



INDIANA UNIVERSITY

OFFICE OF THE EXECUTIVE VICE PRESIDENT
FOR UNIVERSITY ACADEMIC AFFAIRS
University Environmental Health and Safety

Anesthetic Gas Safety Program

March 15, 2017

1. INTRODUCTION

1.1. Purpose

Indiana University Environmental Health and Safety (IUEHS) has developed this program to protect employees at Indiana University who have a potential occupational exposure to anesthetic and waste anesthetic gases. Inhaled anesthetics include two classes of chemicals: nitrous oxide and halogenated agents. Halogenated anesthetic gases include desflurane, enflurane, halothane, isoflurane, methoxyflurane, and sevoflurane. The program is also intended to ensure compliance with all federal, state, and local requirements.

1.2. Scope

This program applies to all employees who work with or supervise work involving anesthetic gases at the Indiana University campuses.

2. AUTHORITY AND RESPONSIBILITY

2.1. University Environmental Health and Safety is responsible for:

- The development, implementation, and oversight of the program;
- Area and personal air monitoring to determine exposure; and
- Auditing compliance with all federal, state, and local regulations.

2.2. Department Supervisors are responsible for:

- Ensuring that all personnel have been trained prior to anesthetic gas use;
- Notifying IUEHS prior to initial anesthetic gas use and when conditions, processes, and/or procedures involving anesthetic gas change;
- Following all safety guidelines for anesthetic gas use;
- Anesthetic gas equipment maintenance;
- Reporting any liquid agent spills or releases to IUEHS;
- Compliance with Indiana University's Hazard Communication Program;
- Reporting results of all monitoring to employees;
- Ensuring compliance with IUEHS recommendations; and
- Ensuring completion of an incident report for any health or safety related incidents and forwarding the report to the designated Medical Services provider identified for each respective campus and IUEHS.

2.3. Employees are responsible for:

- Completing the anesthetic gas training course;
- Following all safety guidelines when working with anesthetic gases;
- Inspecting all equipment prior to and after each use;
- Ensuring the scavenge system is used with all anesthetic gas machines;
- Reporting any problems with equipment to department management;
- Reporting any liquid agent spills or releases to department management and IUEHS;
- Following Indiana University's Hazard Communication Program; and
- Reporting any health or safety concerns to department management and completing an incident report.

3. PROGRAM ELEMENTS

3.1. Occupational Exposure Limits

The following table summarizes the occupational exposure limits (OELs) that have been adopted by the University. Departments shall be responsible for ensuring that employee exposure does not exceed these OELs.

Anesthetic Gas	Indiana University OEL, in parts per million (ppm)
Nitrous Oxide (N ₂ O)	50 ¹
Nitrous Oxide (N ₂ O)	25 ²
Desflurane	2 ²
Enflurane	2 ²
Halothane	2 ²
Isoflurane	2 ²
Methoxyflurane	2 ²
Sevoflurane	2 ²

1: 8-Hour Time-Weighted-Average (TWA) Exposure Limit.

2: 15 Minute Short-Term Exposure Limit (STEL).

3.2. Exposure Monitoring

IUEHS will conduct instantaneous leak testing around equipment. If leak testing identifies a potential concern based on the detection of waste anesthetic gases (WAGS) released from the anesthetic equipment, an instantaneous sample will be collected in the employee's breathing zone. If the instantaneous breathing zone sample exceeds occupational exposure limits specified in Section 3.1, an occupational exposure assessment will be conducted by IUEHS using personal badge sampling for the anesthetic gas in question.

If results of the occupational exposure monitoring indicate exposures exceeding the OEL and/or excessive leaks from the anesthesia system are identified during the evaluation, recommendations will be provided by IUEHS to the supervisor responsible for the anesthesia system.

4. TRAINING & RECORDKEEPING

4.1. Training

All employees who work with or supervise work with anesthetic gases shall complete online Anesthetic Gas Training through E-Training prior to using any anesthetic gas. The training shall consist of the following: regulatory limits, health effects of nitrous oxide and halogenated agents, sources of exposure, scavenge systems, anesthetic gas equipment inspections, engineering controls, work practices, administrative controls, liquid agent spills, air monitoring, medical surveillance, and hazard communication. The training shall be conducted upon initial assignment and whenever there is a change in process or procedure.

Supervisors are responsible for ensuring employees who work with anesthetic gases and associated equipment have been trained in the proper procedures and use of the equipment.

4.2. Recordkeeping

Records of department specific training shall be maintained by the department and made available to IUEHS upon request.

5. REFERENCES

- [OSHA: Anesthetic Gases: Guidelines for Workplace Exposures. 18 May 2000.](#)
- [NIOSH: NIOSH Criteria Document 77-140. *Criteria for a Recommended Standard of Exposure to Waste Anesthetic Gases and Vapors.*](#)
- [NIOSH: Waste Anesthetic Gases – Occupational Hazards in Hospitals. September 2007.](#)
- ACGIH: Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. 2014.
- [NIH: Waste Anesthetic Gas Surveillance Program. June 2012.](#)
- [Indiana University Hazard Communication Program.](#)

6. REVISIONS

March 15, 2017

APPENDIX A - GLOSSARY

Anesthetic gas: A gaseous substance, e.g., nitrous oxide, used in producing a state of anesthesia.

Occupational Exposure Limits (OEL): An upper limit on the acceptable concentration of a hazardous substance in workplace air for a particular substance.

Scavenging: The collection of excess gases from the breathing circuit and removal of these gases to an appropriate place of discharge outside the working environment.

Scavenging system: A device (assembly of specific components) that collects and removes the excess anesthetic gases that are released from the breathing circuit. Scavenging systems are also called evacuation systems, waste anesthetic gas disposal systems, and excess anesthetic gas-scavenging systems.

Waste anesthetic gases: Anesthetic gases that are inadvertently released into the workplace and/or can no longer be used. They include all fugitive anesthetic gases and vapors that are released into anesthetizing and recovery locations, from equipment used in administering anesthetics under normal operating conditions, as well as those gases that leak from the anesthetic gas scavenging system, or are exhaled by the patient into the workplace environment. Waste gases are also those excess gases in the breathing circuit that are ultimately scavenged. Spills of liquid anesthetic agents also contribute to ambient levels of waste gases. Waste anesthetic gases may include nitrous oxide and vapors of potent inhaled volatile anesthetic agents such as desflurane, enflurane, halothane, isoflurane, methoxyflurane, and sevoflurane.