medical Center has an outside consulting firm perform air flow testing in the ARF. The VA requires that there be a minimum of 10 to 15 air changes per hour for the rooms. If any changes to the rooms must be made, including changing the air pressure (negative or positive), VAPHS Facilities Management assist in getting the proper airflow rate and proper amount of air changes.

## 6.2. Employee Information and Training

Each employee, prior to being permitted to work in a WAG area, will receive instructions and training from the Industrial Hygienist on the following:

- The details of the Hazard Communication Policy developed by the VA Medical Center and how employees can obtain and use the appropriate hazard information.
- The nature of the hazards and toxicity of WAG, including recognition of the signs and symptoms of over exposure, and the importance of reporting these immediately to designated health and supervisory personnel.
- The specific nature of the procedure involving WAG that could result in exposure.

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- The nature of medical examinations, including advantages to the employees for participating in the Medical Surveillance Program.
- Sampling methods and observations that may be used to detect the presence or release of WAG in the work area.
- The measures employees can take to protect themselves from hazards associated with WAG exposure, including specific procedures such as engineering and work practices to reduce exposure levels.
- The location and availability of the written WAG policy.

Once an employee has received the training outlined above, the Industrial Hygienist must provide written verification (in the form of a training quiz) to the Research Service, which will maintain the information per record keeping requirements.

In addition, the VAPHS ARF has developed Standard Operating Procedures which govern the use of anesthetic gases within the ARF. These procedures have been excluded from this policy but may be reviewed in the ARF SOP Manual. These procedures outline the methods to be employed to ensure proper use of the anesthesia and scavenging systems within each operating/procedure room. Each employee must be familiar with and properly trained in the use of these systems prior to being permitted to work in a WAG area.

### **6.3. Medical Surveillance**

As part of the Animal Exposure Preventative Medicine Program at VAPHS, the Animal Research Program employees who may potentially be exposed to WAGs will be offered participation in the Medical Surveillance program. The details of this program are described in the R&D Policy, Animal Exposure Preventative Maintenance Program for Personnel with Animal Contact (A-002).

### **6.4. Labels and Posting**

Section G of the medical center's Hazard Communication Policy, Labels and Other Forms of Warning, will be implemented to inform employees of the possible health hazards associated with use of each anesthesia unit.

The ARF staff will be responsible for labeling the unit in accordance with the requirements of the Hazardous Material Identification System, an integral part of the medical center's Hazard Communication Policy.

A Material Safety Data Sheet (MSDS) for each WAG must be made available to Animal Research Program employees. Binders containing MSDSs are maintained in the ARF. The location of MSDS in other facilities must be visibly displayed in rooms in which WAGs may be utilized. Each MSDS communicates detailed hazard/safety information for each WAG.

Vaporizer unit Certification labels will be affixed at the time of inspection/verification.

### **6.5. Record Keeping**

- A. Trace Gas Test and Environmental Monitoring: For quarterly trace gas testing, the consulting firm provided record of all environmental exposure measurements for each of the ARF's anesthesia units and copies of the survey results are retained by the Research Service in accordance with the VA Records Control Schedule. For Environmental Monitoring of the airflow, results are provided to the Research Service from VAPHS Facilities Maintenance Services.
- B. Personal Monitoring: The laboratory that analyzes the monitoring badges will provide employee results to the Research Service. The Research Service will be responsible for notifying the employee, as well as the study Principal Investigator and Industrial Hygienist of acceptable results within 1 business day of receipt. A copy of the results will be maintained by the Research Service. In addition, in the case of a WAG overexposure, the Research Service will be responsible for notifying the affected employee, as well as the study Principal Investigator, Industrial Hygienist, ACOS for Research, Safety Manager, Chair of IBC and IACUC Committees, and Research Compliance Officer within 1 business day of receipt of the results. The affected employee will be required to undergo an exam and counseling with Employee Health (see Policy A-002, Animal Exposure

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Preventive Medicine Program for additional information). Prior to continuing work with WAG, the Industrial Hygienist must also observe the employee working with the anesthetic gas equipment in order to ensure that the individual is properly using the equipment. Information in regards to a WAG overexposure are presented at the next fully convened IBC Committee meeting for review.

In the case of an employee overexposed to WAGs in a VA leased space location, the Research Service will also notify the appropriate department at the facility from whom the space is leased (e.g., University of Pittsburgh's Environmental Health and Safety).

- C. Medical Surveillance: The VA Medical Center will provide for retention of the results of the medical surveillance program and tests conducted by the Physician/Licensed Health Care Professional. All medical examination results will be maintained in the employee's medical file.
- D. Employees: The Research Service will maintain a list of all individuals working with and thus potentially exposed to WAGs. This record will contain notations as to dates of training and any subsequent incidents of note.

Although NIOSH recommends keeping records of air sampling, leak tests and medical surveillance for at least 20 years, Federal Regulations require them to be maintained for the duration of employment, plus 30 years, or for as long as the Official Personnel Folder is maintained, whichever is longer. The same Federal Regulation requires relevant exposure records to be kept in the medical records of exposed employees. Therefore, copies of the reports of quarterly trace gas tests on equipment, environmental monitoring and personnel monitoring/air sampling results are maintained in the Research Office.

## 7.0 REFERENCES

- National Institute for Occupational Safety and Health (NIOSH) Criteria for recommended anesthetic gases and vapors. DHEW (NIOSH) Publication No. 77-140
- Department of Labor, Occupational Health and Safety Administration, Anesthetic Gases: Guidelines for Workplace Exposures (<http://www.osha.gov/dts/osta/anestheticgases/index.html>).
- VAPHS Medical Center Memorandum EC-001 HAZARD COMMUNICATION
- VAPHS Research & Development Policy, Animal Exposure Preventative Medicine Program for Personnel with Animal Contact (A-002)
- VA Office of Construction and Facilities Management- Technical Summaries for Research Facilities (<http://www.cfm.va.gov/til/techSumm.asp>)

## FOLLOW-UP RESPONSIBILITY

This policy will be reviewed annually and revised as needed.

*//electronically signed//*

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