

Waste Anesthetic Gases

Anesthetic Pearls: Work Environment Implications of Waste Anesthetic Gases
(www.osha.gov)

Waste Anesthetic Gases and vapors of concern are nitrous oxide and halogenated agents (vapors) such as Halothane, Enflurane, Methoxyflurane, Trichloroethylene, and Chloroform. OSHA has developed technical instructions designed to give guidance for coping with exposure to waste anesthetic gases (WAGs). The instructions cover sampling methods, leak test procedures, medical surveillance, disposal methods, training and exposure to WAGs.

Exposure / Concentrations

No worker should be exposed to concentrations of WAGs greater than 2 parts per million (ppm) of any halogenated anesthetic agent, based on the weight of the agent collected for a 45-liter air sample by charcoal adsorption over a sampling period not to exceed one hour.

Controlled halogenated agents and their respective weights corresponding to 2 ppm are: Chloroform (9.76 mg/m³); Trichloroethylene (10.75 mg/m³); Halothane (16.15 mg/m³); Methoxyflurane (13.5 mg/m³); Enflurane (151 mg/m³); Fluroxene (10.31 mg/m³).

When such agents are used in combination with nitrous oxide, levels of the halogenated agents well below 2 ppm are achievable. In most situations, control of nitrous oxide to a time weighted average concentration of 25 ppm during the anesthetic administration period will result in levels of about 0.5 ppm of the halogenated agent. The occupational exposure to nitrous oxide, when used as the sole anesthetic agent, shall be controlled so that no worker is exposed at eight-hour time weighted average concentrations greater than 25 ppm during anesthetic administration.

A complete WAGs management program includes at the outset the application of a well-designed WAGs scavenging system. Such a system will consist of: 1) a collecting device (scavenging adapter) to collect WAGs and vapors from breathing systems at the site of overflow; 2) a ventilation system to carry WAGs from the operating room; and 3) a method or device for limiting both positive and negative pressure variations in the breathing circuit which may be used by the scavenging systems. Most anesthesia equipment being manufactured today include comprehensive scavenging systems. The remainder of the WAGs management program should include work practices minimizing gas leakage, the application of a routine equipment maintenance program so that gas leaks are minimized, and periodic exposure monitoring / provision for adequate general ventilation.

Work Practice Controls

Steps that can be taken to reduce gas leakage can include: (1) Make sure that waste gas disposal lines are connected, (2) Avoid turning on nitrous oxide or vaporizer until the circuit is connected to the patient, (3) Switch off the nitrous oxide and vaporizer when not in use, (4) Maintain oxygen flow until scavenging system is flushed.

Personal Sampling

WAG concentrations are measured by collecting a quantity of air in a sampling bag and then performing infrared analysis. Sampling should be conducted based on the particular anesthetic agent in use. Nitrous oxide can be sampled by using devices such as a large plastic bag pump or the Landauer nitrous oxide monitor. Halogenated compounds should be collected in charcoal tubes (107 -110) using two tubes in series.

Medical Surveillance

A medical surveillance program should be made available to all employees who are subject to occupational exposure to WAGs. The program should contain comprehensive pre-placement medical and occupational histories which shall be maintained in the employee medical records with special attention given to the outcome of pregnancies of the employee or spouse, and to the hepatic, renal and hematopoietic systems which may be affected by agents used as anesthetic gases; annual physicals are recommended as well as advising employees of potential health risks such as spontaneous abortions, congenital abnormalities in children, and effects on the liver and kidneys.